Impact of Human Activity on Protected Areas: A case study of Nech Sar National Park in Ethiopia

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Acronyms

ANOVA	Analysis of Variance
B.C.	Before the Birth of Christ
BA	Basal Area
CBD	Convention on Biological Diversity
CCAs	Community Conservation Areas
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COP	Conference of Parties
DFID	United Kingdom Government Department for International Development
EIAR	Ethiopian Institute of Agricultural Research
EWCA	Ethiopian Wildlife Conservation Authority
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussions
GAPA	Governance Assessment for Protected and Conserved Areas
GDP	Gross Domestic Product
GEF	Global Environmental Facilities
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
ICCAs	Indigenous and Community Conserved Areas
ICIMOD	International Centre for Integrated Mountain Development
INHF	Iowa Natural Heritage Foundation
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
Kg	Kilograms
Km^2	Kilo Meter Square
M	Meter
m^2	Meter Square
Masl	Meter Above Sea Level
MEA	Millennium Ecosystem Assessment
Mm	Millimetre
NEPL	Nam Et and Phou Loei
NGOs	Non-Governmental Organizations

No.	Number
NSNP	Nech Sar National Park
PA	Protected Areas
RF	Rainfall
RSPN	Royal Society for Protection of Nature
SAPA	Social Assessment for Protected Areas
S.N.	Serial Number
T	Temperature
UK	United Kingdom
UKNEA	United Kingdom National Ecosystem Assessment
UN	United Nations
UNDP	United Nations Development Programme
UNEP-WCMC	United Nations Environment Programme and World Conservation Monitoring Center
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNGA	United Nations General Assembly
USA	United States of America
WDPA	World Database on Protected Areas
WHC	World Heritage Convention
$	United States Dollar
°C	Degree Centigrade

Definition of Terms

Biodiversity: Biodiversity can be defined as "the variability among living organisms from all sources, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part; this includes diversity within species, between species and ecosystems" (CBD, 2017: Article 2).

Density: In the context of forest ecology, density is the number of individuals of a species per unit area, which provides a quantitative estimate of the stocking of the species in a given area (Emiru, 2003).

Ecosystem: Vreugdenhil *et al*., (2003) and BO (2008) mentioned it as the interactive system established between living things (plants, animals and microorganisms) and their environment in which they live.

Ecosystem Services: UKNEA (2012:1) defined ecosystem services as "the benefits provided by ecosystems that contribute to making human life both possible and worth living."

Governance: The interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken and how citizens or other stakeholders have their say (Borrini-Feyerabend *et al*., 2013:10).

Human Activities: Human activity or threat can be defined as "any activity or processes that cause destruction, degradation, and/or impairment of biodiversity targets" (Schulze *et al*., 2018:3).

Invasive Plant Species: Invasive plant species are plants that become established in a new environment, and then proliferate and spread in ways that are destructive to biodiversity and human interests (GISP, 2004).

Livelihood: Livelihoods comprise the capabilities, assets, and activities required for a means of living (Chambers & Conway, 1992 cited in Andrew, 2018:xi).

Natural Capitals: "Stocks from which resource flows and services are derived (e.g. land, forests, minerals, marine/wild resources, water, etc.)" (DFID, 1999:1)

National Parks: are "large natural or near natural areas set aside to protect largescale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities" (Dudley, 2008:8).

Natural Regeneration of Trees: According to Marco and Raffaello, (2012) regeneration is an ecological process through which forests got renewed in a natural way that is created as a result of the emergence of young plants from seeds (seedlings).

Protected Areas: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008:8).

Species Composition / Diversity: Species diversity refers to the richness in the number of species, evenness in its composition (Ján *et al*., 2012; Bruciamacchie, 1996).

Abstract

Protected areas play a significant role in conserving biodiversity and essential ecosystem services that help in providing sustainable development opportunities. As the world's human population increases, however, these ecologically vital resources are threatened due to over-utilization of their resources. Nech Sar National Park of Ethiopia being one of them, is currently threatened due to the impact of human activities. Hence, this research bridges the knowledge gap on the impact of human activities on the natural capitals of the park. To examine this, ecological surveys were conducted by deploying transect lines along with experimental plots. Information was also collected from the indigenous communities of the park and stakeholders by making use of focus group discussions, interviews and questionnaires. Satellite images were used to assess the impact of human activity on the aquatic ecosystems of the park.

Examination of the natural regeneration status showed that, the ground water vegetation of the park is not maintaining the natural regeneration of trees. According to the results of the Shannon Diversity Index, the woody vegetation species diversity of the park is being degraded due to deforestation. Findings showed that on average 824 matured trees are being cleared on daily basis to satisfy the household energy demands of Arba Minch town and the nearby inhabitants.

The satellite image analysis indicated that, Lake Chamo lost 2,465.46 hectares of its surface area coverage in between the years of 1985 – 2015. The findings have showed more than 70% of the grassland areas of the park is highly endangered by the alien plant species (Prosopis, Abutilon, etc.). The wild animals are less adaptable to these invasive plants and are being affected in sustaining their life in the ecosystem. Due to human-wildlife conflict, the number of wild animals is also shrinking from time to time. Swayne's Hartebeest for instance, may face local extinction since the remaining two individuals were believed to be male.

The study also confirmed that, local communities of the protected area are neglected from participating in the management and governance of the park and this enhanced the lack of ownership feeling by the local communities. On top of this, the top-down governance approach of the park authorities who are based in the capital at about 510 km away from the park is also another bottle-neck that affect the sustainable development of the park since administrative power is not shared for the two regional states which border the park. Therefore, as the park is presently going through immense human interference, this study contributes to the management and governance of protected areas by formulating the

integrated strategic approaches which includes community participation in the governance and management of the park, provision of alternative energy and livelihood opportunities which can help the sustainable development of the park's ecosystem services. The study also recommends further research in the areas of invasive plants and detailed analysis on the impact of human activities on the aquatic ecosystems of the protected area.

Chapter 1 - General Background and Research Context

1.1. Introduction

In today's world, protected areas are the cornerstones for the protection of biodiversity and various ecosystem services. Many critically endangered, endangered and threatened plant and animal species are being sheltered in the landscapes of protected areas. The contribution of protected areas to the economy of many countries and their sustainable development is also significant because of their role in poverty reduction through the creation of sustainable livelihoods and their contribution for climate change adaptation and mitigation because of their ecosystem services (Naidoo *et al*., 2019; WWF, 2018). For instance, they are known to provide drinking water to one in three of the world's 100 largest cities; they also store the same amount of carbon as the tropical rainforests. They are also essential resources in reducing climate related risks and consequences of extreme events of drought, floods, storm and the rise of sea-levels (IUCN, 2014). Protected area ecosystems can also have a positive effect on health-related issues of mankind through changes in the ecological, aesthetic, cultural and recreational values (Chelsea *et al*., 2014; and Keesing *et al*., 2010). However, many protected areas are facing a considerable degradation because of the ever-increasing energy, food, fiber, shelter, etc. demands of the growing population of the world (Barbara *et al*., 2012; Borrini-Feyerabend *et al*., 2012).

The degradation of environment can impede developmental efforts in two ways. Firstly, it diminishes the wellbeing of a community by draining the natural resources and decreasing the value of the environment. Secondly, it decreases longer term productivity of land resources and reduces benefits available to the future generation (FAO, 2011; Mitiku *et al*., 2006). This phenomenon also seems a vicious circle in that as humans use natural resources beyond the replenishment capacity of the system and deplete its productivity, further degradation of natural resources will continue as a result of the need for maximizing the benefits of the ever-increasing demands of the population. This overuse of natural resources aggravates the degradation of the environment and declining of productivity which continues to keep poverty increasing (SCBD, 2008). Such degradations are also caused by the absence of systematic approach to ecosystem management, poverty, increased population pressure and low level of awareness on natural

resources utilization. Poverty may force people to over exploit the available resources beyond the carrying capacity of natural resources. In an effort to enhance livelihoods, it has been observed that people frequently encroach on environmentally conserved areas to get fertile land and associated resources (Anemut, 2006).

As a result of its geographical location in the Great Rift Valley region and varied topography, Ethiopia owns a significant number of endemic plant and animal species. The country is also considered as one of the Vavilov Centers (centers of origin) for the world's genetic resources (EBI, 2014; Van de Laar, 1988, cited in Zenebe 1999; Edwards and Ensermu, 1999; Sayer *et al*., 1992; Shibru and Martha, 1998 in Demel and Mulugeta, 2006). Ethiopia also owns various protected areas which host a significant share of the country's biodiversity resources. 10% of the country's plant genetic diversity is believed to be endemic to the country (EBI, 2014; USAID/Africa, 2008 and IBC, 2009). This magnifies the role of protected areas in the conservation and maintenance of biodiversity resources in the country. Hence, the focus of this research is on exploring the impact of human activities on Nech Sar National Park which is located in the southern part of Ethiopia.

Nech Sar National Park, cherished with diverse ecosystems (forest, wetlands, lakes, etc.) and biodiversity resources is believed to host 20% of the country's biodiversity resources (Simon, 2016; Shetie *et al*., 2015; NSNP, 2016). The Park also has the highest number of tourist flow as compared to other National Parks of the country (GEF/UNDP/EWCA, 2015). However, as a result of the ever-increasing population of the country (the second populous country in Africa) and other human induced and natural factors, Nech Sar National Park and other ecologically vital resources of the country are experiencing serious environmental and biodiversity resources degradation. As for instance, the country's deforestation rate is estimated to be 200,000 hectares per annum (Srinivasan, 2014). Apart from this, in Ethiopia, climate change and other calamities contributed significantly to the degradation of protected areas (Aramde *et al*., 2014). Thus, many of the ecologically important protected areas and their associated biodiversity resources in Ethiopia are facing severe degradation. Therefore, such degradation of protected areas is calling for the development and implementation of systematic approaches to local ecosystem management actions. Such approaches may help to relieve the level of resources degradation by minimizing the degree of local communities' dependence on these natural resources (Simon 2016;

SCBD, 2008; Anemut, 2006). To overcome this strong dependence, a deeper understanding on the impact of human activities on protected areas natural capitals is of a paramount importance.

1.2. Impact of Human Activities on Protected Areas

Ecological diversity offers a natural capital of plant and animal species. Biodiversity constitutes the genetic diversity, the species diversity and the ecosystems diversity (Dudley, 2008; UNEP, 2006 and Swara, 1992). In line with this, protected areas play a pivotal role in global biodiversity conservation efforts since they are the means of protecting species that cannot sustain in human interference ecological settings. Protected areas are also places of natural evolution and forthcoming ecological restoration. Hence, conservation of biodiversity resources from degradation is a vital issue that need to be addressed by decision makers so that the natural ecosystems can continue providing their services (SCBD, 2008).

Research shows that, humans are responsible for the extinction of species 100 - 1,000 times than the natural rate of extinction and it is estimated that up to 25 % of the world's fauna and flora could extinct by the middle of the next century (WWF, 2018). Research further states that, human interference on the natural ecosystems is creating a significant obliteration by posing a threat on the sustenance of natural habitats (Stolton *et al*., 2013; FAO, 2011). It also shows that, land-use and land-cover change, the expansion of invasive species, habitat modification, population growth, the severe impact of fertilizers on the environment, climate change and over-exploitation of natural resources are among the primary causes of the threat (WWF, 2015).

Although protected areas possess the potential to address the degradation of biodiversity and various ecosystems, according to Braat and Brink (2008) if not protected and conserved, protected areas cannot be a guarantee in maintaining the endangered wealth of biodiversity. Many of the natural resources within protected areas are increasingly endangered by human interference and are not more than 'paper parks' (Tranquilli *et al*., 2014). Hence, the sustainable development of protected areas calls for the participation of indigenous and local communities in the management of protected areas by devising strategic actions that would help to reduce the degradation of resources as well as actions that enhance the wellbeing of the local communities (Borrini-Feyerabend *et al.*, 2013; Girma and Till, 2012; Travis *et al*., 2010).

1.3. Community Participation as an approach to Protected Areas Management

Forest, water, green pasture, minerals, etc. are some of the resources which are found in protected areas. These areas could also characterize many of the cultural, aesthetic and spiritual values in the local context. Over the course of Ethiopian history, imperative decisions about the use and conservation of land resources have been made, at times inflaming protracted conflicts in ecosystems (Girma and Till, 2012; Abitot, 2009; Ghimire and Pimbert, 1997).

Protected areas cannot co-exist with societies which are hostile to them. Hence, knowledge about the livelihoods context of the community that are affected by the management arrangement of parks is vital in the protection of fauna and flora resources to be protected (Travis *et al*., 2010). For instance, the park management cannot ignore societies living in or around protected areas that have an important and long-standing attachment with the natural resources for their very existence (IUCN, 1992). There is a gender dimension as well – where women have a crucial role in the protection and management of the resources, but this receives limited attention.

According to SCBD (2008), the management and conservation of protected areas can only be sustainable if the local communities are going to be part of the protection ventures that can improve their livelihoods. This includes the empowerment of the local communities in managing the resources and making decisions that have a direct effect on their wellbeing. Mechanisms that build the local community's participation in the protection of protected areas should be enhanced since they will be able to take care of the resources if they feel the resource is theirs. This magnifies the need for the implementation of community needs assessment to enable them to ascertain the benefits they would accrue from the availability of such resources through the generation of goods and services that sustain their livelihoods (Borrini-Feyerabend *et al.*, 2013; Emiru, 2003).

Partnership arrangements with the local people must be placed in way of attaining the sustained amalgamation of protected areas with sustainable development efforts (Mitiku *et al*., 2006; Mackinnon, 2001). Hence, participatory planning and implementation of park development activities is a key element for the success of protected areas management since considering local contexts and rights over and access to the natural capital will bring strong commitment for the

sustainable management and development of protected areas (Borrini-Feyerabend *et al.*, 2013; Mackinnon, 2001). However, the challenging questions that need to be addressed include (a) which type of resources can be used by the local/indigenous people so that they will be able to generate income to support their livelihood? (b) what will be the role of park authorities in building partnerships with other relevant stakeholders in creating the enabling environment for the eco-friendly livelihood development? and (c) what rules, regulations and law enforcement arrangements are required to address the development challenges facing protected areas? Therefore, the researcher hopes that this research would reply to the above questions by responding to the fundamental research questions of the thesis indicated below.

1.4. Statement of the Problem

Properly managed protected areas such as National Parks serve as preservation, safeguarding and maintenance shield of healthy ecosystems and their associated services that help the existence of humanity (SCBD, 2008). Bowman (2012) described National Parks as areas which are planned to shelter the lasting "wilderness" of a given country and are principally dedicated for the preservation of nature along with its plant and animal species. However, their management has become a matter of considerable social, political, economic and scientific concern to societies (Grazia *et al*., 2012; Emerton, 2005).

Since the existence of life on the planet earth, an estimated 30 billion species have occurred, but only about 0.01% of these remain today. It is estimated that up to 150 species become extinct every day (NPA, 2013; USGCRP, 2007).

Research has shown that the natural ecosystems are endangered due to human activities, for example deforestation contributed in the reduction of oxygen supply and irreplaceable natural capitals (Getahun, 2018). Wetlands are being drained in the name of development, eliminating breeding grounds for millions of birds and reproduction support systems for fishes resulting in the extinction of animal and plant species. Simple human greed is eliminating a natural capital that has taken millennia to amass (Travis *et al*., 2010; IUCN/UNEP/WWF, 1991).

Presently, climate change is posing political, environmental, social and economic challenges to humanity (UNFCCC, 2018; UNDP, 2015). The world's temperature has already warmed by 1ºC.

Environmentalists assert with a proof that the global warming that has occurred during the last 50 years is mainly caused by human interference in to the natural environment (UNFCCC, 2018; BM, 2006).

With the ever-growing rate of the population, the need for necessities (shelter, energy, food, etc.) rises correspondingly by having additional threat on protected areas. This view was echoed by SCBD (2008) who states that many of these areas are not well protected - and are increasingly faced with external threats that are difficult or impossible to control. The threats on protected areas in Ethiopia include climate change, development beyond their boundaries, water limitations and pollution, invasive species, and interrupted wildlife migration corridors (Getahun, 2018; Srinivasan, 2014). Ethiopia, like other developing countries in Africa has a limited achievement in protecting its natural capitals. This resulted in the escalation of threatened and endangered species along with increasing habitat fragmentation for wildlife as experienced at Nech Sar National Park (Getahun, 2018; Srinivasan, 2014; Demel, 1999; EFAP, 1994).

Even though the prevalence of biodiversity loss is recognized for causing a profound ecological degradation which in turn causes a loss in social, economic and livelihood development opportunities in the country, research which explores the degree, magnitude and negative impacts of human activity on the ecosystems of the country's National Parks is very elusive (EWCA, 2014; SCBD, 2008; Kindeya, 1995).

The sustainable use and management of protected areas relies on research that explores the potential negative and positive impacts of human activities on the ecology of these resources and the interactions between the local communities and the natural capitals (Getahun, 2018; Nickson, 2014; Rodger *et al*., 2011). So far though there have been researches done on Nech Sar National Park such as on the floristic composition of the vegetation, changes in wildlife habitat distribution and structure, vegetation dynamics, resettlement, ecotourism, tourist satisfaction, small mammals, etc. (Simon, 2016; Shetie *et al*., 2015; Aramde *et al*., 2014; Girma and Till, 2012; Denna, 2006; Samson *et al*., 2010; Aramde *et al*., 2012; Bililign, 2015; Abiyot, 2009), analysis on the impact of human activities on the state of the natural capitals of the park has not been provided from universities, researchers and wildlife and natural resource assessing groups. For instance,

literature is silent on the impact of human activities on the natural regeneration potentials, density and diversity of the woody vegetation of the park.

This indicates as the impact of human activities on protected areas have not received the necessary attention by the decision makers since the focus of the research outputs is mainly on other academic driven scientific areas such as floristic composition, wildlife diversity and other research areas (Abraham, 2015). This resulted to have a knowledge gap on the impact of human activities on the natural capitals of the country's National Parks including Nech Sar. This reinforces the need to develop the understanding of these impacts and the underlying factors of degradation in National Parks since it will serve as a basis for the development of appropriate strategies that could halt the human induced ecological problems of the park and play a significant role in providing the right policy and governance directions which will help to ensure the sustainable development and management of the park's natural capital.

1.5. Significance of the Study

The protection of the natural environment is central to the survival of mankind as they are the means for the provision of goods and services. However, there is ample evidence indicating that National Park management and the misuse of their associated resources in countries like Ethiopia has had adverse effects on the natural capital of protected areas. In many instances the degradation of the natural ecologies is widely documented (Arega 2005), it is, however, evidenced that the degree and magnitude of natural capitals degradation of the protected areas is not being researched. Hence their broader societal significance is usually undervalued in decision making process since numerous ecosystem services from the ecological capital of these resources have no direct and immediate market values (NERC, 2014; MEA, 2005).

According to IUCN Global Irreplaceability Database on Protected Areas (http://irreplaceability.cefe.cnrs.fr/sites/2278) there are also four animal species in Nech Sar National Park that are considered of global importance as they are endemic to the park. This includes, Ptychadena erlangeri of an Amphibian species; Caprimulgus solala (Nech Sar Nightjar) of a bird species; Crocidura phaeura (Guramba Shrew) and Grammomys minnae (Ethiopian Ticket Rat) of mammalian species. Insects are also diverse in their species composition and are

among the common features of the park, 69% of the butterfly species in Ethiopia are recorded in Nech Sar National Park and 20% of them are endemic (Andreas, 2015).

The park, however, is facing manifold ecological challenges because of the increasing human activities such as deforestation and increased livestock pressure. As for instance, about 98% of Arba Minch city inhabitants are using fuelwood as their major source of household energy supply, that mainly comes from the woody vegetation of the park (Abraham, 2015). The Nech Sar plains are also facing an increased proportion of invasive alien plants and bush encroachment. The declining number and the subsequent local extinction of the Swayne's Hartebeest is also another indicator for the human interference effect on the biodiversity potentials of the park (Simon, 2016).

Hence, the significance of this study lies in the relevance of the study to the development needs of the country (to be further discussed in section 1.9 below). Within the context of the ongoing changes, examining the state of the natural capitals, studying perceptions, identifying the barriers of the sustainable development and utilization of the natural resources of national parks is current and important since the degradation of natural resources is posing a significant threat to the existence of the country's protected areas (Seyoum, 2015; Davies *et al*., 2009). Thus, as the degradation of natural resources in protected areas is occurring with a more change on the obliteration of their ecological functions, with anticipated significant negative impact on the wellbeing of societies, gaining deeper understanding of the local perspective of the park's ecosystem is timely and relevant.

For least developed countries like Ethiopia, protected areas related research is also essential for practical reasons. Knowledge which will emerge from research findings will inform policy and strategic actions by pinpointing the current state and prospects of the natural capital and the formulation of actions that will help to enhance park management and other forms of natural capitals. Accordingly, this research engages different experimental researches to examine the current state of the natural capitals of the Nech Sar National Park vis-à-vis the ongoing human activities that are degrading the natural resources base of the park (Andreas, 2015).

As indicated above in the statement of the problem section, there have been researches done on the park, however, there is a research output gap in systematically analyzing the state of the

natural capital of the park in relation to the ongoing human induced activities in the park. Analysis and recommendations of previous researches were guided by academic interest and have not considered the broad range of human induced impact issues which make the research findings to miss the important connections that could help to ensure the sustainable development of park resources (NSNP, 2016; Abraham, 2015) (to be further discussed in section 3.8 where the researcher addressed existing literature gaps on the study). Hence, understanding the current state of the natural capital of the park in line with assessing the major causes of the natural resource's degradation is believed to bridge the knowledge gap of examining the level of human driven threats that are being posed on the ecosystem services of the park.

This study hence seeks to gain a deep understanding and insight on the state of the forest cover density, diversity, natural regeneration status, impacts related to fuelwood collection, invasive plants, perceptions of the local community, etc. within the context of multiple human activities. The research would offer first hand insight and information about the deep impacts of human activities on the natural capitals of the park, as well as exploring opportunities that would help to mitigate the changing risks of the degradation. Therefore, since ecosystem management is firmly dependent on local perspective, the researcher will develop a conceptual framework which will help the analysis of the state of the natural capital of the park and the human activity related challenges. The framework will be also designed to inform policy and decision makers of the sector in devising evidence based strategic actions which are aimed at mitigating the causative agents of the challenges in an integrated multi-sectoral approach (Amar *et al*., 2018; SCBD, 2008).

1.6. Case of the Research

The natural capital of Ethiopia's protected areas is going through significant degradation because of human activities. The extent and degree of the ongoing resources degradation against human interference have not been sufficiently explored by research. This phenomenon has favoured the overexploitation of these valued resources to be unabated and has also denied policy and strategic level frameworks and tools that could help to halt the situation.

Therefore, the research will respond to the above sectoral challenges which are supported by the need of understanding the level of vulnerability of national park's natural capital. In line with

this the identification of the driving forces of degradation and processes are among the issues that researchers should focus (Nickson, 2014; Scott *et al*., 2007).

1.7. Objectives of the Study

Ethiopia needs an ecosystem-based problem-solving research programme which could inform decision making processes and actions on the overall management of protected areas. The overall aim of this research is to explore the impact of human activity on the natural capital of Nech Sar National Park in Ethiopia and devise strategic framework and approaches to enhance the management and governance of the national park.

The specific objectives of the study are to:

1. To undertake a systematic analysis on the state of natural capital of the park with a major focus on forest, grassland and aquatic ecosystems.
2. Assess governance related factors that impact the management of the park's ecological capital.
3. Assess the perception of relevant stakeholders on the state of ecosystem services and the natural capitals of the park.
4. To propose integrated strategic development approaches that will help to improve the sustainable development of Nech Sar National Park.

1.8. Research Questions

To achieve the above objectives, the study attempted to answer the following research questions:

1. In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems?
2. What are the human induced threats that impact the natural capital and governance of the park?
3. How can the natural capital of the park be protected and managed in a sustainable way?

1.9. Original Contribution to Knowledge

Though various researches tried to pinpoint as the natural resources of protected areas are facing degradation due to human activity, existing studies fail to provide a conceptual framework that will help to explore the quantified and direct impact of human activities on the natural capitals (forest biodiversity, grassland, invasive species and lakes) of protected areas. However, the conceptual framework developed by this research makes an academic contribution in the protection and sustainable development of national parks natural capital, since it is designed to have a systemic analysis of the problem by showing the extent and magnitude of human induced impacts on the natural capital of protected areas. In line with this, the application of the framework produced new and evidence-based findings which will help to improve the governance of protected areas as the research will provide park authorities with a practical tool in addressing the underlying causes of natural capitals degradation of national parks before the state of degradation of these resources reach its irreversible juncture. The data generated through the work contributes to knowledge as this level of information on the park is not available. This applied work also brings academic research closer to practice through its practical recommendations and tools. Although the research was done on a specific case study of Nech Sar National Park, it has relevance to the development challenges facing many other protected areas of the country. In addition to that, the outcomes of the research can be replicated in other developing countries of Africa, Asia, Pacific, and the like. Lastly, the governance related recommendations, such as the deployment of a hybrid governance approach than the traditional and current top-down governance approach of protected areas is another contribution which helps to bridge the knowledge gap in the governance system of protected areas.

1.10. Linkages between Specific Objectives and Research Questions

The below table is designed to present the linkages among the specific objectives and research questions. The table also shows an overview of how relevant information is collected to respond for the research questions and as to how the research questions will be answered.

Table 1: Research objectives, questions and data sources

Research Objectives	Research Questions	How the questions are answered	Data sources and collection methods	Thesis chapter
To undertake a systematic analysis of the state of natural capital in the park.	In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems?	Analysis on the woody vegetation natural regeneration status; species diversity and density across the different disturbance gradients; assess the proportion of ground cover of herbs; analysis on the expansion of invasive plant species; assess the state of the selected ecosystems; etc.	Ecological assessment on forest, grassland, lakes; FGD; observation; triangulation; questionnaire; interviews; satellite images; etc.	Chapter five
Assess governance related factors that impact the management of the park's ecological capital.	What are the human induced threats that impact the natural capital and governance of the park?	Analysis of the existing park governance challenges; identify policy and strategy implementation barriers; identification of human induced threats; etc.	Textual analysis; FGD; interview; observation; etc.	Chapter six
Review the perception of relevant stakeholders on the state of the natural capitals and ecosystem services of the park.	How can the natural capital of the park be protected and managed in a sustainable way?	Literature review; assess key information from best practices of other protected areas; etc.	Literature review, interview, questionnaires and FGDs.	Chapter six
To propose integrated strategic development framework that will help to improve the sustainable development of Nech Sar National Park and other Ethiopian parks in general.		Key information from the problem analysis; information from literature review; key information from ecological assessment results; etc.	Literature review; stakeholders meeting; findings of ecological and qualitative assessment	Chapter seven

1.11. Thesis Outline

The thesis is organized into seven chapters and the key issues addressed in each chapter are summarized in the following table.

Table 2: Thesis Organization

Thesis structure	Key issues
Chapter 1: Introduction	The introduction chapter presented background information of the study. The problem statement, purpose of the study, objectives, research questions to be answered, and the contribution of the study to knowledge are also highlighted in the chapter.
Chapter 2: Setting the Scene, Case Study Context and Background	This chapter is aimed at setting the scene of the study. A description on the country context is highlighted. . The historical background of the country's conservation efforts which dates back to the 1450s is also highlighted alongside with the historical background of its national parks. The governance arrangements of the country's national parks, description of the park's natural capitals, and a review on the impact of human activities are among the issues highlighted in the chapter.
Chapter 3: Literature Review	The review of related literature is aimed at positioning the thesis about what is known about the sustainability of protected areas with a major focus on national parks and human interference. The ecosystem services and benefits provided by nature are also highlighted through critical evaluation of the arguments and identification of relevant information. the review on the impact of human activity on the natural capital of the park, governance arrangements and lessons learned from other protected areas are also discussed in the chapter. The role of protected areas as a natural remedy for climate change, biodiversity conservation and local economic empowerment is also reviewed in this section.
Chapter 4: Methodology	Chapter 4 presents the conceptual framework of the research and discuss the selected methodological approaches of the research. The conceptual framework of the research helps to show how the research is framed in a way that could

Thesis structure	Key issues
	help in exploring the different interplays among the natural capitals of the park and the human activities along with the governance related challenges. Besides, it discusses how the research is designed, methods deployed by the researcher for data sampling, data analysis methods, the ethical considerations utilized by the researcher when implementing the research and the limitations of the research.
Chapter 5: Status and Prospects of Natural Capitals in Nech Sar National Park	This chapter answers the research questions of the thesis by presents the findings of the ecological survey on the impact of human activity on the natural capitals of the park such as vegetation density, species diversity and the natural regeneration potentials of the woody vegetation. The chapter looks in deeper about the magnitude of the degradation of the natural capitals of the park as a result of the ongoing human interference. The chapter is also aimed at presenting the findings of the research with regards to the overall trend of the fuelwood collection and its impact on the park's natural capital.
Chapter 6: Ecosystem Services and Governance Impediments in Nech Sar National Park	This chapter explores the findings of the study on ecosystem services of the park, perception of the communities on the ecosystem services and their preference for the different ecosystems. In this chapter, governance and policy related challenges that affect the natural capital of the park will also be dealt in deeper.
Chapter 7: Discussion and Concluding Remarks	This chapter summarizes the major findings of the research and makes recommendations that could help in the sustainable development and management of the park.

Chapter 2 - Setting the Scene

2.1. Introduction

The purpose of this chapter is to present the background information about the country, the park and its surroundings. It provides some basic information of the country (population, economy, weather, etc.), the background information of the park, its history, conservation efforts, park management, the setting of the indigenous communities who live in and around the park.

2.2. Country Context

Ethiopia is an ancient country with a lot of historical sites. Paleontological investigations have ascertained that Ethiopia is among the cradles of mankind. In an archaeological study done in 1974 "Dinknesh" or "Lucy" was discovered in Ethiopia in a place called Hadar as an ancient and most complete hominoid skeleton which is ever found, which dates back 3.5 million years (DHS, 2012).

Figure 1: Location map of Ethiopia (WA, 2016)

Located in east Africa, Ethiopia is at the crossways among Middle East and Africa. Therefore, throughout its ancient and long history, the country has been a melting pot for a wide range of traditions as well as cultural set ups. As a result, the country owns a complex range of nations

and nationalities, ethnic and linguistic diversity. Presently, more than 80 different languages are spoken in the country which is composed of 12 Semitic, 22 Cushitic, 18 Omotic, and 18 Nilo-Saharan languages which vary in population size from more than 26 million people to fewer than 100 (MOI, 2004; CSA, 2010). The country shares borders with the Republic of Southern Sudan, Kenya, Djibouti, Eritrea, the Republic of Sudan, and Somalia. Ethiopia is also one of the founding members of the United Nations. Apart from that, Ethiopia has been the seat of the Organization of the African Union (OAU) since its formation and today also continues to serve as the seat for the present-day African Union.

In spite of Ethiopia's long and ancient history, there have been no demographic records prior to the 1930s. The total population of the country increased progressively during the last three decades, from 42.6 million in 1984 to 53.5 million in 1994, 73.8 million in 2007 (DHS, 2012), 78 million in 2009 – growing at a rate of 2.6% annually (FTF, 2010) and 94.1 million in 2013 (WB, 2014) and presently it is estimated to be 100 million. About half of the population are Orthodox Christians, one-third are Muslims, about one in every five (18 percent) are Protestants, and 3 percent are followers of traditional religion (CSA, 2010).

2.2.1. Geographical Perspectives of Ethiopia

Ethiopia has varied geographical forms ranging from the Ras Dashen peaks of 4,550m above sea level, to the 110 meters below sea level in the Afar Depressions. The country's average mean annual temperature is 23 degrees celsius, while temperatures also range from 47 degrees celsius in the Afar depression to as low as 10 degrees celsius in the highlands of the country. The country's total area of land is about 1.1 million Km^2 (EBI, 2015; CSA, 2009).

Climatologically, the country has three different categories: dry, tropical rainy and warm temperate. The average maximum and minimum temperatures differ from region to region and across the seasons of the year. The highest temperatures are from March to May while the lowest temperatures are from November to December. The westerly and the south-easterly winds are the one influencing the country's mean annual distribution of rainfall. The overall distribution of the annual rainfall is seasonal which again varies in intensity, amount, coverage, and time as it moves from the southwest to the northeast (EBI, 2015).

2.2.2. Biodiversity in Ethiopia

Braat and Brink (2008) explained biodiversity is not only the diversity of species, populations, genes but also communities and ecosystems. It is also considered as an element and an indicator of the health of all ecosystem and ecological processes. Biodiversity constitutes not only the big fauna and flora but also the smallest organisms along with their habitats. Therefore, biodiversity is the natural/ecological capital of the globe. As a result of its ecological diversity, the horn of Africa is usually considered as an important hot-spot of global biodiversity in relation to the amount of plants and animal species as well as the diversity of the ecosystems it comprises (Swara, 1992; UNEP, 2006).

Ethiopia is endowed with diverse terrestrial and aquatic ecosystems which consists the flora and fauna biodiversity resources of the country. The main terrestrial ecosystems of the country include the Afroalpine and sub-afroalpine, Montane dry forest and scrub, Montane moist forest, Acacia-Comiphora woodland, Combretum-Terminalia woodland, Lowland humid forest, Montane grassland, and Desert and semidesert. The aquatic ecosystems also include wetlands, rivers and lakes (BIE, 2015, BIE, 2016).

The biological diversity of the country is estimated to be made up of 6500 - 7000 higher plant species, 12 % of which are believed to be endemic to Ethiopia. The documented animal resources consist of 277 species of mammals, 861 species of birds, 20 species of reptiles, 63 species of amphibians, 150 species of fish and 324 species of butter flies. In terms of endemism, 31 mammals, 28 birds, 9 reptiles, 24 amphibians, 4 fish, and 7 butterfly species are believed to be endemic to Ethiopia only (Teklu, 2016; EBI, 2015; Husen *et al*., 2012).

Despite these vast amounts of biodiversity, the country is struggling to conserve its biodiversity resources. Human induced factors such as deforestation, increased energy demand and expansion of agricultural lands coupled with natural factors such as climate change are among the key drivers of resources degradation (Getahun, 2018).

2.3. Description of the Study Site

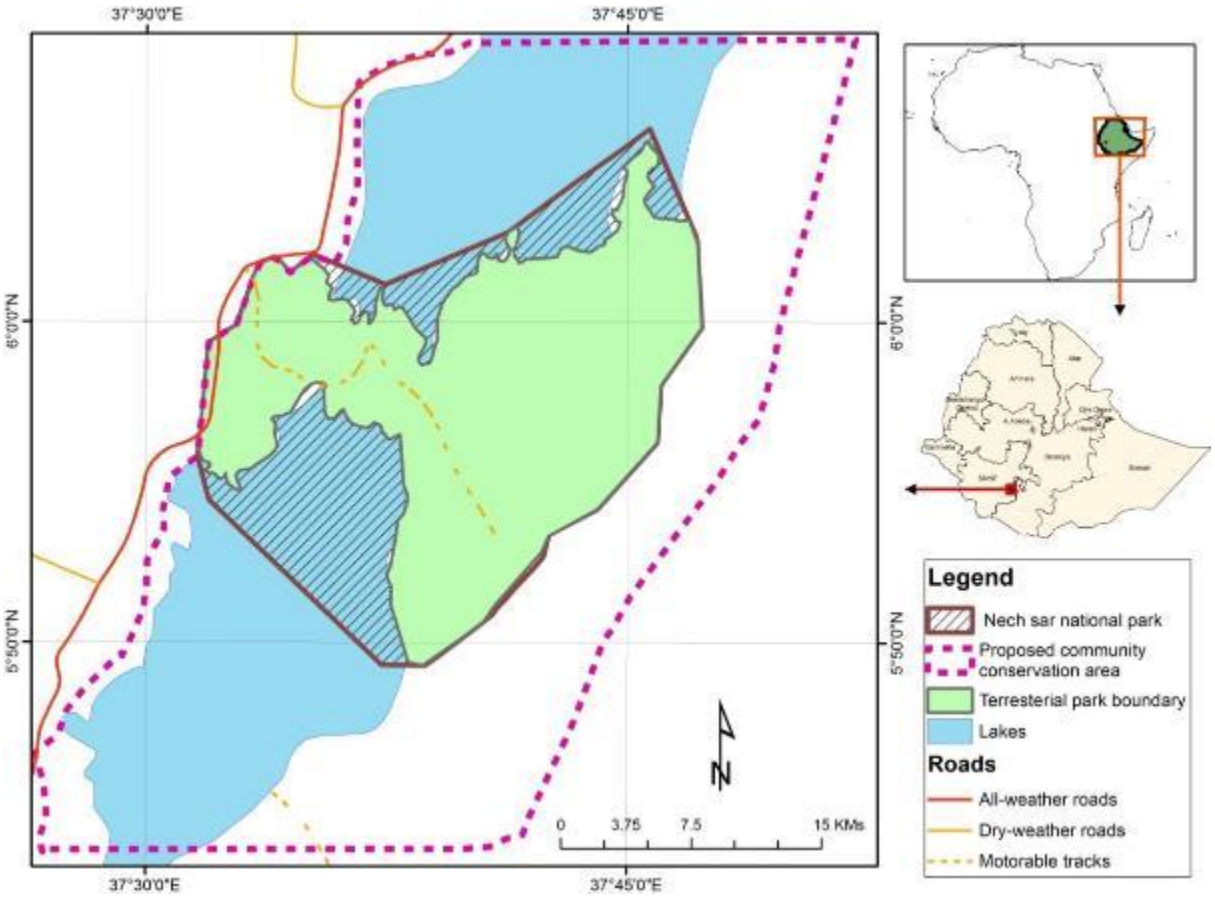


Figure 2: Location Map of Nech Sar National Park (EWCA, 2015)

Nech Sar National Park is located in Southern Ethiopia 510km south of Addis Ababa, the capital. The park lies within the floor of the Great Rift Valley and extends from 5° 51' N to 6 ° 50' N and from 37 ° 32' E to 37 ° 48' E with an elevation varying between 1,108 – 1,650 meters above sea level. The park is bounded to the east by the Amaro Mountain, to the west by the town of Arba Minch and to the north and south by lakes Abaya and Chamo respectively. The "Bridge of God", a narrow piece of land separates Lake Chamo and Lake Abaya, both of which are located in the craters of ancient volcanoes. As a result of its landscapes and the natural ecosystems, the park is also one of the major tourist attraction sites of the country. The 'Crocodile Market' in Lake Chamo that coined its name as a result of the unique population assemblage of crocodiles at a specific site, birds, hippos & associated islands & lakeshores of Chamo Lake along with the diverse terrestrial and aquatic wildlife species are among the touristic sites of the park. Arba Minch is the

principal town of Gamo Goffa administrative zone, located at the base of the western side of the Great Rift Valley in the Southern Nations, Nationalities and Peoples' Regional State of Ethiopia and which is found at an average elevation of 1285m above sea level (Bililign, 2015).

The Park situated in an area of great natural beauty in the mid rift valley, was established in1974 by covering an area of 514 km², of which 78 km^2 (15%) of total coverage is water. Nech Sar named after the white grass, its name was derived from two Amharic words "Nech" meaning "White" and "Sar" meaning "Grass" as the color of the grass which covers the undulating Nech Sar plain during the dry season gives the landscape a yellow-white colour. Among the fascinating landmarks situated inside the park is the presence of "forty springs" (at one particular place) whereby the name of the town Arba Minch itself was also derived from the two Amharic words ("Arba" means "forty" and "Minch" means "Springs"). In the far eastern part of the park, hot springs bubble to the surface (EFDRE, 2015; EWCA, 2014 and Abraham, 2015).

2.3.1. Rainfall and Temperature

Primary data on rainfall and temperature for Nech Sar National Park was collected from Ethiopian Metrological Agency. The mean monthly maximum and minimum temperatures are 33.4^{0}C and 15.4^{0}C in the months of March and December, respectively (Figure 3 and 4). The annual rainfall for the last 30 years ranges between 465.9 – 1,141.1mm with mean annual rainfall distribution of 803.5mm (Figure 5). The long rainy season is from March to June and the short rainy season is from September to November (Figure 6). The peak mean monthly rainfall is in April (151.1mm) and the minimum in January (28.6mm), (Figure 6) (Ethiopian Meteorological Agency, Arba Minch Station: 1987-2019).

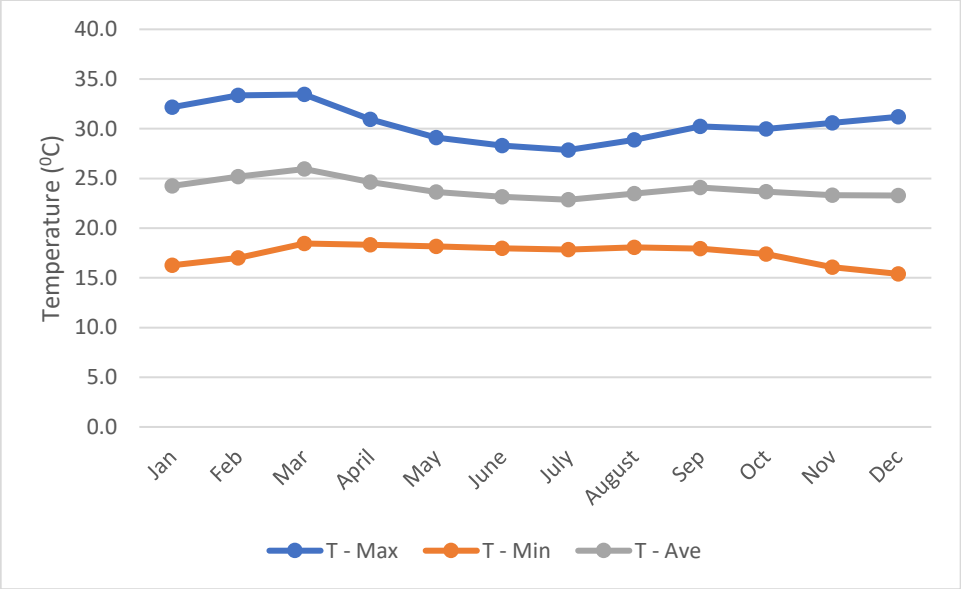


Figure 3: Monthly maximum, minimum and average temperatures of Arba Minch station (1987-2017) - based on data obtained from Ethiopian Meteorological Agency

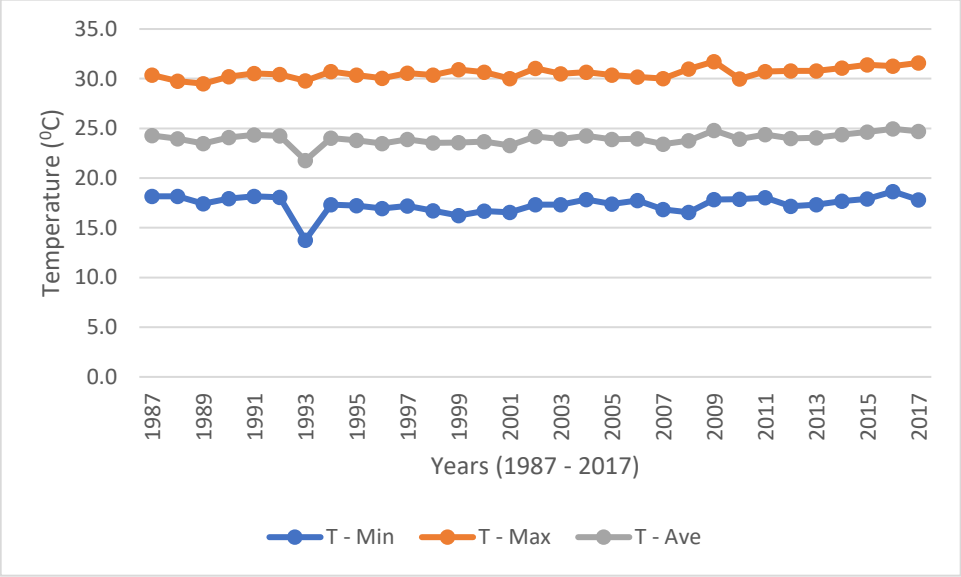


Figure 4: Yearly maximum, minimum and average temperatures of Arba Minch station (1987-2017) – computed from Ethiopian Meteorological Agency data

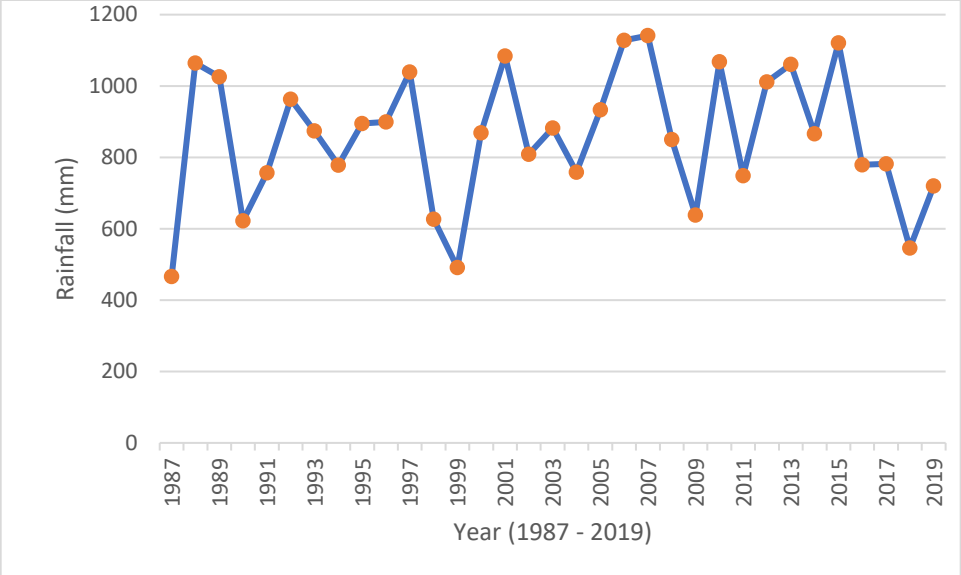


Figure 5: Annual rainfall distribution at Arba Minch station (1987 - 2019) – computed from Ethiopian Meteorological Agency data

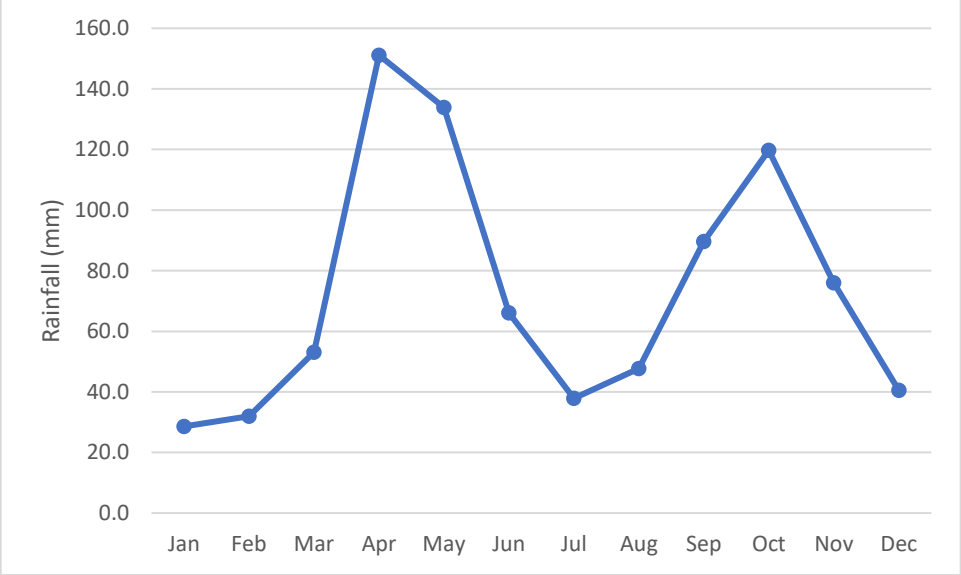


Figure 6: Mean monthly precipitation of Arba Minch (1987 - 2019) – computed from Ethiopian Meteorological Agency data

In summary, the above climatological data has showed that there exists fluctuation in rainfall supply from year to year (Figure 5). As can be seen from Figure 5 in recent years (2008 onwards), the fluctuation is getting more extreme than in the past and such fluctuation will have a direct negative impact on the natural capitals of the park such as on the density and diversity of the forest resources of the park since moisture availability is one of the factors that determine the

growth and development of plants. This phenomenon is also having its own negative impact on the agricultural activities of the local communities (Abiyot, 2009) which in turn causes the increased reliance of the communities on the natural capitals of the park by degrading the forest for household energy supply, overgrazing by livestock, grass mowing, and performing other crops production activities inside the park (Andreas, 2015; Girma and Till, 2012).

2.4. Historical Background of Ethiopian Parks

The below Table 3 is collated to present information on the historical heritages about the establishment of protected areas in Ethiopia. It also explains the genesis of the establishment of Ethiopian park authorities.

Table 3: Historical background of the protected areas development in Ethiopia

Year	Challenges	Milestone	Result
1450	Emperor Zera Yacob (1450s) noted the loss of forest cover on what is now called Wuchacha Mountain.	The forest was replenished at his orders using seeds and seedlings of *Juniperus procera*	Created Menagesha Forest, which stands today as one of the environmentally vital resources of the country (Gilbert 1970, cited in Annon., Undated a).
1908	Depletion of wildlife due to hunting and other illegal activities	The first legislation on the protection of wildlife was passed by Emperor Menelik II.	Reduction of elephants hunting (Mahteme Selassie Wolde Meskal, 1970 in Annon. Undated b).
1944	Although there has been reduction in elephants hunting the communities continued hunting of other wildlife	further legislation was passed by Emperor Hailesellasie to regulate hunting of wildlife to ensure that certain species were not over–hunted. This game law was aimed to enact as one can only hunt with a licensed permission.	Reduction of hunting activities on other species (Annon., undated b.)
1963 - 1965	Absence of adequately functioning protected areas	the Imperial Ethiopian Government established	With help of UNESCO, the Ethiopian Wildlife Conservation

Year	Challenges	Milestone	Result
		a Wildlife Conservation Department	Organization (EWCO) was established in 1964. Mr. J.H.Blower was appointed to the Department to advice on technical matters (Robertson, 1970).
1967	Lack of institutional capacity	wildlife conservation department established through the Ministry of Agriculture has set the following objectives for protected areas	Formulation of clear objectives: 1) To conserve wildlife particularly endangered species; 2) To protect wildlife habitats and areas of ecological significance; 3) To establish conservation areas in the form of National Parks wildlife sanctuaries and reserves; 4) To control wildlife utilization and products; and 5) To create awareness towards wildlife and conservation. (Anemut, 2006)
1967 - 1974	Lack of institutional capacity to manage the protected areas at local and regional level	Governance mechanisms established	Ethiopia has established nine National Parks between 1967 and 1974 and also established eight game reserves and three sanctuaries (Rodrigues *et al.,* 2004; EWCA, 2016).

Ethiopia contains the oldest records of conservation efforts and the oldest conservation area on the continent. Emperor Zera Yacob (1450s) noted the loss of forest cover on what is now called Wuchacha Mountain (Table 3). The forest was replenished at his orders using seeds and seedlings

of *Juniperus procera* to create Menagesha Forest, which stands today as one of the environmentally vital resources of the country (Gilbert 1970, cited in Annon., Undated a).

Over the years the country has devoted financial and human resources in the creation of objectives resulting in the establishment of development plans and legislative frameworks that enhanced the institutional capacities of the sector which has resulted in the creation of 20 National Parks. Since then, the country has devoted about 16% of the total landscape to be protected whereas the global average is 12% (EWCA, 2016; Rodrigues *et al*., 2004).

While the current effort of increasing the number of National Parks is commendable for biodiversity, ecological and tourism related benefits, placing appropriate measures that can ensure the sustainable development and management of these resources is equally important. However, many of the parks are going through various forms of human induced interferences (Tefera, 2011) which in actual sense jeopardizes the intended benefits of these vital resources.

2.5. Historical Background of Nech Sar National Park

The establishment and governance of Ethiopia's protected areas have started its historical journey by the technical support of UNESCO's in 1964 – 65 which helped for the establishment of the then Wildlife Conservation Department. Technical expatriate staff were also deployed to assist the establishment of National Parks and Game Reserves. Records showed that wildlife technical experts Blower and Melvin Bolton (British biologists) have played pivotal technical role during the establishment of the park. It is also documented that Blower has developed the boundary map of the park while Bolton also suggested to include zoning of the landscape in to buffer zones and core areas (Abiyot, 2009). Accordingly, the Nech Sar grassland was marked as a core area for its ecological importance in sheltering the grazer wild animals such as Zebras, Swayne's hartebeest, gazelle and kudu while the rest of the park to be a buffer zone. Bolton then made further assessments and suggested as the area to be established as a National Park. Then based on this suggestion and boundary proposals of the experts the present day Nech Sar National Park was officially established in 1974 by Ethiopian Wildlife Conservation Organization (EWCO) (Girma and Till, 2012). Then to give it a legal ground the establishment of the park was decreed

by the "Wildlife Development, Conservation and Utilization Council of Ministers" Regulations No. 163/2008.

The criteria and grounds for the establishment of the park were based on IUCN protected area designation criteria. This was mainly based on the values of the area to sustain impressive scenic beauties and wildlife resources which are designed to benefit the existing and incoming generation. As highlighted above, prior to its establishment, field level assessment results were used to evaluate the suitability and relevance of the area for the conservation of nature. The assessment results focused mainly on the identification of spectacular scenic attractions, wildlife resources, ecosystem, habitats and species diversity with availability of sufficient habitat range, representativeness, presence of endemic and endangered species, existence of conservation dependent species and natural sites. Apart from that, uniqueness of the landscape which makes the area to be different in its natural settings, pressure and threats level which were inimical to the sustainability of the resources and shows some level of urgency for protection activities were also important elements that necessitated the establishment of the park (Abraham, 2015).

On the other hand, though the ecological and economic values of the area are considered by the park establishing experts, probably due to the existence of large and abundant resources for grazing and other agricultural activities there is no written evidence if the local communities were consulted or have participated when the map of the park was prepared. Thus, during the establishment of the park, enforcement activities could have been very low as a result of the low population size (to be further discussed in the following sections).

As depicted by wildlife conservation development plan of the then Ministry of Agriculture in 1972 "*Nech Sar NP is unspoiled and practically uninhabited by man. Hence, the area had the least human encroachment and, consequently, there is abundant wildlife. A census conducted during 1973/4-1974/5 by wildlife experts have shown that there are 1222 persons living in 302 houses with a livestock population of 5897 head, mostly cattle. 502 of the persons live in permanent villages whereas others are pastoralists. After further assessment, these people can easily be resettled elsewhere in the Sidamo and Gamo Gofa regions where plenty of suitable land is available*" (MoA, 1972 cited in Girma and Till, 2012:11).

This fact indicates as the local communities' reaction was less during that time due to the existence of alternative wide area of land which could be used for livestock grazing activities and prevalence of less human wildlife conflict at the time of establishment. On the other hand, it is also possible to see as there was a strategic action gap by the concerned government institutions at that time in resettling the local people as per the strategic document. This action could have been done very easily by then since there was no population pressure and competition for natural resources in the area. As time goes on, however, this little and under estimated human interference in the park got deep rooted and caused considerable degradation on the natural capital of the park which was by then intended to be protected for its ecological and economic importance and preserve nature for the benefits of the present and upcoming generations.

Hence, during the establishment phases of the park if the above resettlement idea of the local people has been materialized timely, the impact of the present day human induced challenges could have been minimized or avoided and paved the way for the proper governance of the park's ecosystems.

2.6. Local Communities and their Livelihood in and around Nech Sar National Park

Gamo, Kore and Guji are the local communities that live in and around the territories of Nech Sar. These communities are different tribes who speak different languages and governance-wise these three communities belong to two regional states of the country. The Guji to Oromia and the Kore and Gamo to the Southern Nations regional state. The demographic details and livestock data are presented in the following tables (Tables 4 and 5).

Table 4: Human population structure of the local communities (2016)

S.N.	Name of Community	Household		Population		M+F Total
		Male Headed	Female Headed	Male	Female	
1	Guji	1,120	96	2,236	3,512	5,748
2	Kore	2,821	2,181	12,492	13,271	25,763
3	Gamo	19,999	18,706	79,097	78,572	157,669
	Total	23,940	20,983	93,825	95,355	189,180

(Source: Park records and Arba Minch Office of Statistics)

The human population of the local communities who have a direct impact on the park was also 133,883 in 2010 and this number has increased to 189,180 in 2016 (NSNP, 2016). In terms of resource competition and degradation on the park's natural capital it is also meant a lot of pressure on the park's resources.

Table 5: Livestock population of the local communities in 2010 and 2016

S.N.	Name of Community	2010 Total	2016 Total
1	Guji	31,350	120,851
2	Kore	32,772	46,293
3	Gamo	10,877	40,111
	Total	74,999	207,255

(collated from park records and office of agriculture)

The above statistical data indicates that (Table 5), the number of livestock population which largely depends on the park's natural capital has increased two, three and four folds in between the years of 2010 and 2016 because of the increasing households and human population.

The Guji communities are found on the eastern tip of the park where there is a grassland plain which is about 35 kilometres from the park's main office. Even though, the Guji population is the smallest of all communities (above Tables 4 and 5), they hold the highest incomparable number of livestock as compared to the other local communities (about three-fold of others). They are also living inside and outside of the park.

The Guji speak Oromigna, one of the Kushitic languages of the country. There exists a controversy on the settlement time of the Guji communities in the Nech Sar area. Some say that the Guji were there before the establishment of the park while the park management believes as the Guji only encroached the area following the fall of the revolutionary government of Ethiopia in 1991. The Guji on the other hand says as they have been there for long. Rich grazing land, water resources like Lake Chamo, Sermele rivers and fertile land are among the factors that attracted the Guji (Abiyot, 2009).

Pastoralism is the main stay for the livelihood of the Guji. they rely on their cattle to support their household food supply and as income generation. They also started practicing a bit of subsistence agricultural activities like crop production in recent decades (mainly maize and sorghum production).

They practice the very traditional way of animal production where the production system is focused on having a high number of livestock per household for which is a symbol of wealth as well as a means of getting social prestige values than focusing on the quality. This is mainly an attribute of the fact that, people with highest number of cattle will be considered as rich in the area and have more social acceptance and values over the community. They also practice free grazing in the grassland plains of the park.

It is very apparent that the grassland in many places is getting devoid of ground cover of herbs as a result of the high livestock pressure. This phenomenon has a direct impact on the availability of feed for the remaining wild animals of the park. Apart from that, the existence of these livestock pressure in the park has its own negative impact on the survival of the endangered species like the lions since the communities usually kill these carnivores to protect their cattle from being preyed. To this end, at the time of data collection, the researcher has witnessed a freshly gunshot dead body of a lion in the grassland ecosystem, as the local communities decided to kill it as the lion was hunting their cattle.

According to the regulation of protected areas management, settlement and agricultural practices are strictly forbidden inside National Park territories and hence, concerned regions were supposed to peacefully evict the inhabitants and settle them in a comparable fertile area where they can support their livelihood in a more efficient way. Accordingly, while the Southern Nations have settled the Kore communities in an alternative land, the Oromia regional state did not seem to perform this resettlement and in the grassland plains of the park it is not uncommon to see the thatched houses of the Guji community. This poor governance arrangement, however, is among the prime factors that degraded the natural capital of the park.

The Kore community is also the other indigenous community that lived in the area. They are administered under the Southern Nations regional state and they also have their own language. They are located in the east and south eastern areas at about 49 kilometres from the main office

of the park. They mainly rely on crops production for their livelihoods. Teff, maize, sorghum and Enset are the prominent crops harvested in their area. They also practice livestock rearing. Field observations have proved as their farming activities are being supported by agricultural extension programmes of the area. However, lack of road infrastructure has challenged them to have a better access to market linkages and sell their produce for a better price.

A greater portion of the kore community was also living within the territories of the park. However, as part of the Southern Nations regional state adherence to the protection areas regulation, they managed to resettle these communities 15 kilometres away from the park. Flour mills were also provided for the community. As part of the resettlement package, each household was also provided two hectares of land where they can perform agricultural activities.

Even though the Kore communities were evicted from the park territories and settled in the nearby area, they continue to return to the grassland and water resources since the rehabilitation endeavores didnot provide water supply, schools and other social support services that would enable them to live a comfortable life. Road and other infrastructure facilities were not put in place to assist their movement, facilitate market linkage and communication to other communities. In general, there were no efforts done to provide viable alternative livelihoods that could stop the communities from exploiting the resources of the park. In the absence of these facilities the communities have reverted to the park and continued to exploit the resources of the park as a way of maintaining their livelihoods (Abiyot, 2009).

The resettlement of the communities was a top-down decision made by the federal, regional and park authorities without the consultation and participation of the local and indigenous communities to find out their views on the project and as to what needs to be done to facilitate smooth rehabilitation which has led to heighten tensions between park officials and local communities. This issue was also pointed out by Girma and Till (2012) as one of the drawbacks that affected the effectiveness of the resettlement programme. This research has also observed the inefficiency of the resettlement programme since there exists a continued use of the park resources by these communities even after the translocation. This has also escalated the deterioration of the grassland because of the expansion of the invasive plants and bush encroachment caused by the frequent in and out movement of the livestock in to the park's

territory. In the new resettlement areas (where the Kore are translocated), absence of water sources for the livestock (which they used to get from the park area) have also affected the lives of many who are dependent on livestock production. This being one of the factors that forced the communities to return and make use of the park's natural capital in sustaining their livelihood (Girma and Till, 2012).

In terms of a workable arrangement to resolve the tense situation, there should have been consultations with the local communities and get their consent to the rehabilitation project by getting their views on specifics that needs to be put in place before translocating them to the new locations. There should also be the development of strategic programmes in collaboration with the local and indigenous communities that will enable to develop small and micro enterprises and other sustainable livelihood programmes within the rehabilitated community.

On the other hand, the Kore community also looks unhappy since their former Guji neighbours are still living in the park by getting a better grazing land for their cattle. It does also seem that, as a serious conflict on resource utilization may arise if this antagonistic governance arrangement is not resolved by the administrative authorities (Abiyot, 2009; Girma and Till, 2012).

The third local community that has a direct linkage with the park is the Gamo indigenous community. They live in and around the town of Arba Minch by bordering the park in its western part. This community is under the administration of the Southern Nations regional state and they also speak Gamogna language. The water supply of the town of Arba Minch is also coming directly from the "forty springs" present in the park.

Micro enterprises, fishing, fuelwood collection, and livestock rearing are the prominent features of the Gamo community livelihoods. They also perform banana, mango and coffee production activities at large. Some are also engaged in tourism activities like renting boats for touristic activities on lake Chamo. The biggest challenge exerted by the Gamo community on the park's natural capital is fuelwood collection. They also practice grass mowing from the park and sell for the urban cattle herders. Illegal fishing activities of this community are also the prominent activities that affect the park's biodiversity potential.

2.7. Governance History of Nech Sar

Institutional structure changes in governing protected areas have not only affected the capacity of the sector but also affected the sustainable development and management of Ethiopia's National Parks. This has also affected the timely formulation and implementation of policies and strategies that could have helped the efficient management of protected areas. As for instance, from the 20 National Parks of the country which cover about 16% of the country's landmass it is only Awash and Siemen Mountains National Parks that are gazzeted by proclamation. Nech Sar though established in 1974, is never gazetted but is operating as a de facto National Park since then.

Girma and Till (2012) pointed that, in between the years of 1964 – 1970 the protected areas of the country were administered by the Wildlife Conservation Department of the Ministry of Agriculture under the general guidance of the Wildlife Conservation Board. Afterwards the administration of the protected areas was given to the Ethiopian Wildlife Conservation Organization, which was answerable to the then Ministry of Agriculture. The change continued until the present-day Ethiopian Wildlife Authority was established which at present even its accountability is being handed from the Ministry of Tourism to the Ministry of Forestry and Climate Change.

Nech Sar from the time of its establishment in 1974 have gone through fundamental and repeated governance arrangements which have severely caused for the degradation of its natural resources. Park records showed that, during the time of park establishment there were only few people living in the park's territory. As time goes on, however, the Guji, Kore and Gamo communities who used to farm in the nearby highlands have started to encroach the park territories and perform farming activities in and around the park.

Having noted this encroachment, when the revolutionary military regime of the country came to power the local communities were told to leave the area and settle in the nearby fertile lands. As a follow-up of this order, the Kore and Gamo people moved out of the park and settled to the western and other nearby areas of the park. The Guji, however, refused to leave the grassland plain by justifying the suitability of the area for their cattle in terms of water and grazing land

availability. Hence, in the early 1980s, the revolutionary military regime has forcefully evicted the community from the territories of the park by burning houses and destroying properties and afterwards the park was freed from human interference for many years. However, when the military regime collapsed by the year 1991 the local communities quickly returned in to the park territories in huge numbers and the severe damage of the park's natural capital began in that transition period as the people have started to cut trees aggressively and perform other agricultural activities with in the park territories. The excessive deforestation and fishing activities were reduced afterwards with the collaborated effort of the Gamo Zone Police and the park authorities, even though livestock grazing and crops cultivation in the eastern tip where the Gujis live continued (Dena, 2006; Abiyot 2009).

According to park records, when the current federal government took power from the revolutionary regime, the administration of the park was handed over to the newly formulated Southern Nations regional state in 1995. This transfer of governance was, however, not supported by a proper human and financial resources capacity and the management of the park's resources have faced another phase of degradation for lack of proper protection activities. As time goes on, however, with the support of European Union National Parks Rehabilitation Project support some activities like resettling the local communities out of the park were performed. For instance, about 1,088 Kore community households were settled with the support of this project. Resettling the Guji was not achieved as a result of the difficult and lengthy negotiations between the Southern Nations and Oromia regional states. The project has failed from achieving its objective for lack of the support from the side of the Oromia regional state in resettling the Gujis outside of the park (Girma and Till, 2012). This disagreement between the two regional states have played a big role in the degradation of the natural capitals of the park as people were allowed to remain intact with the resources of the park.

The other milestone in the park's governance history was in February 2004 when the park's management was handed-over to African Parks Network, a non-governmental international conservation organization. This park management agreement was entered between Southern Nations Regional State, the Federal Government of Ethiopia (represented by the Ministry of Agriculture) and the African Parks Network. The agreement was entered for 25 years where the African Parks Network to be responsible for the overall management of the park which includes

but not limited to are road construction, establishment of fire breaks, water provisioning, tourism and visitor management, community involvement, resource mobilization from donors, etc (Dena 2006). This agreement was entered with a pre-requisite of the governmental authorities to resettle all the inhabitants outside of the park. Hence, the Southern Nations were able to resettle all their people outside of the park. Oromia on the other hand were not able to materialize the resettlement of the Guji since they feel as they have ancestral rights of living in the area while the other community members strongly contest this claim. As a result of this, even though the African Parks management was able to bring substantial change in terms of human resources capacity development and restoration of the park's resources, the organization was not able to proceed with the agreement since the Guji were residing inside the park. Subsequently, the African Parks Network was forced to cancel the agreement in 2008 and withdrew from Ethiopia by stopping all the planned activities and the park administration was taken by the Southern Nations Bureau of Culture and Tourism and in 2009 the administration was again taken-over by the Ethiopian Wildlife Conservation Authority. Since then the threat on the biodiversity potential of the park has increased from time to time (Solomon and Dereje, 2015; Aramde *et al*., 2012; Dena 2006).

2.8. Chapter Summary

Chapter two has provided the background information on the country context. It has also discussed the demographic, biodiversity and other geographical aspects of the country. The review of records showed that, Ethiopia has the longest recorded history in the protected areas establishment in the Africa continent. However, the country has limited success in conserving these protected areas due to poor protected areas governance systems and weak institutional capacity. In the case of the Nech Sar Park, due to the increase in human and livestock population compounded by the lack of viable employment opportunities and increasing poverty among the local communities, there have been increasing evidence in the elicit use of the natural resource base of the park by the local community for sustaining their livelihoods. This has resulted in the increased degradation of the natural capitals of the park. Details will be provided in the subsequent chapters.

Chapter 3 - Literature Review

3.1. Introduction

The review of related literature presented in this chapter starts by providing the broader concept and understanding of what protected areas are. The anthropogenic factors affecting the sustainable management of protected areas are also explored along with their influence on forest species diversity, density and natural regeneration potentials. It also pinpoints the impact of human activity on the natural capital of protected areas and explores the knowledge gap on the impact of human activities on natural capital of protected areas in the context of Ethiopian national parks including Nech Sar park. The significance of protected areas in biodiversity conservation, local economic development and the ecosystem services which sets the relevance of their protection and contribution towards sustainable development arenas are discussed. As a tool of designing the research conceptual framework of this thesis, protected area related research frameworks are also reviewed in the chapter.

3.2. Why Protected Areas?

A landmark new report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is about to be released while the summary of which was approved at the 7th session of the IPBES plenary meeting which was held in Paris (29 April – 4 May, 2019). The summary of the report states that nature is declining globally at rates unprecedented in human history. It warns that rate of species extinctions is accelerating with grave impacts on people around the world (IPBES, 2019; UNEP, 2019). In presenting the findings of the report to the public the IPBES Chair, Sir Robert Watson states:

> "The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide."

IPBES has also developed a Conceptual Framework - Connecting Nature and People. The framework is designed to denote the different elements of nature and the society at large which embraces "conservation and sustainable use of biodiversity, long-term human well-being and sustainable development', and therefore the key elements (or components) are nature, the

benefits that people derive from nature and a good quality of life". It also emphasizes the central role that institutions, governance and decision-making play on the links among these elements and most importantly, the Conceptual Framework "explicitly includes multiple knowledge systems" (Diaz *et al*., 2015:3).

In this regard, the findings from this thesis could also contribute for the undertakings of IPBES to further understand protected areas related challenges as well as the knowledge gaps on the ongoing human induced impacts that are degrading the natural capitals of protected areas. Conserving biological diversity has emerged as a priority shared by both conservation and development practitioners (Wells *et al*., 1992; Kelbora and Stellmacher, 2012). Protected areas play a vital role in contributing to climate change mitigation and adaptation both on global and local scale. It accounts for 14% of the world land surface (UNEP-WCMC, 2018). The role of protected areas in responding to climate change and other development calamities is currently insufficient and not being fully recognized in national strategies and policies in most developing countries (IUCN, 2012).

Research shows that ecosystem degradation and loss are one of the main causes of Greenhouse Gases emission which accounts for 20% of global greenhouse Gas emission (Nixon, 2014; Dudley *et al*., 2010). It is also evidenced that, human induced impacts such as deforestation can switch ecosystems in a short time period from being carbon sinks to carbon source (IUCN, 2012). Research by IUCN (2012) also shows that degradation of ecosystem services globally is contributing to the increase of natural calamities such as drough, floods and wild fires since 1940.

Climate change may also contribute to the intensifying shortages in water, food and traditional medicines (Analiz and Joaquin, 2015). Such food and water shortages are likely to be unpredictable and severe in developing countries like Ethiopia. Climate change is also likely to exacerbate the spread of certain diseases such as malaria and yellow fever (Zuberi, 2014).

Protected areas, however, are widely recognized as one of the most important strategy for mitigating climate crisis, achieving conservation and sustainable development (Analiz and Joaquin, 2015; Du *et al*., 2015 and Ignacio *et al*., 2013).

3.2.1. Protected Areas: Definition, Relevance and Recognition

Protected areas are primarily designed to conserve biodiversity, considered as "refuges for species" and maintain ecological functions that sustain the wellbeing of humanity. They are also viewed as one of the only hopes for preventing endangered, and endemic species from extermination (Dudley, 2008). Apart from these, protected areas are also known to play significant roles in socio-economic development endeavors as they have a considerable role in livelihoods and local economic development activities.

The International Union for the Conservation of Nature (IUCN) defines protected areas as:

> ***"A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values"*** (Leung *et al*., 2018:2).

IUCN has also categorized and defined protected areas according to their management objectives. This classification and definitions of protected areas are also recognized by international bodies such as the United Nations through the Framework Conventions on Biodiversity (Kelbora and Stellmacher, 2012; SCBD, 2010), and by many national governments and non-government agencies as the global standard for defining and recording protected areas and as such are increasingly being incorporated into government legislation.

Accordingly, category II of the IUCN categorization belongs to the National Parks which are defined as:

> ***"large natural or near natural areas set aside to protect largescale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities"*** (IUCN, 2016:1).

Proclamation No. 541/2007 of the Federal Democratic Republic of Ethiopia defines National Parks as:

> ***"an area designated to conserve wildlife and associated natural resources to preserve the scenic and scientific value of the area which may include lakes and other aquatic areas"*** (FDRE, 2007:2).

The above definitions indicate that the objective for establishing national parks is to ensure the protection of the biodiversity and ecosystems of the protected area along with its ecological structure and supporting environmental development systems which will also help to ensure the promotion of educational and recreational benefits (Chalachew, 2014).

3.2.2. Historical Overview of Protected Areas

In the year 252 B.C. the Emperor Asoka of India has passed a decree for the protection and conservation of animals, fish and forests (John *et al*., 1982), This is one of the earliest documented case on the establishment of what we today call protected areas. The modern concept of protected areas was established through the creation of the Kings hill Forest Reserve in Saint Vincent and the Grenadines in 1791. This phenomenon gave rise to the creation of the first environmental law recorded and mark the beginning of the first effort to use protected areas as a vehicle to reduce the impact of climate change on protected areas (Grove, 2000; Simmons, 2018). In recent times, approximately 100 year ago there were recorded efforts to create protected areas on the frontier of the North American West. This was a period of disruption where the indigenous people were displaced by immigrants, often with substantial violence and consequences (Jeffrey, 1994).

The West was a comprehensive holding of the diverse ethnic groups for thousands of years; however, for the European immigrants, it was classified as a "wilderness" that has to be "conquered". In order to preserve at least a sample of this "pristine" wilderness with a minimum of human interference, Yellowstone National Park was established in the year 1872 in an area that was previously occupied by the Shoshone, Crow and Blackfoot Indians (Chape *et al*., 2003; Jeffrey, 1994; Britannica Concise Encyclopaedia, 2007). Over the past century; however, the concept of parks continued to evolve from a reserve for elitist groups, such as the Royal hunting

grounds for royal households to one that conserves the biological diversity and ecosystems for the benefit of humanity. Due to the increased relevance of protected areas in biodiversity conservation and cognizant of their role in climate change mitigation, the total number of protected areas has increased globally (Figure 7) (UNEP-WCMC, 2018; UNEP, 2014; Chape *et al.*, 2003). However, this developing paradigm is taking place within the context of dwindling financial and technical resources to sustain the development of protected areas, specifically in developing countries like Ethiopia. It is also evolving within the context of conflict and heightened tensions between protected areas managers on one side and local people on the other side (Kelboro and Stillmacher, 2012).

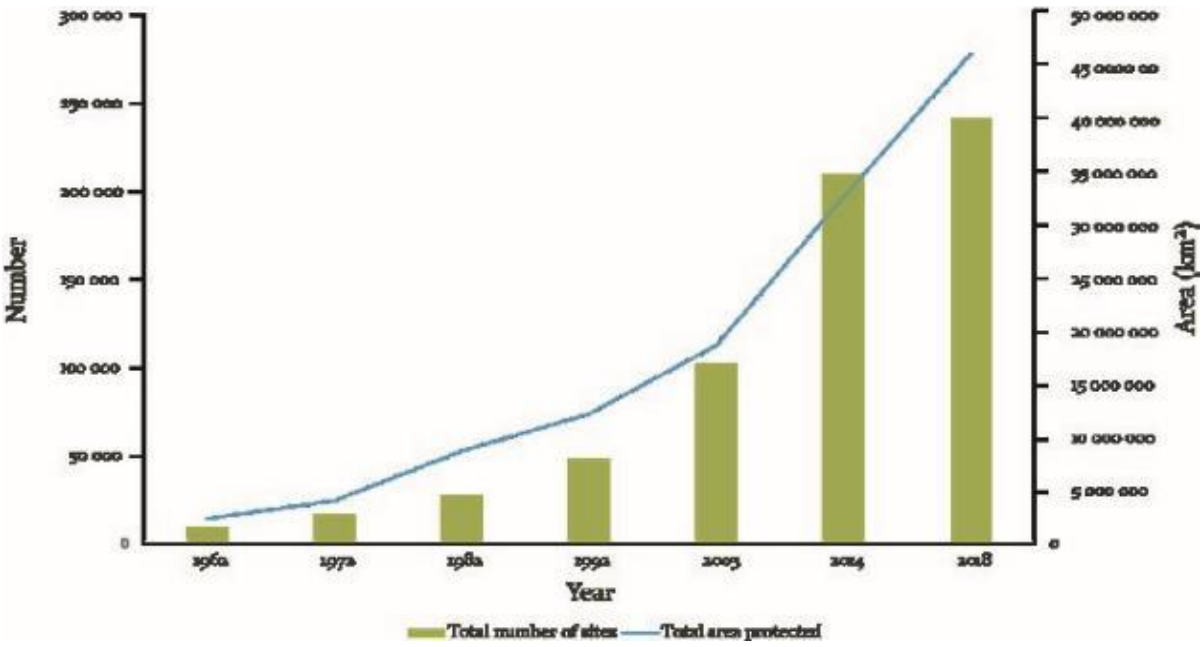


Figure 7: Evolution of the terrestrial and marine protected area network, in numbers of sites (green bars) and in area (km^2; blue line) since the first World Park Congress in 1962 based on previous versions of the UN List (UNEP-WCMC, 2018).

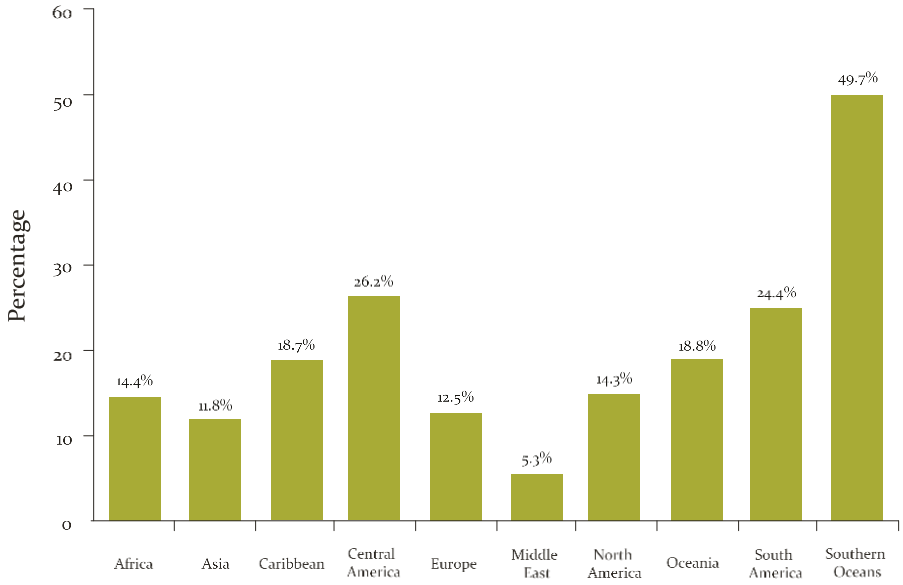


Figure 8: Percentage of land covered by protected areas in the regions. The numbers indicate the percentage of land protected for each region (UNEP-WCMC, 2018)

In terms of proportion the Southern Oceans, Central and Southern American countries are hosting the highest proportion of protected areas (Figure 8). According to UNEP-WCMC, (2018), this is a result of greater awareness and knowledge on the relevance and benefits of protected areas, provision of positive support in areas of technical and financial resources by government and donor agencies, greater clarity in terms of policy and legal framework and practice putting in to protected areas management and governance. In these regions local communities are also working along with government authorities in the implementation of strategic actions related to protected areas (UNEP-WCMC, 2018).

3.3. Benefits of Protected Areas

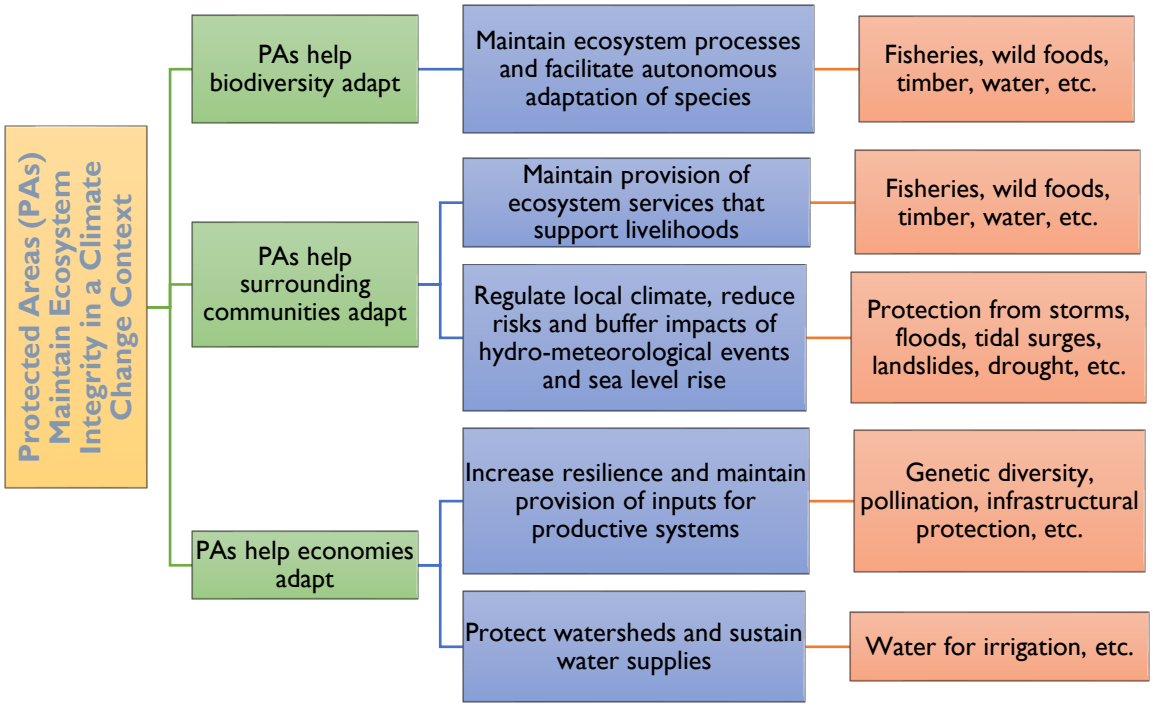


Figure 9: Benefits of protected areas for climate change adaptation (Analiz and Joaquin, 2015)

The figure above by Analiz and Joaquim (2015), shows the numerous benefits that are produced by protected areas. These benefits range from the maintenance of ecosystem processes and facilitation of autonomous adaptation of species to protection of watersheds and sustaining water supplies. Protected areas help to maintain ecological, social and economic benefits to local, regional and global development ventures.

The prime objective of protected areas is to focus on the conservation and preservation of ecosystems in their natural set-up. The natural resources of protected areas provide vital ecosystem services such as shelter for the different forms of life and serve as carbon sink through the carbon sequestration potential of forests which has a role to play in combating global warming and climate change. Forests of protected areas also contribute to moderating local and regional rainfall distribution and intensity. In addition, these resources have medicinal, aesthetic and recreational values apart from serving as source of food, clean water, etc. (Lisa and Sarat, 2010; Bill, 2003).

Protected areas provide a range of ecosystem services to enhance human wellbeing. These ecosystem services include a) provision of services such as food, minerals, pharmaceuticals and energy, b) regulation service such as carbon sequestration and climate regulation, decomposition, water and air purification, crop pollination, pest and disease control, c) support services such as nutrient cycling, seed dispersal and d) cultural services which includes cultural, spiritual recreation, and scientific discovery (UKNEA, 2012; IUCN, 2012). Protected areas contributed to the maintenance of essential ecosystems service which increases the resilience of local communities and reduces the vulnerability of livelihoods against climate change and other calamities (Rob *et al*., 2015; Cote *et al*., 2001; Roberts *et al*., 2001). Protected areas also help to increase crops production as it facilitates pollination services since it hosts different insects. It is critical to note that a healthy ecosystem in protected areas would also prevent the expansion of vector-borne diseases and provide access to traditional medicines (Unnikrishnan, 2009).

As stated above protected areas are in unique position to support national and local climate change mitigation and adoption programme. Research shows that protected areas are already established as efficient, effective and successful and cost-effective tools for ecosystem management. However, the effectiveness of protected areas in carrying out such functions is dependent on the implementation of appropriate policies, laws and management institutions with the capacity and expertise to effectively manage these protected areas (Borrini-Feyerabend *et al*., 2013).

3.4. Protected Areas and Sustainable Development

Human development is closely linked with ecosystem services and environmental development (IPBES, 2019). About half of the urban population of Africa, Asia, Latin America, and the Caribbean are still struggling with one or more diseases linked with inadequate water supply and poor sanitation facilities. The current decline on the availability of fish in aquatic ecosystems is posing a severe threat on the supply of protein in the developing world. Climate change is affecting the livelihoods of many (IPCC, 2014; UN 2015) and desertification and deforestation have adversely affected the energy supplies of many households in developing countries. Currently, the planet's atmosphere and hydrosphere are being modified very rapidly due to the impact of climate change (IFCCC, 2018; Adams, 2006).

Different regions of the world are gaining economic prosperity at the expense of ecosystem services (IPCC, 2014, Vivek and David, 2008). Due to the rapid expansion in population growth, many of the natural ecosystems are changed to yield different benefits, for instance more than 40 percent of the earth's surface is being used for agriculture. As a result of human induced interference, local and global ecosystems are facing ecological pressure. This is also affecting the achievement of future sustainable development goals due increases in biodiversity loss, climate change and different forms of calamities such as natural disasters. IUCN (2016b) and UNEP (2010), proposed a multi sectorial strategic approach involving government, civil society organizations, academia, the private sector and communities to develop and implement coordinated actions in overcoming this global development challenge and enhance the achievement of sustainable development which is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," (United Nations, 1987 in UNESCO, 2014:20).

IUCN (2015:1) "envisions sustainable development as a path that leads to a just and prosperous world which values and conserves nature by ensuring, through effective and equitable governance, that its resources are used sustainably…should be the ultimate outcome of any process to set sustainable development goals". Safeguarding nature is, therefore, more important than ever.

The United Nations has developed a set of Sustainable Development Goals (SDG) which are geared towards achieving global development goals such as poverty eradication, food security, health services coverage, education, gender equality, water security, access to energy, sustainable economic growth, resilient infrastructure, reduction of inequalities between countries, sustainable consumption and production, climate change, ecosystems and biodiversity conservation and the development of peaceful societies (UNDP, 2015). In all these the conservation and development of nature is woven and acknowledged as it is central and fundamental for the wellbeing of humanity. Hence, the proper management and development of protected areas must get a strong emphasis as a result of their undeniable role in the realization of the Sustainable Development Goals. Critics of sustainable development models state that these goals are unachievable because most of the developing countries lack the human, financial and technical resources and the capacity to develop and implement viable strategic programmes for the achievement of these sustainable development goals (Swain, 2018).

The increased reliance on the natural resources as a result of increasing population pressure, which creates severe biodiversity crisis, the establishment of an effective protected area management system is the preeminent option for the conservation of biodiversity and ecosystem services (CBD, 2005). Hence, prioritizing this in the development and management of policies and strategies is a matter of practical necessity for the sustained survival of humanity (Nigel, 2009). Therefore, research undertaking supported by the need to understand the level of vulnerability of national parks in line with the identification of the threats that affect their contribution towards sustainable development are among the issues researchers should focus (Nickson, 2014; Scott *et al*., 2007).

3.5. Threats Impacting Protected Areas

The landmark global report on the status of the world environment published by the United Nations in May 2019 mentioned that climate change is already affecting the planet. Almost one million species face extinction because of loss of habitat due to anthropogenic induced changes in land-use practices, pollution and over-exploitation of biodiversity; essential crops which are the foundation of food security are under threat because of years of unsustainable agricultural practices and the overfishing of oceans which are also presently getting home for more plastic than fish (IPBES, 2019). The report also concludes that the world must act with urgency to establish broad conservation efforts in key areas as a way of surviving these calamities (IPBES, 2019).

The key issues in the UN IPBES report are summarized as a) Climate breakdown and the destruction of the natural world are connected, b) Without the life-essential services nature provides such as breathable air, drinkable water, healthy oceans, a stable climate, human beings will not survive if these life essential services continue to degrade at such alarming rate and c) There is still time to conserve natural habitats, if we act quickly to preserve key areas (Hannah, 2019). Protected areas in this regard has been viewed by earlier records too as an essential strategy to conserve biodiversity (Kelbora and Stellmacher, 2012).

Protected areas were established mainly to maintain biological diversity and natural formations. Many of the most important protected areas are experiencing degradation because of largescale

development projects, expansion of agriculture production into protected areas, illegal hunting and logging, fuel wood collection, expansion of invasive plant species and uncontrolled fire (Tranquilli, *et al*., 2014; Kideghesho *et al*., 2006; Kelbora and Stellmacher, 2012). The current situation facing protected areas is depressing, therefore if current trends continue the biological diversity in many critical conservation areas will diminish dramatically in the next decades (WWF, 2018).

A survey was done by Schulze *et al*. (2018) on 1,961 terrestrial protected areas across 149 countries. The report highlighted the most common threats as a) residential development b) agriculture and aquaculture expansion c) energy production d) illegal removal of animals life e) removal of vegetation f) transportation service corridors expansion g) human disturbance h) expansion of invasive species i) pollution, etc. Threats like invasive plants, deforestation, etc. have been also mentioned by different research undertakings (Solomon and Dereje, 2015; David, 2012).

Threats are, therefore, defined as activities of human or natural origin that cause significant damage to protected areas or in serious conflict with the objectives of the protected areas administration and management (Tranquilli *et al*., 2014).

The local threats to protected areas in developing countries usually evolved from unsustainable exploitation through hunting, agriculture encroachment, fire, logging, the collection of forest product or a combination of all the causes expressed above (Coad *et al*., 2008). It is important to note that these causes can vary from one protected area to another or even within a single protected area. Studies tried to compare the threats associated with protected areas, however comparison of threats have been generally unsatisfactory and have focused on the visual appearances instead of exploring the underlying causes of these problems (Ahebwa and Van, 2013). Another weakness identified from studies on the causes of threats in protected areas is that they do not adequately distinguish causes and impacts of these threats, including the issues related to local attitudes and or human encroachment. These studies give little insights into the causes of these threats and do not categorize the importance of such threats to sustaining the biodiversity of the protected areas.

It is also important to note that many of the causes of these threats go beyond the boundaries of the protect areas. This phenomenon forms the difficulties in analyzing some of the site-specific threats facing protected areas e.g. as experienced in Nech Sar Park illegal cutting of trees in-side the park could have numerous causes such as changing agricultural practices of the community, high growth of population utilizing the park for their livelihoods and the promotion of new access to forest product market outside of the area.

Rapid population growth within communities located within or those adjacent to the protected area through natural increases in growth and or through migration is one of the most pervasive threats facing protected areas across the globe, including the Nech Sar park (Murray and Admassu, 2013). The degradation of protected areas can be increased in situations where there are loss of jobs and lack of alternative employment opportunities for people residing in the nearby of parks. This will cause local people to illegally exploit the natural capital in the protected area in an effort to ensure their own survival. The encroachment of people on protected area by clearing forested areas or grassland to plant agricultural crops, illegal logging for timber and hunting could be caused by the above problems (Ahebwa and Van, 2013).

Research also shows the activities of local people may represent the most immediate, visible and direct threat to the conservation of protected areas in developing counties, however the pressures on ecosystems are resulting from laws, policies, social changes and economic forces over which poor people and their communities have no influences on and are classified as the most influential factors that affect protected areas (Wells *et al*., 1992, Kelbora and Stellmacher, 2012). These factors are the key drivers in determining the livelihoods and wellbeing options the poor and their communities may choose to ensure their survival. Hence, this indicates that any effort to conserve biodiversity must involve stakeholders and institutions who reside beyond the local community (Borrini-Feyerabend *et al*., 2013). In the case of Nech Sar National Park the key officials for setting policies, laws and strategic plan reside over 510 km away in Addis Ababa, the capital, thus exerting a top-down approach to the governance of the protected area (Simmon, 2016; OECD, 2013).

Researchers have a tendency to categorize the communities located within and or around the protected areas as marginalized communities with little political influence, remote from

established markets and employment opportunities and lacking critical services and infrastructure (Asebe, 2012; Abiyot, 2009). Although there is some truth in this perception, it is important to note that there are differences within these communities in terms of social and political systems, economic activities, history and most importantly the linkages of these protected areas to national, regional and international economies and networks (Simmon, 2018). However, Tabor *et al*. (2018) echoed that, the protection and development of protected areas continues being a challenge due to shortage of funding to protected areas, lack of political will and lack of the local community's engagement in protected areas management. Hence, knowledge on the type and impact of threats that affect protected areas can help to have a well-coordinated and targeted investment efforts by policy-oriented actions with the aim of meeting international policy needs whilst improving the efforts in conserving biodiversity resources on the ground (Schulze *et al*., 2018). The following Table 6 is thus outlined to summarize threats faced by protected areas along with their underlying causes and the impact they pose on protected areas.

Table 6: Threats faced by protected areas (source: compiled by the author)

Threats	Causes of the threats	Impact of the threats on protected areas
Inadequate management resources (Tabor *et al*., 2018; Schulze *et al*., 2018)	Lack of government revenues for funding protected areas which is compounded by reduction of funding of donor communities. The limited funding that are available to government is spent in areas of high priority including health, education, economic, infrastructural development. Lack of implementing innovative management and governance structures such as the involvement of local people and their communities in protected area management.	Poor management of protected areas. Poor maintenance of physical infrastructure and ecosystems in protected areas. Observation of corruption among park officials - tendency for officials to be involved in illegal and corrupt activities such as logging, poaching and selling of endangered species.
Adjacent land development and inappropriate internal	Governments and private sector involved in road, train lines or other infrastructures development project.	Construction on the protected area can cause destruction or displacement of valuable

Threats	Causes of the threats	Impact of the threats on protected areas
development e.g. roads (Schulze *et al*., 2018)	Development of tourism infrastructure around parks.	ecosystem and biodiversity lose in protected areas. Roads and train line close to parks can encourage people to gather around parks and encourage the setting-up of communities at a later date.
Human encroachment (Yosef and Afework, 2011; Nicole, 2006)	Expansion of agricultural production on lands adjacent or with in the protected area. E.g. in some developing countries like Ethiopia government may provide land from protected areas to entrepreneurs for agricultural purposes.	Reducing size of Protected area. Leads to destruction of valuable ecosystem and biodiversity. Cause forest fire due to encroachment of humans. Contamination of water supply due to use of pesticides close to river/streams.
Change in water regime or hydro development (UNU-UNRA, 2014)	Government decides to use water produced in the protected area for commercial purposes. Agreed to build hydro dames to produce more electricity for expansion of industrial sector or to sell to neighbouring states or countries.	Devastation of wildlife and other ecosystem in the protected area due to the reduction in water supply to support life in the protected areas. Visible impact of climate change due to the reduction in water supply. Hydro development would cause death of large amount of wildlife and various ecosystems. Impact the water supply to human settlement areas which inturn affects the use of water within Protected Areas.
Poaching (David, 2012; Kideghesho *et al*., 2006)	Increased poaching of animals and wild life due to poverty as a result of limited employment opportunities.	Reduction of animals and wildlife in protected areas. Reduction in wildlife tourism resulted in increase of

Threats	Causes of the threats	Impact of the threats on protected areas
	Availablity of market for trading endangered species	unemployment among the adjacent communities.
Mining (Schulze *et al*., 2018)	Government and local authorities selling mining rights in protected areas due to discovery of minerals etc.	Destruction of the aesthetic values of protected area as well as wildlife and valuable ecosystems. Reduction of tourism and other sustainable livelihoods activities in the protected area.
Livestock conflicts (Girma and Till, 2013)	Increased number of pastoralists along with their cattle using the protected area to graze their animals (Chapter 2 – Tables 4 and 5). Such conflict may arise among the various groups within pastoralist communities or between the members of the pastoralist community and the protected area officials.	Spreading of invasive plants and diseases by the animals. This has the potential to evolve in open physical conflicts among the various communities and between the pastoral community and protected areas officials (the loss of life).
Cutting of trees (Srinivasan, 2014; Tabor *et al*., 2018)	Due to unemployment and poverty among local people living with in or adjacent protected areas. This can be done for fuelwood consummation, agriculture expansion and for logging purposes.	Deforestation of protected areas. Loss of biodiversity and valuable ecosystem. Unattractive landscapes resulting in the loss of tourism and other forms of sustainable livelihoods.

These factors are also the main challenges that affect the biodiversity potentials of Ethiopia's protected areas. As for instance, though the Semien Mountains and Awash National Parks are the only officially gazetted parks of the country, i.e. they are legally recognized and protected by law, they are being challenged from fire, expansion of agricultural practices, deforestation due to fuelwood collection, expansion of invasive plants, overgrazing by livestock, etc. The Bale Mountains National Park, which is known to have diverse ecosystems and endemic animal and plant species is also not in different to these anthropogenic challenges (EWCA, 2016; Tamene *et al*., 2011; Yosef and Afework, 2011). The Babile Elephants Sanctuary which is located in the eastern part of the country is also facing habitat fragmentation and decline of its area coverage as

a result of agricultural activities expansion, selective cutting of trees for fuel and construction purposes, human settlement and expansion of agricultural investment ventures in the area. In the sanctuary, it is also reported as human-wildlife conflict is adversely affecting the existence of the elephants in the sanctuary (Anteneh and Sebsibe, 2011).

In the same vein, various scholars agree as Nech Sar National Park which hosts a range of terrestrial and aquatic ecosystems is also under considerable biodiversity decline threat due to the long-standing human interference and the competition among wild animals and livestock pressure (Simon, 2016; Girma and Till, 2012; Aramde *et al*., 2014). Fuelwood collection and charcoal making, overgrazing and livestock pressure, expansion of settlements by the Guji and Kore local communities, invasive plants, over fishing, siltation of lakes and poor waste disposal are among the prominent factors that threaten the biodiversity and ecosystem services potentials of the Nash Sar National Park (Andreas, 2015; Abraham and Bayisa, 2015). However, the breadth and intensity of the threats on the natural capitals of the park have not been explored by research endeavors (research gap to be further discussed in section 3.8), indicating as there is a need for research undertakings that could inform decision makers and other development partners in taking appropriate remedial actions which could reverse the ongoing natural resources degradation of Nech Sar National Park.

3.5.1. Human Influence on Forest Species Diversity, Density and Natural Regeneration Potentials

Human beings' daily life is dependent on biodiversity resources which can be utilized sustainably if managed properly (Travis *et al.*, 2010). Humans rely on biodiversity to attain manufactured goods and services. Hence, is it possible to afford the massive losses of biodiversity? The degradation of biodiversity is hazardous for the mere fact that, the world's ecosystems are the support systems of humanity's life (Braat and Brink, 2008; Jeffrey and Neely, 2001; Swara, 1992). Therefore, it is impossible to restore a species once extinct and hence an effort to preserve a single species from human induced extinction should be emphasized by programmes aimed at the conservation of biodiversity.

The forest ecosystems are reservoirs of a biological diversity that offer a range of timber and non-timber goods and services. Excessive use of these resources due to exponential growth of

human population caused the dwindling of forest species diversity (Aseba, 2012). Such human induced activities have negatively affected the species diversity, density and natural regeneration potentials of forest resources by causing the extinction of locally adaptive species. This phenomenon has directly impacted the existence of plant and animal species since the functioning of biodiversity resources in a given ecosystem is interrelated to each other (Rodger *et al*., 2011; Emiru, 2003; Kindeya 2003).

In line with this, a study conducted in Ades forest of West Hararghe, Ethiopia revealed that anthropogenic factors are impacting the natural regeneration, population composition of the woody plants in the Ades forest reserve (Dereje and Duguma, 2019).

A study done by Gitamani and Ashalata (2013) on tropical moist deciduous Sal forest of Assam (northeast India) also showed that the species diversity and structure of the forest is affected by human activities such as grazing and fuelwood extraction. The research also recommended further investigation on impact of the threats so that proper forest resources management plans could be placed.

A structural diversity study done by Rahman *et al*., (2007) which compared peripheral and buffer zones of Gachabari Sal Forest Area in Bangladesh revealed that human activities like crop production within the forested territories resulted in the loss of indigenous tree species diversity of the reserve. The research further shows as the recruitment of seedlings and saplings is being challenged by the ongoing human interference in the area. Rahman *et al*., (2009) have also conducted a study to assess the anthropogenic impacts on forest species diversity, structure and natural regeneration potentials of the Madhupur Sal forests of Bangladesh by classifying the study site in to low, medium and high disturbance areas. These classifications were based on the intensity of the anthropogenic impacts which the protected forest area is facing. The findings of the research showed that the highest species diversity which was as high as 125 species was recorded in the low disturbance area while 19 species were observed in the high human interference area. Such type of study is required to inform politicians, local communities and the scientific communities of the challenge faced by protected areas and the actions that can be implemented to reduce the impact of human induced interventions (Asebe, 2012, Travis *et al*., 2010).

3.5.2. Invasive Alien Plants as a threat to Biodiversity and Protected Areas

The natural habitats and barriers like mountains, oceans, lakes, rivers and drylands have served as an isolation barrier for the evolution and sustenance of different organisms over time. However, these natural habitats have lost their barrier function as a result of the ever-increasing flow of trade, which intentionally and or unintendedly enhanced the travel of organisms from one corner of the world to other (Monica *et al*., 2014; BC and IPCBC, 2011; De Poorter *et al.,* 2007).

Invasive plants are alien species that can pose a considerable threat to the environment, humans, animals, ecosystems and the services they provide. Globally, the cost of damage caused by invasive alien species is estimated to be £1.5 trillion per year which accounts about 5% of the global GDP (EBI, 2016). Unlike native plant species, alien species have the capacity of invading an area and establishing themselves very quickly and compete with the native species for the available soil, nutrient and moisture in an aggressive way (Fessehaie *et al*., 2007).

Invasive plants will have a different morphology which will enable them not to be palatable and not be source of feed. Most of them are also believed to produce a significant amount of seed which will enable them multiply and invade an area within a short period of time (BC and IPCBC, 2011). Invasive species are able to breach through natural barriers and also cross political boundaries (Anderson, 2005; Dubale, 2008; Monica *et al*., 2014). The potential risk of invasive species to water, soil, forage products contamination as a result of the invasive nature of these alien species was highlighted in a study by BC and IPCBC (2011).

Even though, the potential threat of invasive species on protected areas is getting a wider attention, action to combat their spread is at its infant stage. This is mainly attributed to the management of alien species in agricultural related fields that greatly differs from the alien species management of protected areas, as the later one is designated to manage its ecological complexities in its natural form. However, many of the species in protected areas are being endangered because of the aggressive expansion of invasive alien species in protected areas thereby lowering the ecosystem functions of protected areas (Foxcroft *et al*., 2013). This magnifies the need for the development of strategic approaches that will help to address the human induced threats in protected areas.

3.6. Strategy Development for Addressing Human Induced Threats in Protected Areas

Based on the local context, management objectives of the protected area, status of the natural capital, etc. different strategies can be deployed in addressing the impact of human activities on the natural resources. In the case of deforestation for instance, an interplay of its impact could affect the wellbeing of a given community through fuelwood shortages which could increase the workload on women and health related challenges. Hence, devising appropriate strategies which could help to alleviate the interrelated challenges of forest degradation is an essential element for effective management of protected areas.

In responding to the threats which protected areas are facing, Pressey *et al.* (2015) designed the logic model in developing the strategic interventions (Figure 10). According to Shakman and Rodriguez (2015), the Logic Model also "provides a kind of map for a program or initiative, helping clarify a program or policy's destination, the pathways toward the destination, and markers along the way". It also shows the linkages among the required inputs, activities and the ultimate desired outcomes of an initiative. The logic model is also regarded as it is not a "strategic or fully developed plan for designing or managing a program or policy" since "additional work is necessary to create both programmatic and evaluation plans" (Shakman and Rodriguez, 2015).

Hence, this approach helps to describe the process of the desired change in the park by making explicit ways of thinking about the current human induced problems, its underlying causes, the long-term change sought, and what needs to be in place for the realization of the change to come about. This process also calls for the prior and proper analysis of the identified threats on the natural capitals of the park since without a well evidenced supportive procedure and a proper situational analysis, the crafting and exploring of alternative strategies may prove to be misleading in achieving the intended outcome of conserving the biodiversity potential of protected areas.

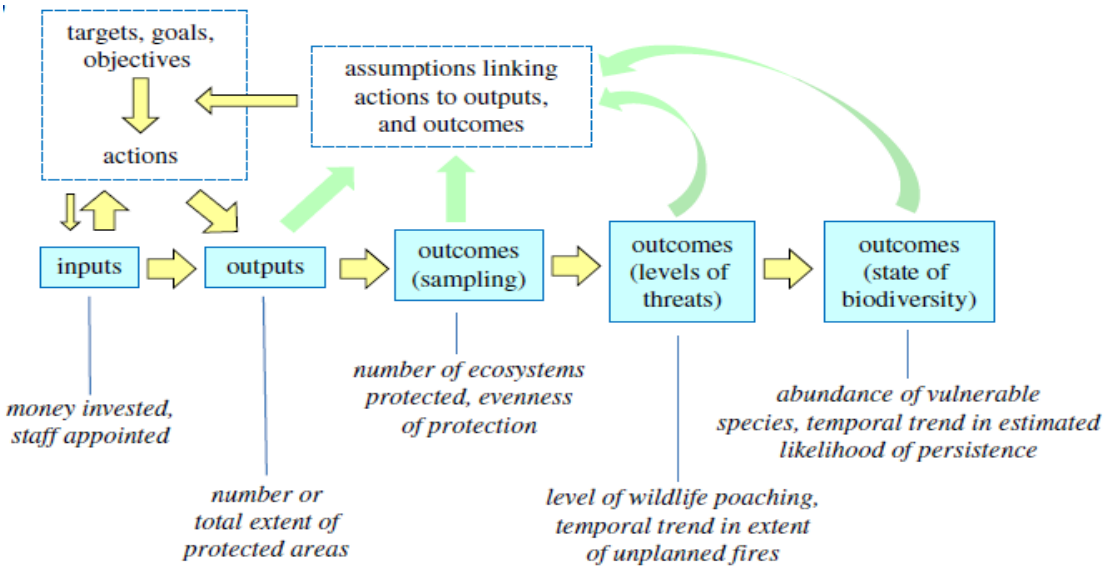


Figure 10: Logic model for achieving biodiversity conservation in protected areas (Pressey *et al*., 2015)

Pressey *et al*. (2015) described the blue boxes of the above figure 10 as the measures which will be deployed in the performance management of a given strategic action while the yellow arrows are designed to show the chain of influence among the different measures. The terms placed in italics are intended to set examples as to how targets and objectives could be formulated. The chain of results (inputs, outputs and outcomes) illustrates the flow of the measures which will help to counteract the threats and achieve the intended biodiversity conservation efforts. These concepts will be borrowed by this research in designing the integrated development approaches which are aimed at reversing the ongoing human induced natural capitals degradation of the protected area as per the below explanations.

Inputs: are financial or material investments in enhancing the management of protected areas (Stem *et al*., 2005). Usually, before determining the amount of required inputs, goals or targets have to be identified in the first place. However, as Kapos *et al*. (2008) pointed out in many cases inputs will be determined ahead of setting goals based on the available financial resources and the other competing needs. Because of this, it is not uncommon for inputs to influence intended actions. In order to offset such influence, the revenue generated by the protected areas can be channeled towards the achievement of conservation efforts than the revenues being channeled to federal financial systems as the case might be in Ethiopia.

Outputs: Pressey *et al*. (2015) explained outputs as the concrete, tangible and countable direct results that emanate from the implementation of conservation activities. The targets of the activities could be community members, government representatives, private sector (businesses), infrastructures, plant and animal habitat, and other natural resources. Some examples of outputs include number of farmers trained; number of groups established; number of government staff trained; length of roads constructed; size of areas rehabilitated; number of trees planted; and amount of budget allocated for park management.

Outcomes: are the expected short-term and long-term impacts of different intervention outputs (CTOC, 2018) which will help to enhance the conservation and rehabilitation of protected areas by ensuring sustainable development and utilization of the ecosystem services that in turn contribute in meeting the national targets of ecotourism development; the policy and strategy of protected areas and the regulations associated with National Parks development and protection. In line with this, Pourco *et al*., (2017) mentioned that due to the differences in the context, type of challenges, nature of the resources, level of policy enforcement, etc. factors on protected areas strategic outcomes and objectives differ from one region to the other and from protected area to protected area. However, the following strategic directions are suggested to tackle protected areas related threats.

***Prioritizing and Enhancing Conservation*:** human encroachment, expansion of invasive species, adjacent land development, poaching, expansion of agricultural activities, increased livestock pressure and cutting of trees for meeting household energy demands are among the rampant threats that affect the biodiversity potential of protected areas. The indicative strategic approaches which will help to counteract these challenges could include, securing the boundaries of protected areas by regulations; establishment of buffer zones which would benefit the local and indigenous communities by designing management plans; and enhancing law enforcement (RGC, 2017; Graziella, 2016).

***Institutional Capacity Strengthening and Partnership Development*:** inadequate protected areas management resources (financial and human), weak technical capabilities, weak coordination among stakeholders and low level of awareness on the importance of protected areas have a direct impact on the sustainable management of protected areas. In strengthening

the effectiveness of protected areas management, the placement of adequate technical human resources along with adequate budget; enhancing collaboration and partnerships among governmental institutions, local authorities and development partners (donors, NGOs, etc.) are among the strategic approaches that would help to harmonize developmental ventures with conservation efforts (Eduardo and François-Michel, 2016; Graziella, 2016). In addition to these, enhanced collaboration on research undertakings would also inform policy actions to gear towards the conservation and sustainable development of protected areas.

***Community Participation and Benefits Sharing*:** protected areas cannot exist with communities that are hostile to them (SCBD, 2008). Lack of benefits sharing mechanisms with the local and indigenous communities and the lack of their participation in the management and governance of protected areas are among the factors that aggravate this hostility. However, the promotion of community engagement can help to gain their support for the sustainable conservation and management of the protected areas natural capital. Apart from this, establishing the system for the benefits accrued by the protected areas to be shared among the local communities is another strategic approach that will help the sustainable development of protected areas (WWF, 2018; Eduardo and François-Michel, 2016).

***Development and Expansion of Livelihood Opportunities*:** in many developing countries the livelihood of the local and indigenous people who live around protected areas is dependent on the natural capital of protected areas. This is believed to be the major causative agent for the degradation of the protected areas resources (Pourco *et al*., 2017; Paul *et al*., 2012). Hence, the issue calls for the development of innovative and environment friendly approaches that would help to increase the income generation potentials of the local communities. This strategic approach will help to link local economic development with conservation efforts. Thus, exploring the development of sustainable ecotourism potentials along with the financing mechanisms would help to reduce the increased dependence of local communities on the natural resources of protected areas (Paul *et al*., 2012).

***Public Awareness*:** the other strategic approach in addressing degradation and reduced human induced impact on protected areas is through the promotion of public awareness and education. The lack of suitable agricultural knowledge and a lack of environmental education were identified

as the main factors undermining economic development and intensify degradation of biodiversity and ecosystems in protected areas (Tefera, 2011). Tefera (2011) also emphasized the importance of using participatory approaches to explore the capacity of the educational levels of the local people and their communities with the aim to raise the awareness of the community on environmental theme based on the existence of protected areas outcomes. Here efforts could be made to design education and public awareness programmes to communicate crucial environmental messages to the communities by utilizing numerous mediums and strategies including social media, popular theatre, traditional media such as radio and television etc. In this strategy the facilitator/project manager must report on the successes as well as shortfalls of the project. The strategy is crucial for encouraging intelligent, informed, natural and human capital investments across the community (Travis *et al.*, 2010).

In general, the achievement of these stated strategic approaches requires the efficient collaboration and partnership development among the different stakeholders.

3.6.1. Role of Partnership in Sustainable Protected Areas Management

The sustainable improvement of land resources management of protected areas requires a better understanding of the interrelationships and coordination mechanisms in linking ecological, social, cultural, political and economic dimensions by all stakeholders from local to international levels (Aramde *et al*., 2012; Anemut, 2006). Participatory planning approaches at the community level are also among the tools which will contribute for the sustainability of this management efforts. A cross-sectoral coordination development framework will also play a role towards managing protected areas in a sustainable way as different sectors like education, health, etc. are all dependent on the wellbeing of land resources such as National Parks.

Participatory and holistic monitoring and evaluation should also be an integral part of the approach. It entails the participation of all partners which includes the beneficiary local communities, agricultural and other development institutions, researchers, decision and policy makers, civil society organizations, NGOs, development partners (donors), etc. (Abraham, 2016; Dudley, 1999). This strategy is designed to enhance buy-in of all stakeholders to the process as

well as sharing responsibility and accountability of stakeholders in all levels of the management and governance hierarchies.

3.6.2. Participation of Communities in the Management of Protected Areas

Originally most protected areas were established with little or no regards for local people, and few of these people were believed to benefits from the tourism and other benefits that are generated by the protected area. Over the past decades park management has emphasized on a policing role aimed at keeping local people out of the park. This is characterized by researchers such as Wells *et al.* (1992) as the 'fencing and fine' approach to the management and governance of parks and protected areas. Researchers have indicated that the preservationist approach as practiced by park managers is similar to that practice by military officials and would lead to conflict between parks officials and local communities (Girma and Tell, 2012; Abiyot, 2009).

The framework convention on Sustainable Development (UN, 1992) provides the spring board for the promotion of the rights of local people to participate in sustainable development initiative, of which the conservation of the ecosystem and biodiversity of protected areas is an important vehicle in the conservation of biodiversity (Girma and Tell, 2012). The convention also states that local people possesses the knowledge and practice to contribute to the sustainable use and management of protected areas.

It is important to note that communities located within or adjacent to protected areas usually bear substantial cost due to the lack of access to the protected area and usually they will be receiving no compensation from park authority for the loss of access. The residents of the communities who in most situations are categorized as poor and receive little or no government services, often view protected areas as restricting their ability to earn decent livelihoods from the natural resources of the protected area (Borrini-Feyerabend *et al*., 2013; Neumann Roderick, 2002).

It is also observed that issues relating to population pressures and unsustainable land-use practices outside of the protected areas boundaries sometime lead to illegal encroachment. Numerous development partners including the UNDP and the SCBD recognized the critical role that local and indigenous communities should play in the achievement of sustainable development

goals and protected areas. This strategy was promoted due to recognition of the global stakeholders on the growing awareness of the importance and complexity pertaining to the links between poverty and sustainable development. This has motivated development planners and policy makers to work collectively to develop strategies to make conservation people oriented (UNDP, 2015; IPCC, 2014; IPCC, 2007; Well *et al*., 1992). There is growing recognition across the globe that the involvement and participation of local people in the management and governance of protected areas is essential to ensure the long-term protection and conservation of protected areas (UNDP, 2015).

Despite such recognition of the importance of local communities in the protection of protected areas, there are efforts on the part of the park authority to exclude local people, mainly the poor, who have limited access to resources from protected areas reserves without providing them with alternative means of livelihoods. Such view is supported by Asebe (2012) who states that according to traditional ecological knowledge, humans are not considered as stewards of nature, who are considered to have the obligation of protecting nature. He concludes that humans and non-humans are created as citizens of nature through mutual respect and interconnectedness, therefore they do not have responsibility over other forms of nature to protect biodiversity and ecosystem. Pierotti, *et al* (2000) and Burkes, (2008) support this view by stating that although indigenous people and traditional communities have lived in harmony with nature through respect, trust and mutuality, the western depiction of these groups has always portrayed them as "noble savage" communing with nature. Therefore, local and indigenous people would always be sidelined by traditional conservation practitioners and model.

It is premature to argue that generalizing traditional knowledge of adaptive capacity for indigenous people and local communities in the conservation of protected areas as it will make them better able to manage protected areas (Berkes, 2008). This is mainly because there are numerous instances where some traditional groups lack comprehensive environmental wisdom to effectively conserve protected areas.

Traditional knowledge alone does not guarantee that a local community and or traditional groups live in harmony with the environment. What is important in this situation is the method, techniques and systems in which the knowledge is interpreted and translated into practice which

occur to benefit the community and the protection of the biodiversity and ecosystems of protected areas (Neuman, 2002; Asebe, 2012).

3.7. Governance of Protected Areas

Over the past decade, the term Governance has grown-up in various developmental endeavors including protected areas. It relates to a range of issues such as principles, guidelines, policies, strategies and rules in decision making (Borrini-Feyerabend *et al*., 2013; Kitthananan, 2006; Weiss, 2000).

Graham *et al*., (2003:ii) defined Governance as:

> ***"The interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken and how citizens or other stakeholders have their say".***

Governance is also defined as about who decides what the objectives are, what to do to pursue them, and with what means; how those decisions are taken; who holds power, authority and responsibility and who is or should be held accountable for action/outcomes and decision (Borrini-Feyerabend *et al*., 2013).

The framework on protected areas governance instruments is expected to constitute the following areas as indicated in Table 7.

Table 7: The framework on protected areas governance instruments (Borrini-Feyerabend et al., 2013).

Mechanism	Purpose
"International law, conventions, standards and best practices	For conservation in general and protected areas in particular, especially international conventions that have been nationally-ratified.
National legislation, policies, strategies, agreements and plans	Ranging from the national constitution to sector-specific legislation; and from accepted customary law to established conservation goals relating to protected areas.

Mechanism	Purpose
Formal management plans and regulations	For establishing priorities and a zoning system, timing for the use of a resource, opening or closing access to an area, and allowing or disallowing a particular activity or technology, and agreements such as legally binding memorandum of understanding.
Customary and local rules and plans	Including traditional systems of resource access and use regulated by local institutions and depending on local knowledge and skills.
Technical and other forms of advice	On what kind of decisions might be effective, desirable, proper, feasible, cost-effective, etc., including through advisory committees and taskforces.
Social incentives and disincentives	Such as social recognition and esteem, awards and rewards (e.g., for environmental stewardship actions), ostracism for destructive or careless behavior", etc.

The table above sets out the basic parameter through which the governance of protect areas function, however due to lack of human and institutional capacity of most protected area management system and political will on the part of some governments in developing countries, the policies are not adhered by most National Protected Area Authorities/Ministries (Graham *et al*., 2003; Kelbora and Stellmacher, 2012). A key element of the governance system is the participation of local people/community in the governance of the protected area. Numerous governments do not adhere to such practices, although the UN Framework Convention on Sustainable Development (UNCSD) (UN, 1992) provide the springboard for the rights of local people to participate in the sustainable development initiatives, of which protected areas are important element of the convention.

The convention also states that these local people possess the knowledge and practice to contribute to a sustainable use and management of protected areas (Beltran, 2000) and as they should be given the opportunity to share the benefits derived from the protected areas. Hence,

community participation which forms the sustainable development of the protected areas will be given more emphasies in the design of the integrated development approaches of this research.

The conventions reiterated the point that the effectiveness of the governance and management of protected areas is not only dependent on the institutionalization of national policies and laws, enforcement, boundary demarcation as traditionally practiced but importantly on providing direct compensation to the local communities (Bruner *et al*., 2001). Overall, the adherence to benefits sharing mechanism practices is becoming an important mechanism in the governance of biological diversity of protected areas in developing countries, however, such practice is not adhered by governments who are the signatories to the conventions.

Kelboroa and Stellmacher, (2012) identified a number of strategies on how to enhance benefits to local people and communities as incentives for enhancing governance of protected areas. They advocate for the creation of Management Zone as an effective strategy for increasing benefits of local people in protected areas. This strategy concerns with dividing the protected area into core protection areas i.e. areas that are used exclusively for conservation boarderd with buffers zones which can be used by local people to reduce the pressures on the conservation area. There is also transition or development areas where local people can manage to implement their own purposes (Yoseph and Afework, 2011). It is regrettable to note that this model of governance is not being practiced in Ethiopia.

Another mechanism which can benefit the local people and enhance good governance is the creation of mechanisms for sharing revenues derived from tourism, sports, hunting and other commercial activities by enhancing the quality of public services provided to these communities. Another approach is for local communities to organize themselves into associations such as cooperatives and take on the responsibility for the protection and management of the protected areas in the regions. Although there are a number of resources focused associations operating in communities located in or adjacent to the Nech Sar National Park, it is regrettable to say that none of the members of these associations are involved in the governance of Nech Sar.

3.7.1. Types of Governance Practices and their Relevance and Applications to Nech Sar National Park

Traditionally the governance of protected areas was controlled by governments with little or no consideration of local and indigenous community's involvement. The Durban (2003) World Parks Congress, however, have identified four main protected area governance types and are explained in the following table (UNEP-WCMC, 2016).

Table 8: IUCN Governance types for protected areas

Governance Types	Description
Type A. Governance by Government	This governance arrangement is a system whereby the objectives of conservation and management plans of protected areas is controlled by government body. The natural resources found in these protected areas are also owned by the government. Nech Sar National Park falls under this category.
Type B. Shared Governance	Under this governance arrangement, government may share management authority and responsibility with local communities, NGOs or the private sector which depends up on the consensus among the participating bodies. Although several government stakeholders are involved in Nech Sar National Park their role in the governance of the park is negligible.
Type C. Private Governance	This is a governance system where by private individuals, cooperatives, corporate bodies, or NGOs are given the right to administer protected areas for tourism and other economic reasons whilst attaining conservation purposes too. This governance system is not being practiced in Ethiopia because only government agencies are involved in the governance of protected areas. These includes Federal government, Regional State Government and or Local Authorities.
Type D. Governance by Indigenous Peoples and Local Communities	This governance arrangement is a system where the conservation areas are managed by local and indigeneous communities for cultural, economical and ecological benefits. The Guassa Community Conservation Area is an example of this type of

Governance Types	Description
	governance arrangement in Ethiopia. The Guassa local community has community-based associations which ensures the sutainable development of the protected area as well as mechanisms whereby the benefits are shared among the local communities. For example, the communities can harvest grass in a controlled way without affecting the ecostem. Apart from that, part of the revenue generated from tourism is allocated to establish social services such as health and other community facilities. Thus, such learning can be brought to Nech Sar.

(UNEP-WCMC, 2016; Borrini-Feyerabend *et al*., 2013)

3.7.2. Governance Approaches: Top-down and Bottom-up Approaches

There are competing views regarding different approaches to the practice of governance and management of protected areas. In the context of conservation, protecting nature is a question of social and economic security. Hence, safeguarding nature is bestowed on humans where scientific knowledge is crucial in the protection venture. Usually this leads to a top-down natural resources governance approach whereby scientific knowledge is given more emphasies over local and indigenous technical knowledge and experience. In the top-down approach, the local and indigenous people are excluded from the governance arrangements of protected areas (Bosak *et al*., 2008).

Equally, when nature is internalized or seen as a holistic entity in which humans and non-humans are instituted, the emphasis would be given to local people and their local knowledge. Therefore, the responsibility for the conservation of the protected areas will be done by the local people. This strategy would take on a more bottom-up approach to the governance of protected areas. Here conservation policies, strategies and programmes are designed and implemented through the dual insight of nature and participation of local and indigenous people in the governance processes (Asebe, 2012).

In all these, the natural resources management knowledge of indegenuous people is a vital element for the success in conserving protected areas since such knowledge is implanted in the local cultural values and practice of the community (RRI, 2015). Therefore, the participation of the local people in the governance arrangements of protected areas will be of benefit for the conservation of biodiversity resources in the protected areas. Hence, this view supports the case for the promotion of the bottom-up governance approach for the protection of biodiversity and ecosystem services of protected areas.

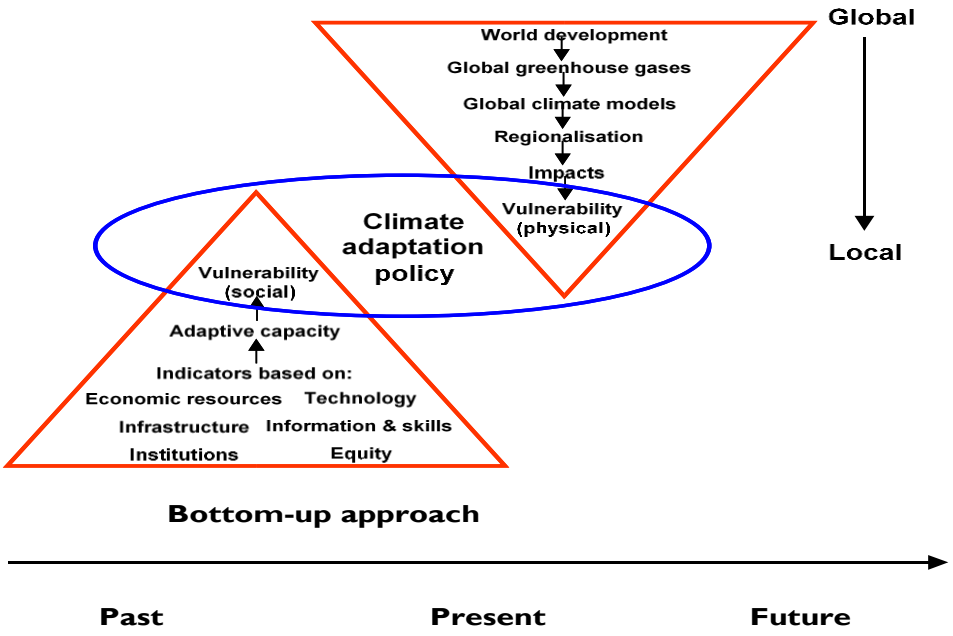


Figure 11: Top-down and bottom-up approaches for addressing climate adaptation policy (adapted from Dessai and Hulme, 2004)

Although this model developed by Dessia and Hulme (2004), focuses on addressing climate change adaption policies and practice, it has relevance for dealing with issues pertaining to the governance of protected areas in developing countries. Top-down and bottom-up approaches are applicable to the management and governance of protected areas. Top-down approaches can be described as planned and coordinated approaches and or actions designed to accomplish intended results implemented by an authority operating from a central office such as government or an institution (OECD, 2013; Simmons, 2018). A top-down approach is being implemented in the management and governance of the Nech Sar National Park in Ethiopia. The park is governed

by a team of officials remotely from their central office located in the capital, Addis (510 km away from the park).

Top-down approaches include the provision of services by public or private agencies through centralized planning and implementation of special project activities, appeared effective in individual studies for connecting population to water, sanitation, electricity and other essential services and natural resources. Studies suggest the customization of solutions to meet local needs as well as to better deliver services through alternative non-government service providers via bottom-up approach (Annamali *et al.,* 2016). The literature on the application and effectiveness of top-down and bottom-up approaches to the application of effective governance in protected areas is under researched or to some extent non-existent.

Although there is evidence of the implementation of top-down approaches in the management of the Nech Sar Park in Ethiopia, it has critics who claimed that the top-down approach does not consider the significance of previous actions taken to resolve development issues and challenges. The approach is fashioned on the command and control approach (OECD, 2013). This approach has come under considerable scrutiny for its role in increasing the potential to worsen vulnerabilities of protected areas and causing negative impacts on the development initiatives that are implemented at local level.

Interest in the application of bottom-up approaches in the management of protected areas are gaining attraction globally. This approach is encouraged mainly by the international development agencies and practitioners to provide support to community development initiatives so as to enhance the capacity of communities to participate in the management and governance of protected areas (Mc Namara and Buggy, 2016; Jaja & Gaude, 2016 in Simmons, 2018).

Bottom-up approach to the governance and management of protected areas relates to participatory approaches which are mainly adapted by NGOs and CBOs. In developing countries like Ethiopia, the application of such an approach is mainly suited to the establishment of community associations which ensure the protection of the natural capitals in the protected area. This is also true, in the case of Guassa community-based conservation area in Ethiopia, where by community leadrs are ensuring the protection of the resources whilst they also manage the controlled mowing of grass by the community members without affecting the natural resources

base. Part of the tourism related revenues are also used to establish health and other community development facilities in the localities such as construction and maintenance of toilets projects and the delivery of other community services.

It is also important to note that a critical challenge on the application of bottom-up approach is that it suffers from the problem of scaling-up to regional and national levels. Even when there is successful application of bottom-up approaches the replication of the success may always not be possible since the same conditions may not be present in different locations (Annamali *et al*., 2016).

Bottom-up approaches to the protection and management of protected areas is focused mainly on the concept of vulnerability. The approach assumes that "if one can address actual vulnerability today, one inevitably reduces future (expected) vulnerability" (Burton *et al*., 2002 in Simmons, 2018:39-40). Bottom-up approaches consider vulnerability as representative of social and ecological structures that are generated by multiple factors and processes (O'Brien *et al*., 2007 in Simmons, 2018:39-40).

3.8. Gaps in Literature on the Study

The scale of biodiversity depletion instigated by the current generation of human activities have reached its climax and recovery from this loss is expected to demand substantial amount of time and effort (WWF, 2018; FAO, 2011; Emiru, 2002). Nech Sar National Park is geographically located between two regional states in Ethiopia. It is situated 510 km from the Addis Ababa, the capital. The park is governed remotely from Addis Ababa through a top-down approach by governmental officials from the capital. This situation makes the Nech Sar National Park an ideal location to conduct studies on the impact of human interference on the park and complexities of the governance of protected areas.

Despite the emergence of a growing body of interest in research on protected areas as a mechanism for sustaining biodiversity and enhancement of ecosystem services, appropriate research and field experiences in the area are very limited.

There is also little analytical literature on the impact of human activities on national park in East Africa, specifically in Ethiopia (Table 9). There is also the absence of a conceptual framework to conduct research on the project and the absence of the existence of appropriate criteria for the evaluation of protected areas in east Africa.

Most of the studies carried out on national parks focused on either local people negative impact on natural resources within parks (Aramd *et al*., 2012; Asaye, 2008,) or on conflict between local people and park authorities (Asebe, 2011; Abiyot 2009).

Table 9: Gaps in the literature on the impact of human activities on protected areas

Gaps in the literature	Consequences of the gaps in the literature
The impact of human activities on protected areas	Little research has tried to explore the ongoing human activities on Ethiopia's protected areas (Girma and Till, 2012, Abiyot, 2009). Lack of research outputs in this regard has denied policy and decision makers the proper understanding on the magnitude and intensity of the impact of human induced activities and their impact on protected areas of Africa (Nickson, 2014). This situation has also negatively impacted the formulation of evidence based strategic actions which can tackle the root causes of the challenges which the country's protected areas are going through and pave the way where protected areas contribute towards the sustainable development and economic empowerment of the society (Bililign, 2015).
Systematic analysis of the state of natural capital in the park	So far though there has been research on floristic composition of the vegetation, vegetation dynamics, resettlement, tourist satisfaction, small mammals, etc. (Shetie *et al*., 2015; Girma and Till, 2012; Denna, 2006; Samson *et al*., 2010; Aramde *et al*., 2012; Bililign, 2015; Abiyot, 2009), the lack of data on the state of protected areas in relation to human activity such as its impact on forest species diversity, natural regeneration and density of the woody vegetation impedes policy maker and practitioners from having a mechanism in devising appropriate protected area management plans as the case of Nech Sar National Park.

Gaps in the literature	Consequences of the gaps in the literature
	In addition to that the lack of awareness and empirical data and complete information about the impact and expansion of invasive plant species on the park and protected area biological system has also denied park managers to have appropriate management plans which will help to curve the degradation of the landscape as a result of the invasive species expansion (NSNP, 2016).
Governance related factors that impact the management of the park's ecological capital	People living in and around protected areas form the major building blocks for sustainable development and management of protected areas (RRI, 2015). The shortage of an in-depth analysis on the governance factors has negatively affected the park's natural capital and contributed for the prevalence of poor community and park authorities partnership since many of the research findings in the governance aspect of the park were largely driven by academic interest (Abraham, 2015) and are more focused on theoretical approaches rather than on assessments which would inform as to how the various governance mechanism can be geared towards the sustainable development of the protected areas.
Integrated strategic development approaches that will help to protect the natural capital in a sustainable way and improve the sustainable development of Nech Sar National Park	The researcher has reviewed a number of conceptual development frameworks (Badola *et al*., 2018; Bennett *et al*., 2018; Nick and Eva 2000) to explore their appropriateness to the research and found that none of these are appropriate to the research study. The lack of an integrated strategic development framework has denied policy and decision makers to have a practical tool and guide for analyzing the human induced challenges that aggravate the degradation of the protected area natural capital and the design of interventions which would aid the sustainable development of the park in an integrated and multi-sectoral way.

Gaps in the literature	Consequences of the gaps in the literature
Human induced threats that impact the natural capital of the park	The ongoing natural capitals degradation level and its intensity have not been addressed by research activities and the urgent need of remedial actions has not been presented to policy makers and practitioners involved in the management and governance of the park. The lack of research in this area shows the absence of empirical research findings to back-up actions that could minimize the impact of human activities on the natural capital of the protected area (Travis *et al*., 2010).
The significance of protected areas and evidence on the effective approaches of protected areas management	In the Ethiopian context little attention is given to the development of protected areas as part of the broader poverty reduction and sustainable development strategies. The contribution of protected areas in livelihoods and economic development of communities and the country as a whole is not captured to make evidence based informed decision (Getahun, 2018; Aramde *et al*., 2014). This has also negatively affected in having efficient institutions and coordination system among stakeholders that could help the sustainable development and management of protected areas. In addition to these, lessons from other countries effective protected areas management approaches such as the establishment of buffer zones are not being replicated in the context of the country's protected areas management systems (Solomon and Dereje, 2015).

The table below builds on the analysis of the gap in the literature presented in the table above. It presents some of the main articles reviewed by the researcher in terms of the author, the source of the information presented, the focus of the area of study and the weaknesses and limitation of the article in relation to the research objectives of this thesis.

Table 10: Gap analysis in the literature on the impact of human activities on the protected area

Author	Sources of information / Data	Focus areas of the study	Weakness / Limitations
Girma and Till, 2012	Review of reports Review of Literature Surveys	The paper on Contesting the National Park theorem? Governance and Land-use in Nech Sar National Park, Ethiopia highlighted the reasons for the natural resources degradation in the park. The paper stated that access and use of natural resources of the park by the local communities as the root cause for the degradation of the park's natural resources. It also mentioned as the governance system of Ethiopia's protected areas is mainly characterized by excluding local communities from the governance system which resulted in having conflicting relationship between the park and the local communities.	Though the prevalence of poor governance system is identified as the major bottle neck that affects the country's protected areas, the analysis did not explore the breadth and intensity of this impact on the natural capital of the park which could inform policy makers and parks officials on the urgency of developing and implementation of strategic actions that could curb the ongoing impact of human activities on the natural capitals of the park.
Samson *et al.*, 2010	Archival data Review of Literature Surveys	The research on Floristic Diversity and Structure of Nech Sar National Park, Ethiopia focuses on identifying the species composition of the woody vegetation in the park. This type of research is good in giving scientific information about the composition of the forest species and the natural capitals of the park.	Even though the paper explored basic information about the species diversity of the park, the paper lacks appropriate information about the impact of human activities on the natural regeneration potentials of the vegetation, species diversity and density of the woody vegetation.

Author	Sources of information / Data	Focus areas of the study	Weakness / Limitations
Abiyot, 2009	Archival data Review of Literature Surveys	The research work titled "Resettlement and Local Livelihoods in Nech Sar National Park, Southern Ethiopia" explored the existing conflicting relationship between the park's natural resources, park authorities and the livelihoods of the Guji community.	The park is being affected by the livelihood activities of three local communities located in the nearby and within the territories of the park, namely the Kore, Gamo and Guji. However, this paper mainly focused on exploring the livelihoods of one local community in detail while the livelihood of the other two is also putting an equally considerable pressure on the natural capitals of the park. Apart from that, the research did not explore the degree and intensity of the natural capital degradation that resulted from the livelihood activities of the Guji

Author	Sources of information / Data	Focus areas of the study	Weakness / Limitations
Aramde *et al., 2012*	Survey Archival data Review of Literature	The paper presents the "Contribution of Ecotourism for Sustainable Livelihood Development in the Nech Sar National Park" (Aramde *et al.,* 2012). The paper assessed the increased income being earned by hotels, restaurants and lodges and also the revenue which is being generated through tourist entrance fee at the main gate of the park. The paper also advocated for the development of ecotourim opportunities in the area.	The paper mainly focussed on the tourism related livelihood opportunities in the affluent communities such as hotels, lodges and restaurants which are functioning adjacent to the park. It has not pinpointed as to how ecotourism opportunities which can help to empower the livelihoods of the wider local and indigenous communities who live in the rural marginalised setting can be cultivated and contribute to the sustainable development of the park. The paper has not also advocated as part of the revenue generated from the park to be utilised for local development initiatives and contribute for the sustainable development and management of the park.

Author	Sources of information / Data	Focus areas of the study	Weakness / Limitations
Asebe, 2012	Archival data Review of Literature Surveys	The paper presented a contesting view on protected areas conservation and development in Ethiopia. The paper argues that "contrasts in environmental cosmologies between the western and indigenous perspectives have ultimately resulted in unsustainable resource management and also disrupted local livelihood conditions". The paper further argues that conservation in the name of protected areas is taking priority over the cultural and economic territories of the local communities.	The paper stressed that the natural resources of protected areas should be used by the local communities to develop and maintain their livelihoods. However, at this era of climate change the paper ignored and under-estimated the role of protected areas in conserving nature, biodiversity, ecosystem services, etc. which ensure the survival of humanity on the planet earth.

Human induced anthropogenic degradation has impacted negatively the natural capital of protected areas. Despite this negative impact little research has tried to examine the ongoing human activities on the forest resources of Ethiopia's National Parks (Girma and Till, 2012, Abiyot, 2009). There has been no research which tried to explore the impact of human activities on the forest species diversity, natural regeneration and density of the woody vegetation. The impact of the Arba Minch town's household energy demand on the woody vegetation of Nech Sar has not been examined so far. Apart from that, the intensity and magnitude of invasive plants on the protected area has not been addressed by research findings. Therefore, in order to avert the further degradation of the resources in Nech Sar National Park, there is an urgent need to explore the impact of human activities on the natural capitals of the Park and inform decision making process for placing remedial strategic actions that could halt the ongoing degradation of the park.

Although this study is deemed an effective and viable topic to be researched due to its potential in providing opportunities for exploring the impact of human activity on the biodiversity of the Nech Sar National Park and devising strategies for enhancing the participation of local people in the management and governance of protected areas, the literature on the topic is very limited and to some extent, non-existent since the topic is receiving little or no attention from researchers. Therefore, the situation described above amplify as there is a need to understand how the processes connect and are integrated to augument the park's sustainable development.

3.9. Towards a Practical Conceptual Framework for Linking Human Needs and Biodiversity Conservation in Protected Areas

The significance of protected areas in biodiversity conservation, local economic development and the ecosystem services sets the importance of their protection. In line with this, the researcher assessed a number of conceptual frameworks used by other researchers who conducted related research undertakings. This provided opportunities for the researcher to determine whether these conceptual frameworks are appropriate for the research on "impact of human activities on protected areas: the case of Nech Sar National Park". Therefore, as a tool of designing the research conceptual framework of this thesis, protected area related research frameworks are reviewed in this section.

Miles and Huberman (1994) said that Conceptual Framework is "the system of concepts, assumptions, expectations, beliefs, and theories that support and inform your research. It explains either graphically or in narrative form the main things to be studied - the key factors, concepts and the presumed relationships between them". Yosef (2009) also defined conceptual framework as "a network, or a plane of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena". He further states that, "a conceptual framework is not merely a collection of concepts but, rather, a construct in which each concept plays an integral role since it helps to provide not a causal/analytical setting but, rather, an interpretative approach to social reality". Thus, this research adopts the definition of Yosef (2009) to frame the conceptual framework of this study since the development of a conceptual framework which guides the understanding of the status and prospects of the natural capitals of protected areas in a specific ecosystem-based approach is an important consideration as it will help to understand

the underlying causes of resources degradation (Borrini-Feyerabend *et al*., 2013 and Meinzen-Dick *et al*., 2001).

Even though there are different frameworks designed to assist the governance of protected areas, ecosystem-based protected areas natural capitals status in line with human interference has not been well addressed by these frameworks. In this regard, IPBES for instance, has developed a Conceptual Framework - Connecting Nature and People. The framework is designed to denote the different elements of nature and the society at large which embraces "conservation and sustainable use of biodiversity, long-term human well-being and sustainable development', and therefore the key elements (or components) are nature, the benefits that people derive from nature and a good quality of life". It also emphasizes the central role that institutions, governance and decision-making play on the links among these elements and most importantly, the Conceptual Framework "explicitly includes multiple knowledge systems" (Diaz *et al*., 2015:3).

The IPBES framework also focuses on safeguarding the benefits of nature which are derived from the provisioning, regulating, and cultural goods and services of ecosystems (Figure 12). In this regard, the findings from this thesis could also contribute for the undertakings of IPBES to further understand protected areas related challenges as well as the knowledge gaps on the ongoing human induced impacts that are degrading the natural capitals of protected areas.

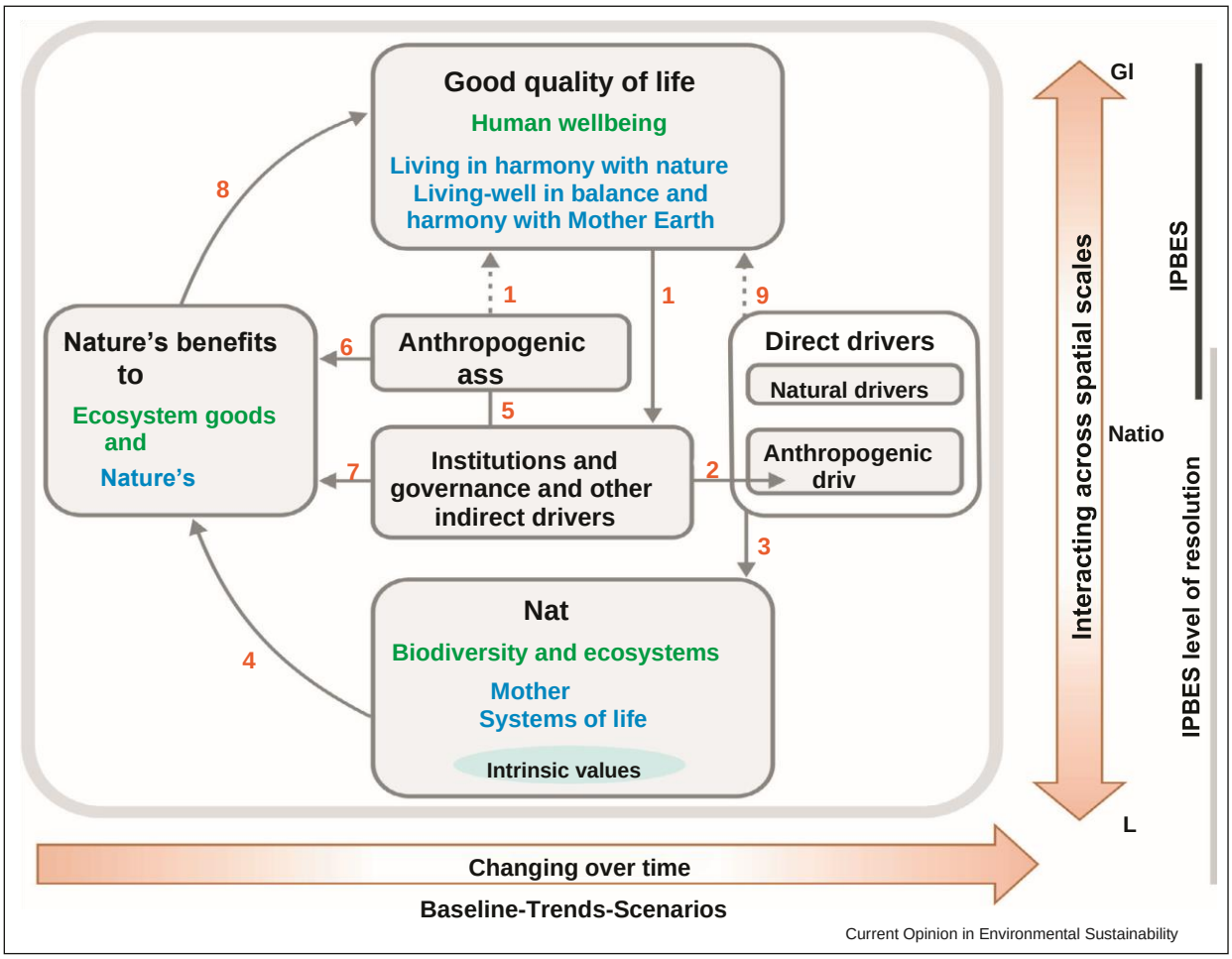


Figure 12: The IPBES Conceptual Framework - connecting nature and people (Diaz *et al*., 2015)

On the other hand, however, the IPBES framework is designed to capture broadest and global level assessments as it is formulated to augment spatially aggregate as well as the heterogenous nature of biodiversity (Diaz *et al*., 2015). Apart from that, the framework is designed to be more of organization based (IPBES) as some of the elements of the framework are organized to guide local, national and global level attributes along with a baseline information which will help to inform IPBES level of resolution and scope. In addition to these, the framework is not designed to guide the assessment of quantified impact of human activities on the biodiversity of protected areas and hence this thesis was not able to make use of the IPBES framework. As a result of this, based on their applicability and relevance for the context of assessing the impact of human activities on the natural capital of protected areas, this study chose to review the conceptual

frameworks listed below and adopted some of the relevant contexts which helped the design of the new conceptual framework of the thesis.

3.9.1. Sustainable Livelihood Development Framework and Conservation of Protected Areas

Olivier (2008) defines livelihoods as the capabilities, assets, and activities essential for a means of living. A livelihood is to be considered sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities, assets, and activities both now and in the future. This is done within the context of not damaging the natural resource base of the protected area or biodiversity.

The United Kingdom Government Department for International Development (DFID) has formulated the Sustainable Livelihood Framework in 1999, which is being used by various development partners and agencies as a framework for designing and implementing livelihood development programmes, research design and implementation of livelihood development activities (DFID, 1999). Oliver (2008:1) explained the Sustainable Livelihoods Development Framework as:

> ***"A way of thinking about the objectives, scope, and priorities for development activities. It is based on evolving thinking about the way the poor and vulnerable live their lives and the importance of policies and institutions".***

He states that the framework helps to frame livelihood development activities and actions that are a) people-centered; b) responsive and participatory; c) multilevel; d) conducted in partnership with the public and private sectors and e) dynamic and sustainable.

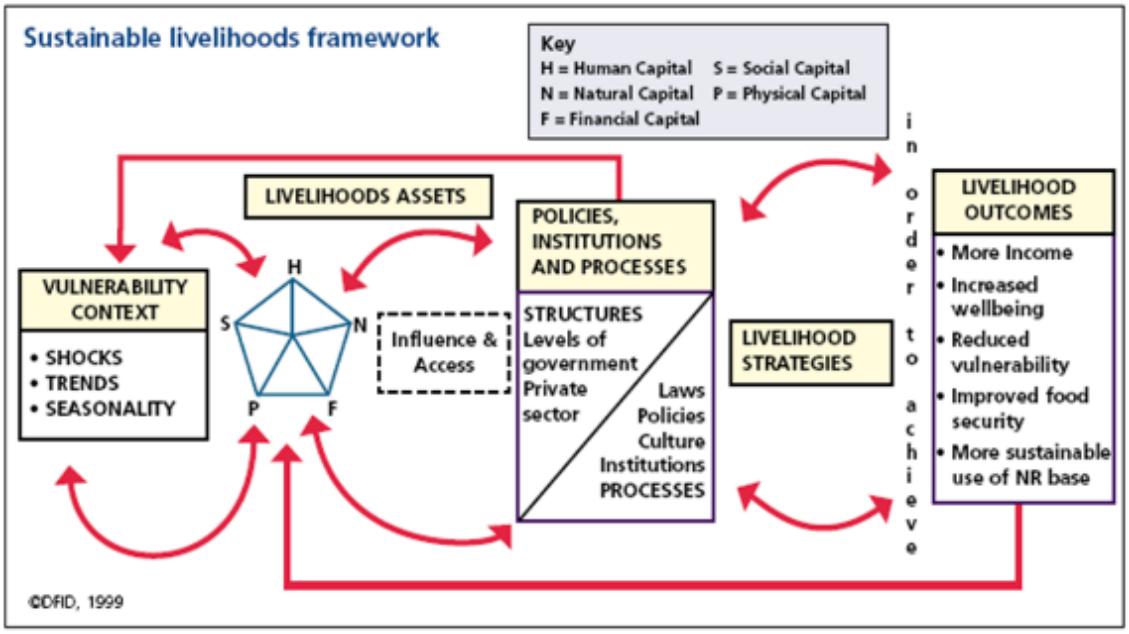


Figure 13: Sustainable livelihood development framework (DFID, 1999)

The Sustainable Livelihood Development Framework is composed of five principal interacting components (i) Vulnerability Context; (ii) Livelihood Assets; (iii) Transforming Structures and Processes; (iv) Livelihood Strategies; (v) Livelihood Outcomes (Figure 13). As described by DFID (1999), the vulnerability context refers to the external factors where people do not have control over them. These includes seasonality, trends and prevalence of shocks. These factors have a direct impact on the livelihoods of people since the sustainability of livelihoods is dependent on the extent and magnitude of the vulnerability elements. Therefore, understanding the ways in which the vulnerability contexts impacted the community's livelihoods will help the researcher to identify the negative factors that affect the wellbeing of the community and also help to design appropriate resilient livelihood activities by making use of the available livelihood assets of the people.

In this regard, in the context of the local and indigenous communities of Nech Sar, the concept of social vulnerability of women caused by culture, norms and values of the local society is also an issue that needs to be assessed and addressed by designing appropriate integrated approaches. As for instance, literature confirms that women of this community are the main collectors of fuelwood by risking their wellbeing inside the forest resources of the park (Abiyot, 2008; NSNP,

2016). Hence, addressing the development challenges of the protected area has to be aligned with measures that would help to address the vulnerability of women.

DFID (1999) also identified the livelihood assets as human, social, natural, physical and financial assets or capitals and defined them as follows:

Table 11: Defining the five sustainable development assets or capitals

Capital	Description
Human capital:	"Skills, knowledge, ability to labor and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives"
Social capital:	"Networks and connectedness, accepted rules, norms and sanctions, relationships of trust and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety-nets amongst the poor"
Natural capital:	"Stocks from which resource flows and services are derived (e.g. land, forests, minerals, marine/wild resources, water, etc.)"
Physical capital:	"Basic infrastructure and producer goods (e.g. transport, shelter and buildings, water system, energy, and access to information)"
Financial capital:	"Financial resources (available stocks, regular inflows of money)"

(DFID,1999:1)

Livelihood assets are described as the main building blocks in the design and formulation of integrated livelihoods development programmes which are aimed at maintaining the sustainability of natural resources. It is imperative for livelihood development programmes to consider the challenges and opportunities associated with each asset so as to plan a sound development programme which can enhance the sustainable development of protected areas (FHE, 2010). Hence, the framework would help to identify the main factors that affect the livelihood of people and also helps to design sustainable livelihood development activities by outlining the linkage among the different livelihood assets including human, social, natural, physical and financial assets. However, for the purpose of this research the researcher will focus only on natural capitals.

The other component of the framework is the transforming structures and processes. This component includes the creation of the enabling environment that could aid the formation of

resilient livelihoods. Policies, institutional capacities and structures are the major elements of this component and are believed to play a pivotal role in the process of sustainable livelihoods development. The researcher will include an assessment of policies, institutional capacities and structures in the new framework because these are critical indicators to determine the levels and quality of participation of people in the governance of protected areas.

The livelihood strategies and outcomes of the framework also encompass activities that people undertake as a means of generating income that ensures their wellbeing. However, these elements can always be impacted by the amount and access to livelihood assets and the effectiveness of the structures and processes in building the resilient livelihood outcomes for the community members. Therefore, analyzing the livelihood strategies and outcomes helps the researcher to understand the priorities, challenges and potentials of local communities' livelihoods development process (Chalachew, 2014). The research will borrow this aspect for the inclusion in the new conceptual framework.

Well-managed protected areas can contribute to maintain and improve livelihood opportunities of the local people. If dealt properly, this phenomenon is also seen to create a linkage between people, livelihoods development and protected areas. However, creating the linkage among local people, livelihoods development and conservation of these resources is not an easy task to accomplish. The researcher will focus on finding the balance among resources utilization, livelihoods development and conservation objectives. This can be a very complex scenario in cases where livelihoods development efforts can pose a threat on the natural resources base of the protected areas. Ahebwa & Van (2013) ascertained in the case of developing countries as there can be imbalances among conservation priorities and traditional livelihood activities.

Even though the sustainable livelihoods framework is not designed to address the case of protected areas, the researcher considered using various aspects of the framework identified above in the design and development of the new conceptual framework for the research to assess the impact of human interference on the natural capitals of Nech Sar National Park as wells as for designing the integrated development strategic approaches which will be explained in the upcoming sections.

As a data collection tool, the Sustainable Livelihoods Framework uses existing literature, project documents, key informants, household survey, market surveys, observation, etc. (Caroline and Karim, 2002). However, in the case of protected areas these tools may not be applied as they are not suitable in the context of indigenous communities that have got their own way of life that is undisturbed by modern ways of social interaction and integration. In terms of finance and time related factors, tools like household survey would not be suitable for this study. As a result of this limitations, the researcher instead deployed focus group discussions (FGD) in soliciting information from the indigenous communities of the park.

Although the DFID Sustainable Livelihood Framework can be viewed as a comprehensive development framework which emphasizes the importance of the involvement and participation of people in the achievement of sustainable livelihoods initiative, a fundamental weakness observed by the researcher is that the framework is silent on the relevance of monitoring and evaluation which plays an important role in ensuring the achievement of sustainable livelihood initiatives. In any development programme one needs to establish mechamism to provide feedback to the implementer on the performance of such programmes so as to enable them to enhance the planning and monitoring processes, to address the specific weaknesses observed during the implementation process and also to put remedial strategies in place to achieve the anticipated outcomes. Therefore, the inclusion of monitoring and evaluation with a development process is of vital importance.

3.9.2. Social Assessment for Protected Areas Analytical framework

The Social Assessment for Protected Areas (SAPA) was initially drafted in 2014 and after several reviews and field level tests implemented in about eight sites of Africa. The methodology was then finalized in early 2016 by International Institute for Environment and Development in London (Franks *et al*., 2018). The SAPA framework is designed to assess the negative and positive social impacts of protected areas on the wellbeing of the local communities and helps to explore the nature of the relationship between these impacts (Figure 14). The different impacts could be an attribute of a direct result of the protected areas or can also be a partial result of the protected area where other external factors have helped for the occurrence of the impact. The framework can also be used for all categories of protected areas. A multi-stakeholder process

is the central body of the SAPA framework as it will help to ensure credibility and accuracy of the outputs of the analysis (Franks *et al.*, 2014).

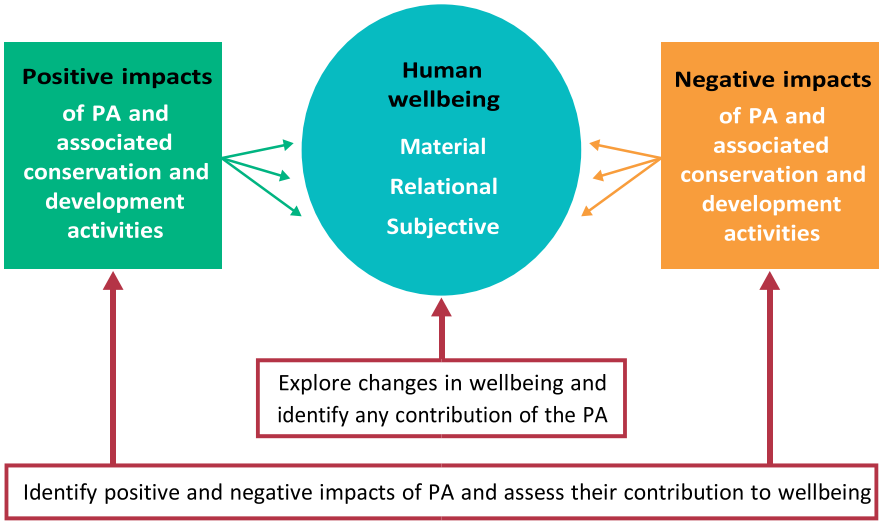


Figure 14: SAPA analytical framework (Franks *et al.*, 2014)

The framework has also adopted the human wellbeing domains developed by White (2009) and the component encompasses the material (income, assets and the ecosystem services), relational (social interactions, and relationships) and subjective domains (fears, hopes, perceptions and aspirations). The main forms of assets which the local community holds are also believed to be created by their interaction with the protected areas (Paul *et al.*, 2015). The new framework to be developed will adapt this aspect of the SAPA framework to enhance the depth of analysis and rigors of the impact of people on protected areas.

The SAPA framework follows a questions-based methodological approach where it has standard questions and gives the room to craft site specific questions that considered the actual situations of the site to be assessed.

Among other questions like "How are relations between the PA and local communities and how might these be improved?" (Franks *et al.*, 2014) are among the points that are adapted from the SAPA and will be incorporated in the design of the new conceptual framework of this thesis. The researcher will use this idea to find what are the factors that caused the degradation of the natural resources and ecosystem services of the protected area by making use of focus group

discussions, questionnaire and interviews. This approach will assist the researcher to identify ways of engaging local communities in the protection of protected areas development process.

The SAPA framework has also identified the different phases of the research as preparation, scoping, assessment and action. Hence, following these phases has enabled the researcher to define main activities, the timeframe for field missions, conduct a scoping mission (reconnaissance survey), ensure that the park authorities have proper understanding of the research and fulfil all the required legal and ethical pre-requisites to conduct the research, and to facilitate the data collection process in an organized way.

The weakness of the SAPA conceptual framework is that it focuses on the social capital of protected area only. Although the different aspects of social capital are relevant to sustainable development of parks, e.g. assessment of social networks, the impact of policies, legal framework and strategies, the issue of natural capitals of protected areas (the focus of this research) is not given the necessary consideration and weight in this framework.

In addition to this, Franks and Booker (2018) have also formulated a tool called "Governance Assessment for Protected and Conserved Areas (GAPA)". It is a methodological approach used to assess governance related challenges, strengths and weaknesses as a way of promoting strong protected areas governance mechanisms. The method can also be done with a minimal cost and in a short period of time. It is an assessment procedure which sets 11 protected areas good governance principles and makes use of research instruments like focus group discussion, interviews, validation workshops and generate strategic approaches which can ease the sustainable development of protected areas. Hence, this research will also adopt GAPA to analyze the governance related challenges of Nech Sar by considering related GAPA governance principles listed below.

The analytical methodology follows assessing the desired level of achievement in line with the predefined governance principles (below box) and diagnosing the root causes that favored the prevalence of poor protected areas governance. In doing so challenges will be identified and analyzed based on the information gathered from the field and other sources. It will also help to define strategic approaches that will help to avert the protected area's good governance related challenges.

GAPA's 11 Good Governance Principles (Franks and Booker, 2018)

1. Recognition and respect for the rights of all relevant actors
2. Recognition and respect of all relevant actors and their knowledge, values and institutions
3. Full and effective participation of all relevant actors in decision making
4. Transparency supported by timely access to relevant information in appropriate forms
5. Accountability for fulfilling responsibilities and other actions and inactions
6. Access to justice, including effective dispute resolution processes
7. Effective and fair enforcement of laws and regulations
8. Effective measures to mitigate negative impacts on indigenous peoples and local communities
9. Benefits equitably shared among relevant actors based on one or more agreed targeting options
10. Achievement of conservation and other objectives
11. Effective coordination and collaboration between actors, sectors and levels.

3.9.3. Conceptual Framework for Assessing the Integration of Human Needs with Biodiversity

The livelihood of local communities that reside in and around protected areas is dependent on the natural resources of these protected areas. On the other hand, these protected areas are designed to protect the biodiversity capacities of a given area. This phenomenon will result in conflicting situations between people and officials from institutions with responsibility for the conservation of the natural capitals of protected areas. Nick and Eva (2000) in their study to assess the linkage of livelihoods and conservation have developed a conceptual framework to analyze the integration of human needs with biodiversity (Figure 15).

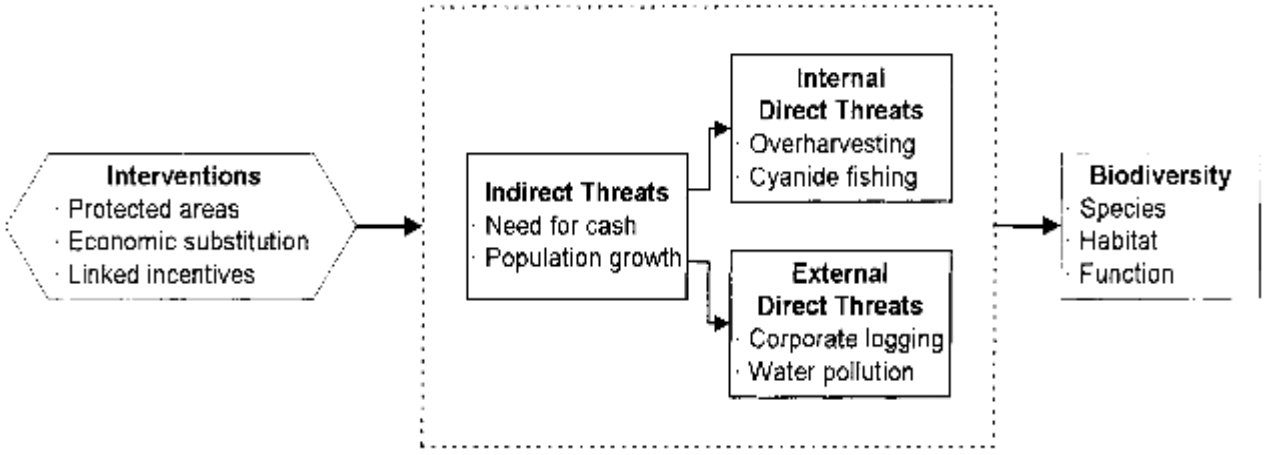


Figure 15: Conceptual framework linking livelihoods and conservation (Nick and Eva, 2000)

The framework envisages the understanding of the threats posed on the biodiversity potentials of protected areas by identifying the indirect threats which are induced by human activities. These indirect threats could emanate from the need for cash as well as population growth. The framework in the next component has subdivided these indirect threats into internal and external direct threats whereby the internal threats are caused by people or stakeholders who live in the protected areas (such as overharvesting of the natural resources by the locals) while the external direct threats are coming from outsiders such as pollution of water bodies by factories located in another area which will have a direct impact on the biodiversity potentials of a given protected area. The framework in general considered human activities as the driving force for the degradation of the biodiversity resources which will then affect the functions of ecosystems and the services they provide. Hence, the new conceptual framework of the thesis will borrow this aspect of the conceptual framework in an effort to link livelihoods and conservation (Nick and Eva, 2000).

Some of the major reasons which makes this conceptual framework not applicable to the thesis are a) it did not explain the methods to be deployed for collecting the information from the protected areas and b) the issue of protected areas governance has not been dealt within the framework as there is absence of credible mechanism for the assessment of governance issues.

3.9.4. Framework for Assessing Institutional Arrangements to Manage Tourism in the Indian Himalayan Protected Areas

A study on the Himalayan protected areas of India implemented by Badola *et al.* (2018) has examined the role of institutional arrangements. This study concludes that effective institutional arrangements will play a significant role by ensuring the sustainability of protected areas through benefits sharing. The analytical framework of the research assesses the major dimensions of protected areas governance such as the interactions between the concerned stakeholders, sharing of benefits with the local communities and the institutional power relationships of the different participating stakeholders (Figure 16). The framework was also designed to identify the challenges as well as the opportunities in attaining the good governance of protected areas.

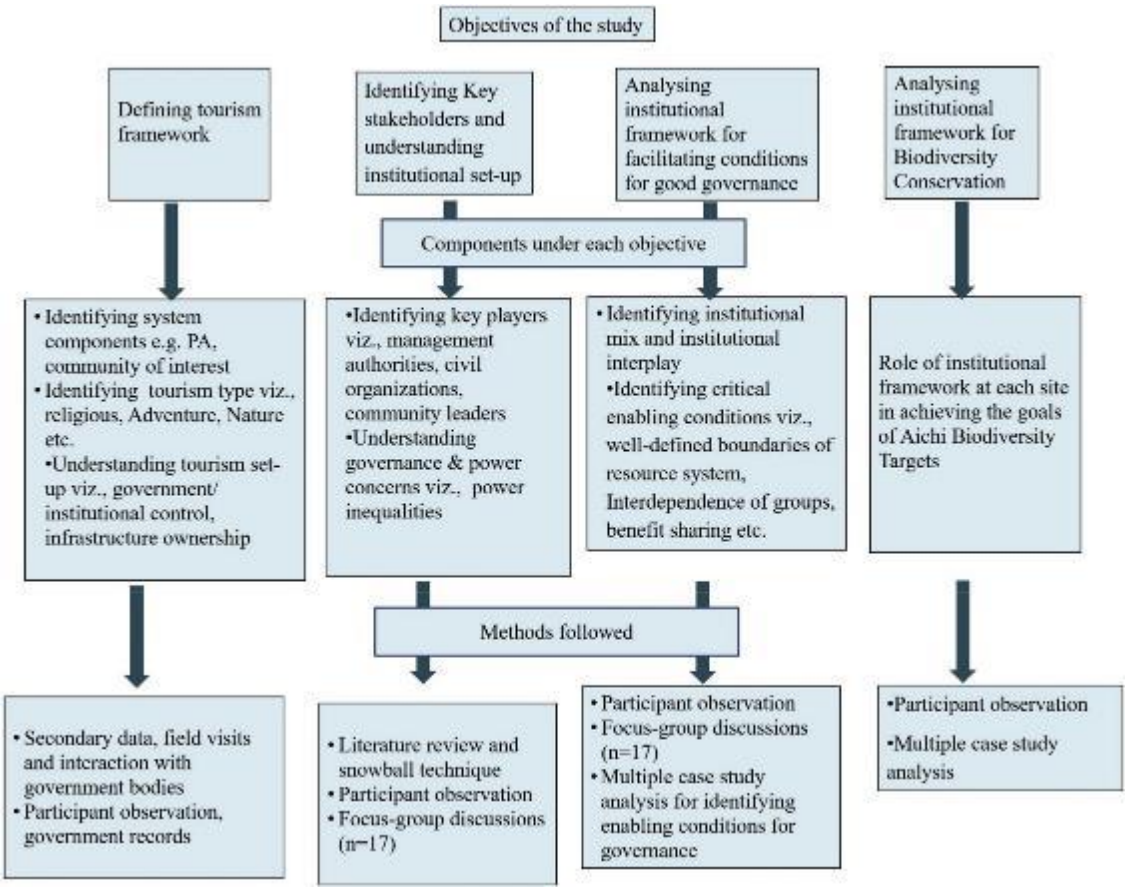


Figure 16: Framework for assessing institutional arrangements for managing tourism in the Indian Himalayan protected areas (Badola et al., 2018)

This framework assesses the institutional related gaps by 1) assessing the institutional arrangement and partnership modalities with all the concerned stakeholders and 2) assists the researcher in identifying the key players in the governance of protected areas and 3) provide a mechanism for the understanding of the institutional set-up and their role in the governance of protected areas. The thesis will use some of the ideas articulated in this framework into the development of the new conceptual framework so as to assess the impact of people on the protected area. A major weakness of the framework is that it mainly focuses on the institutional set-up of the governance mechanism and is not designed to capture the impact of human activity on the natural capital of protected areas.

3.9.5. A Practical Framework for Understanding Environmental Governance

Bennett and Satterfield (2018) have also formulated a practical framework to design and analyse environmental governance (Figure 17). The framework defined three environmental governance

elements as 1) institutions (laws, policies, rules and norms), 2) structures (decision making bodies, formal organizations and informal networks) and 3) processes (decision making, policy creation, negotiation of values and conflict resolution) that will help to achieve environmental governance objectives.

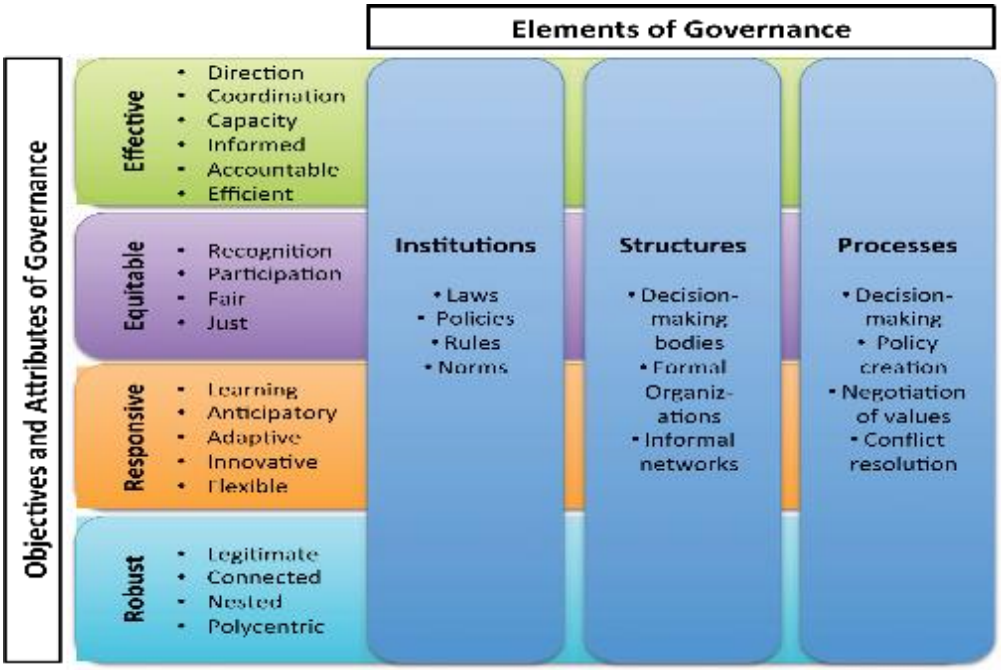


Figure 17: A practical framework for understanding the objectives, attributes, and elements of environmental governance (Bennett *et al*., 2018)

The above framework has provided useful insights on the interplay between human needs and natural resources. Hence, the key strength of the framework is that, it is designed to frame the complex linkages between the objectives, attributes and elements that affect the effective environmental governance arrangements. This will help stakeholders to have a comprehensive understanding of the phenomena by giving a clear picture for the logical flow of the entire governance process. This conceptual framework is designed to aid policy makers in visualizing the linkages among the different factors that affect resources governance so that they can take appropriate actions in formulating a coordinated actionable strategy.

A weakness of this conceptual framework is, it did not show the linkage of how governance arrangements are impacting natural capitals. For instance, the framework is silent on the participation of local communities in the effective implementation of governance systems on environmental governance.

In general, the above frameworks are framed in ways of fitting into specific concepts and have their own strengths and limitations. The impact of human activities on the natural capital of protected areas is not well outlined by the different conceptual frameworks. However, the researcher will use some of the related elements of the framework for analyzing the overall capacity of the park management and performance of protected areas regulations which are developed by the government of Ethiopia within the current context of Nech Sar.

3.10. Chapter Summary

The chapter has reviewed related literature pertinent to the study. It started by providing the wider understanding of the concept of protected areas in general and national parks in particular as per the International Union for the Conservation of Nature (IUCN) guidelines. Accordingly, National Parks are explained as a large natural or near natural protected areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities. Therefore, the primary objective of establishing a National Park is to protect natural biodiversity along with its underlying ecological structures and supporting environmental processes, and to promote education and recreation.

The main focus of this study is to identify the major human induced issues that affect the sustainable development of protected areas with a focus on National Parks. National parks are playing a major role in the conservation of biodiversity resources and ecosystem services that nourish the wellbeing of humanity and other life forms. However, these resources are being degraded because of deforestation, increased human population pressure, energy demand, invasive species, expansion of agricultural lands, etc. The review has, therefore, explained the impact of the ongoing human interferences on the protected areas and the dire need of interventions that could reverse the ongoing degradation of these resources.

Furthermore, the literature review also revealed the severity of the impact of human interference on Ethiopia's National Parks vegetation species diversity, natural regeneration potential, density, etc. areas is not well researched and documented. Hence there exists a gap

in this area of research. Because of this, policy making, and enforcement officials are not being challenged by research findings which have gone in to a deeper analysis on the impact of human activities on the National Parks of the country. Due to this and other factors many of Ethiopia's National Parks and protected areas are currently being operated without appropriate management plans and functioning governance structures.

Nech Sar National Park is not an exception to this reality. Hence, there is a need to conduct research which will explore the breadth and impact of human activities on the natural capitals of the country's National Parks. The development of policy and appropriate strategic actions can save the biodiversity resources of the country from degradation. Earlier in the chapter related conceptual frameworks were also reviewed with a view of assessing their applicability to the research and formulate the conceptual framework of this research. The following chapter presents the methodological approaches which is used to assess the impact of human activities on Nech Sar National Park of Ethiopia.

Chapter 4 - Methodology

4.1. Introduction

This chapter is divided in two parts. Section 1 of the chapter deals with the conceptual framework of the thesis while section 2 deals with the research methods utilized for the collection and analysis of data. The conceptual framework is presented to analyse the "Impact of human activity on the natural capital of the Nech Sar National Park". It discusses the stages involved in design and operationalization of the conceptual framework so as to achieve the stated objectives of the thesis.

Besides focusing on the collection of data, section 2 of chapter 4 discusses how the research is designed, methods deployed by the researcher for data sampling, the ethical considerations utilized by the researcher when implementing the research and the limitations of the research. This section is responding to objective 4 of Chapter 1 of the thesis.

The research objective and questions for the thesis are listed in the table below.

Table 12: The objectives and question of the research.

Research Objectives	**Research Questions**
1. To undertake a systematic analysis of the state of natural capital in the park.	1. In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems?
2. Assess governance related factors that impact the management of the park's ecological capital.	2. What are the human induced threats that impact the natural capital and governance of the park?
3. Review the perception of relevant stakeholders on the state of the natural capitals and ecosystem services of the park.	3. How can the natural capital of the park be protected and managed in a sustainable way?
4. To propose integrated strategic development framework that will help to improve the sustainable development of Nech Sar National Park and other Ethiopian parks in general.	

As pointed out by Creswell (2003), before executing research programmes, a thorough discussion of the methodological approaches is a preliminary requirement. Nickson (2014) also mentioned that, discussion of research methodology will focus on the tools used for collecting and analyzing the data since it will help to justify as to why the researcher chose the methods from the list of available alternative techniques.

4.2. Conceptual Framework for Analyzing the Impact of Human Activity on the Natural Capital of Nech Sar

The conceptual framework of this thesis is designed to show the actual situation in the protected area and helped to identify and describe the theory associated with the framework. Firstly, these theories use concepts i.e. related information is clustered into a conceptual group, which involves an interpretation of the raw data. Secondly, the concepts are related by means of statements of relationships (Prashant, 2013). The issues of relationship were further discussed by Adom *et al.* (2018) who state that in qualitative studies the aim is to describe and explain a pattern of relationships. This can only be done with a set of conceptually specified categories which involve organizing the information based on the thematic areas of the findings.

Accordingly, as presented in Figure 18, the different elements of the conceptual framework of this research include:

(i) Vulnerability of the natural capitals - focus on the natural resources of the protected area that are prone to human interference

(ii) State of the natural capitals – designed to show how human activities are affecting the natural regeneration potential of the forest, effect on diversity and density of the vegetation, introduction of invasive plant species, etc.

(iii) Governance and processes – where weak policy, institutional capacity, coordination and other factors are contributing to the degradation of the resources.

(iv) An integrated development strategic approach towards addressing the challenges – focusing on developing a set of strategies that are designed to respond to the development challenges faced by the protected area and focuses on empowering local community to develop sustainable

livelihoods, reduced dependence on biomass energy sources, increased institutional capacity for governance and improved land-use practices.

The integrated strategic approach is, therefore, designed with a set of attributes that relate to each other and aimed at providing guidance for the synthesis of the thesis. A description of each of the elements of the conceptual framework is presented in the figure below and discussed in the following section.

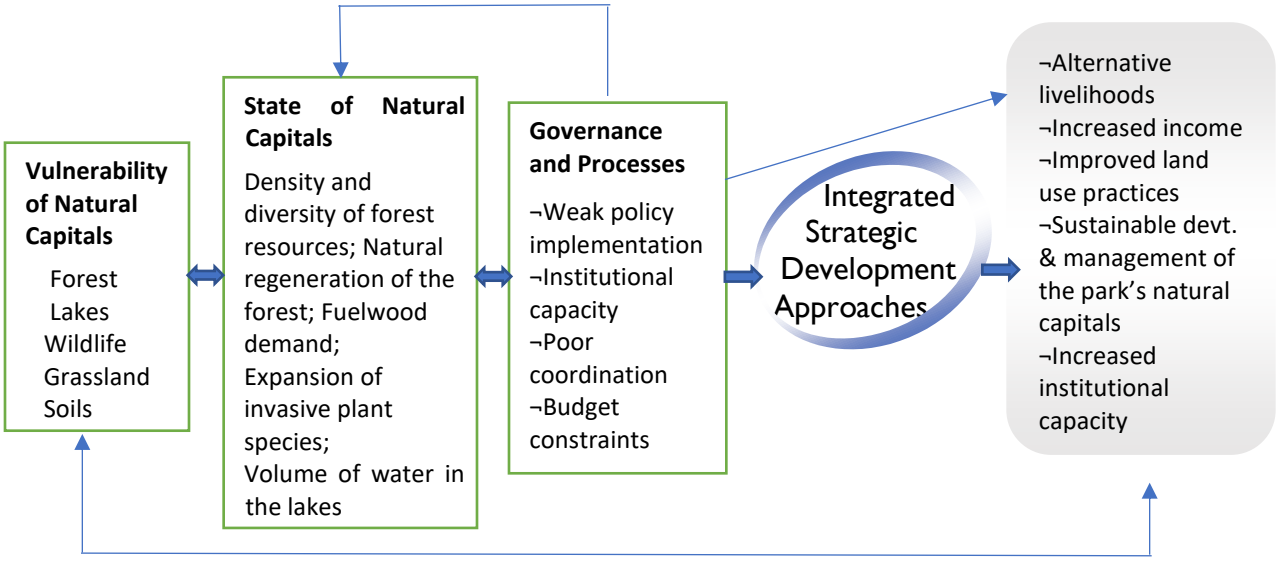


Figure 18: Conceptual framework for analyzing the impact of human activity on the natural capital of Nech Sar National Park

The conceptual framework is featured with main elements that will help to assess the current state of the protected area and the attributes that will enhance the sustainable development of the resources. The boxes and arrows denote the main elements of the conceptual framework. The vulnerable natural capitals are identified in the first box and are linked by a double-sided arrow with the state of natural capitals box to show as these vulnerable natural capitals will be the main focuses which will be examined in detail. The state of the natural capitals box is again linked with the governance and processes box by a double-sided arrow since the natural capitals are being affected by weak governance processes. Since weak governance of the protected areas in Ethiopia is the major contributor for the degradation of the resources, the box is again linked to the integrated strategic development circle which is designed to enhance the governance, management and sustainable development of the protected area through suggested approaches. The suggested approaches are also linked with the natural capitals box since their effective implementation will help to address the vulnerability of the protected area natural capitals.

4.2.1. Elements of the Conceptual Framework of the Research

The conceptual framework for analyzing the impact of human activity on the natural capital of Nech Sar National Park of the thesis is designed to guide the entire assessment process in the park. The framework is developed by identifying key issues from protected areas natural capitals perspective as well as from the above reviewed related frameworks. The details of the different elements of the framework are discussed as follows.

(a) Vulnerability of Natural capitals in the protected area

The first element of the framework is aimed at defining the vulnerable natural capitals of the park. As highlighted in Chapter One section 1.4 different research undertakings mentioned mentioned as the natural resources of the park are being degraded due to human activities. However, literature is silent on the impact of human activities on the natural regeneration potentials, density and diversity of the woody vegetation of the park. This indicates that the vulnerability of the park's natural capital due to the impact of human activities on protected areas have not received the necessary attention by the decision makers as a result of the knowledge gap on the impact of human activities on the natural capitals of the country's protected areas. On the otherhand this reinforces the need to develop the concept of understanding the vulnerability of these natural capitals and the underlying factors of degradation.

In conceptualizing this element of the framework, the researcher deployed scoping missions to the protected area as well as carried out a reconnaissance survey by making use of field tours, observations and discussions with the park authorities and local communities. Based on this undertakings, forest, grassland, aquatic ecosystems (lakes Abaya and Chamo, hot springs and rivers), wild animals and the soil are the major resources that are vulnerable to human induced impacts.

(b) State of the natural capitals – in line with the impact of human activities

Protected areas are primarily designed to conserve biodiversity and maintain ecological functions that sustain the wellbeing of humanity. These phenomena are viewed as one of the only hopes for preventing endangered, and endemic species from extinction (WWF, 2018). However, the

rates of degradation of protected areas by humans are impacting negatively the natural capital of parks and protected areas in Ethiopia. The natural capital is one of the five livelihood assets identified by the Sustainable Livelihoods Framework created by DFID (DFID, 1999) as discussed in Chapter 3 of the Review of Literature. This research has therefore, adopted the natural capital concept from the DFID Framework on Sustainable Livelihoods by contextualizing it within the case of Nech Sar National Park ("Stocks from which resource flows and services are derived (e.g. land, forests, minerals, marine/wild resources, water, etc.", DFID, 1999:1). This definition is referring to plural stocks and hence, this thesis refers capitals plural. Accordingly, the natural capitals of the park which would be considered in the study include the forest, grassland, lakes and wildlife since these are the resources that are subject to human induced factors in meeting the livelihood needs of the expanding population which resides within and adjacent to the protected area (Travis *et al.*, 2010).

Thus, this element of the conceptual framework will focus on defining the current state of the natural capitals in the protected area by considering the impact of human activities on the natural capitals. Human activity or human induced threat in this case is defined as "any activity or processes that cause destruction, degradation / impairment of biodiversity targets" (Schulze *et al.*, 2018:3).

The livelihood of many people living in the park / adjacent communities are directly dependent on natural resources base and ecosystems of the protected area. Over exploitation of the biodiversity and ecosystems of protected areas and improper utilization of these resources will have an immense impact on the sustainable development and management of the resources and the services they provide (Barbara *et al.*, 2012).

Prior to the creation of protected areas by government officials, local and indigenous communities used the resources for the maintenance of their livelihoods. Therefore, researchers such as Asebe (2012), argued that protected areas are causing disruptions to the livelihoods of the indigenous people and neighboring communities since these areas are taking away essential resources like land, water, and other resources from the reach of these communities.

This view is also supported by Abiyot (2009), who concludes that there will always be tensions and conflicts between indigenous people and local communities on one hand and conservation and protected area management officials on the other side who intend to achieve the goals of protected areas which cannot survive in cases where the communities are relying on these resources to fulfill their basic needs. This is the main cause for the degradation of the ecosystem services in protected areas.

Environmentalists and other institutions on the other hand argued that, it is important to create protected areas to preserve critical biodiversity and ecosystems which would have disappeared was it not for the creation of these protected areas (UNDP, 2015, Travis *et al.*, 2010). They argued that communities benefit from the very existence of protected areas as a result of local employment opportunities, sustainable access to the traditional / religious nservices and others. Protected areas are used by the communities for local economic development as a result of tourism, and the preservation of ecosystem services in which the local as well regional ecological services are obtained (Paul, 2008).

Because of its relevance to this research, the Social Assessment for Protected Areas (SAPA) Analytical framework (SAPA) is one of the conceptual frameworks reviewed by this research. The framework has identified the different phases of the research as preparation, scoping, assessment and action (Franks *et al.*, 2014). The researcher will adapt this aspect of the SAPA by using these phases to assist him to define the main activities to be implemented during the research project implementation cycle, including the timeframe for field missions, conduct a scoping mission (reconnaissance survey), ensure that the park authorities have a proper understanding of the research and fulfil all the required legal and ethical pre-requisites to conduct the research and to facilitate the data collection process in an organized way.

This element of the framework will be operationalized by assessing the levels of the degradation of the natural capital in the protected area. The natural capitals which will be assessed in detail include mainly the forest, lakes and grassland of the park. In assessing the forest, the researchers will evaluate the levels of degradation on density and diversity of the forest as well as the natural regeneration of the trees and other plants in the park (Aklilu, 2013; Emiru, 2003; Demil, 2005).

This assessment will help to explore the magnitude of forest resources vulnerability caused by human activity.

To assess the grassland areas, the researcher will compare ground cover of herbs across the protected areas so as to evaluate the availability of feed for the wildlife. Whereas, for the assessment of the health of the lakes, the researcher will identify the challenges facing the lakes by assessing the factors that facilitated the sediment flow to the lake and over exploitation of fishes. He will try to determine whether such flow in sedimentation can result in receding of the amount of water in the lake. The researcher will observe over three (3) decades of satellite imagery to validate whether the lakes in Nech Sar National Park are vulnerable to the impact of sedimentation and other human induced factors.

Pertaining to the wildlife, the researcher will identify the prevalence of challenges like the increased competition for feed, over grazing by cattle, dissemination of insect pests and disease that are brought by cattle into the protected area since other domesticated animals are grazing in the protected area as well as through natural forms such as wind.

(c) Governance and Processes

According to Borrini-Feyerabend *et al*., (2013:11) governance from protected areas perspective is to find out "who holds authority and responsibility and can be held accountable according to legal, customary or otherwise legitimate means." The authority and the ability of making appropriate decisions do impact the sustainable development and management of protected areas.

Although there is recognition of the participation of all stakeholders in the governance of protected areas, this is not happening in most developing countries due to a) poor institutional capacity of most protected area management systems in providing the necessary technical and supervisory support which enhance the governance and management of protected areas, b) the lack of political will on the part of the government of Ethiopia and others to provide the enabling environment such as policy, strategic plans and resources for enhanced governance systems, c) lack of participation of the local community and indigenous people in the governance process and

the d) absence of strategic partnership among stakeholders involved in the protected area development sector (Girma and Tell, 2012).

The participation of indigenous communities and local people in the governance of the protected area is reflected in policies and declarations of international development agencies, of which Ethiopia is a signatory to these declarations. As early as 1992 UN Framework Convention on Sustainable Development (UNCSD) (UN, 1992) includes the rights of local and indigenous people to participate in the governance of protected areas.

The Framework for Assessing Institutional Arrangements to Manage Tourism in the Indian Himalayan Protected Areas (Badola *et al*., 2018) builds on the premise that local and indigenous people play a significant role by ensuring the sustainability of protected areas through benefits sharing. The framework assesses the major dimensions of protected areas governance such as a) the interactions between the concerned stakeholders, b) sharing of benefits with the local communities and c) enhancing the institutional power relationships of the different participating stakeholders. The researcher will adapt these tools from the Badola (2018) framework to assesses the institutional related gaps in protected areas governance by assessing the institutional arrangement and partnership modalities with all the concerned stakeholders and by identifying whether the governance arrangement of the park is inclusive of the local community. In addition to that, the researcher will also consider assessing the concept of benefits sharing by the local community as that will have a key role in the sustainable governance of the protected area.

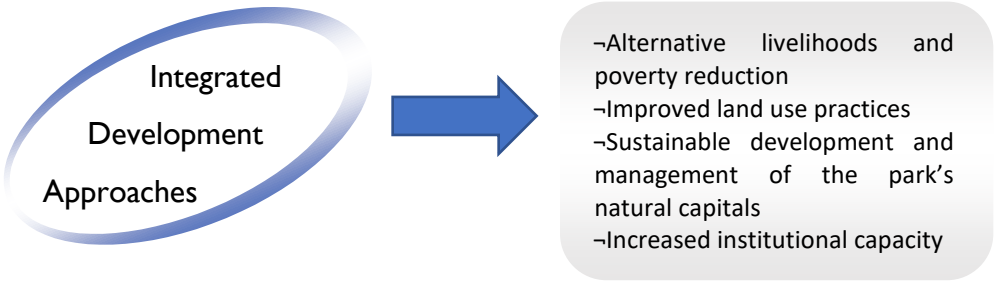
An important component of the DFID (1999) Framework for sustainable livelihoods concerns with transforming structures and processes. This includes the creation of the enabling environment that could aid the formation of resilient livelihoods. The policies, institutional capacities and structures are the major elements of this component and are believed to play a pivotal role in the process of building appropriate governance mechanism to enhance the participation of local people and indigenous communities in sustainable livelihoods development.

The Practical Framework for Understanding Environmental Governance (Bennett *et al*., 2018) defined three environmental governance elements as a) institutions (laws, policies, rules and norms), b) structures (decision making bodies, formal organizations and informal networks) and 3) processes (decision making, policy creation, negotiation of values and conflict resolution) that

will help to achieve environmental governance objectives. Stage three of the new framework will incorporate the structures and institutional elements articulated with the DFID (1999) Framework for Sustainable Livelihoods and the Practical Framework for Understanding Environmental Governance (Bennett *et al*., 2018) to enhance the governance environment in the Nech Sar National Park as it will help the framework more responsive, participatory and sustainable in responding to the needs of the local and indigenous communities.

This element of the framework will be operationalised through the review of policy, strategy and regulation documents which will help to identify the decision-making processes and governance arrangements of the country's protected areas. In addition to that, this stage will be implemented by administering interviews and questionnaire to get information from government officials in Addis Ababa and Officials in Nech Sar National Park on the governance arrangements of the park and its associated challenges. The researcher will also administer Focus Group Discussion (FGD) among local people and indigenous communities to solicit their view on their participation in the governance and management systems of the park and the measures that can be taken to improve the practice.

(d) Integrated Development Approaches



In many parts of the world, people who live in and around protected areas are highly dependent on the natural capital of these resources for their wellbeing and livelihoods (Asebe, 2012; Travis *et al*., 2010). Research shows that conventional management approaches to the governance of protected area were inclined towards seeing people and nature as separate entities (Asebe, 2012). This has come at a considerable social cost, mainly to local communities, and has prevented the effective involvement and participation of stakeholders in conservation efforts. Integrated development and conservation approaches are being advocated by the UN Convention on

Biological Diversity in its programme of work on protected areas, which includes a specific element focusing on governance, equity, participation and benefit sharing (SCBD and UNEP, 2019). Similar programmes are advocated by bilateral and multilateral development agencies and international NGOs to take actions now to build sustainable governance and management systems to reduce degradation and enhance biodiversity and ecosystem services of protected areas (UN, 2015).

In this phase of the conceptual framework, the researcher analyzes the impact of human activity on the natural capital of Nech Sar National Park. The researcher echoed the call of the UN Convention on Biodiversity and the work of other international development agencies to devise and integrate development approaches in view of finding solutions which will reduce the impact of human interference on the natural capital of protected areas. The integrated development approach is divided into two parts. The first part will explore a number of systemic approaches which the researcher will borrow from the reviewed conceptual frameworks so as to enhance the new conceptual framework and secondly, it will propose a set of strategies to address the fundamental issues such as a) Alternative livelihoods, b) Increased income, c) Improved land-use practices, d) Sustainable development and management of the park's natural capitals and e) Increased institutional capacity as a way of reducing the human interference on the natural capital of the Nech Sar National Park in Ethiopia.

The research would adapt the transforming structures and processes features of the DFID framework (1999) to the new conceptual framework. These features include the creation of the enabling environment that could aid in the formation of resilient and sustainable livelihoods. The transformation of policies, institutional capacities and structures are the major elements of this component and are believed to play a pivotal role in the achievement of sustainable livelihoods development. Indigenous and local people exploit the natural capital of protected areas mainly as a means of acquiring livelihoods (basic survival). This usually leads to the degradation of the natural resources and biodiversity of protected areas. Therefore, the livelihood strategies and outcomes that will be developed in the new framework would ensure the activities local people will undertake and result in the generation of sustainable income and wellbeing.

The researcher would also incorporate some features of the Practical Framework for Understanding Environmental Governance (Bennett and Satterfield, 2018) into the design of element 4 of the new conceptual framework. This new conceptual framework would be designed to assist policy makers to visualize the linkages among the different factors that affect the resources of the protected area and enable them to take appropriate actions in formulating detailed integrated sustainable development strategy for the protected area.

From the Framework for Assessing Institutional Arrangements to Manage Tourism in the Indian Himalayan Protected Areas, the researcher will adapt strategies which will enable to identify the challenges as well as the opportunities in attaining the good governance of the protected areas. The researcher would identify the key player in the governance of the protected area and provide a mechanism for the understanding of the institutional set-up and their role in the governance of the protected area.

According to the Sustainable Livelihoods Framework (DFID, 1999), an analysis of the livelihood strategies and outcomes implemented by the institutions, would help the researcher to understand the priorities, challenges and potentials of local communities' livelihoods development process (Chalachew, 2014).

To operationalize this stage of the new conceptual framework, the researcher would implement a series of strategies (surveys, review of record, journals, etc.) in developing strategies to enhance the management capacity of the protected area. The researcher would assess the policies, institutional capacities and structures in determining the levels and quality of participation of people in the governance of protected areas and make recommendations to enhance participation of local and indigenous people. This concerns the development of strategic programmes that enhance alternative sustainable livelihoods; increased income level of local people and indigenous communities; improved land-use practices to reduce sedimentation, soil depletion etc; sustainable management of the park's natural capitals; and increased institutional capacity and governance systems. The researcher would conduct interviews with policy makers and park officials and FGD with local and indigenous communities to explore possible solutions that would aid to address the governance and management challenges impacting the natural capital of the protected area.

4.2.2. Summary of the Section

The researcher assessed five conceptual frameworks in the literature review to determine the feasibility and applicability of these frameworks to the research he is undertaking on the impact of human activities on the natural capitals in Nech Sar National Park of Ethiopia. After careful analysis of the conceptual frameworks, the researcher found none of these frameworks is applicable for the study on their own. What is missing in each of them was the concept of capturing how human activities are impacting the state of natural capitals in the context of protected areas. Hence, a new conceptual framework was developed by overcoming this gap through the design of an element of the framework which helps to assess the impact of human activities on the density, species diversity and natural regeneration potentials of the protected area woody vegetation.

The review of related frameworks has also showed that there is a gap as to how these impacts can be reversed through strategic actions. In this regard, the new conceptual framework has overcomed this challenge by crafting the element of integrated strategic development concept in to the conceptual framework of the research as one of the building blocks of the framework.

Therefore, this new conceptul framework would make a significant contribution to the body of knowledge in the field of protected areas management and development, as the research offers strategic directions in overcoming the threats, particularly where human activity is recognised as a leading challenge for the sustainable development of protected areas. The following section will provide details on the data collection and analysis methods.

Section 2: Methodological Section

4.3. The Research Paradigms

Discussing the research paradigm is a crucial element of presenting research methods (Jennings, 2010) since it will give the opportunity of looking at the descriptions and views of the reality from which research questions and the discussion of research findings can be based (Neuman, 2011).

Andrew (2018:85) defined paradigm as "a perspective or a way of looking at reality". Schwandt (2001) said that "a paradigm is a shared world view that represents the beliefs and values in a discipline and that guides how problems are solved". Nickson (2014) supported this view by stating that paradigm is "philosophical assumptions, concepts, and propositions about the nature of reality which provide a basis for designing and executing the research". Hence, a paradigm is a theoretical framework for conducting a research and is defined as "a net that contains the epistemological, ontological and methodological premises of a research" (Hennink *et al*., 2011). Interpretivism (constructionism) and objectivism are also the two contrasting theoretical views that characterize the epistemological and ontological perspectives of a paradigm where the first view assumes reality as the result of social processes while the later signifies as there is an independent reality (Neuman and Kreuger, 2003).

Ontology is related to the belief as there is a reality that can be verified by a certain means, whereas epistemology relates to making inquiries about the nature of knowledge. It enquires about the sources of the knowledge being sought along with the reliability of the sources. It also asks how one can be certain about the knowledge by asking evidence of proof. A paradigm then leads to ask further questions as to how one can explore knowledge through systematic approaches called methods. There are a range of methodological approaches, but the researcher would choose the methods that best suit the subject under study whereby ethical considerations should form an important element of it. The interplay of these facts and aspects will guide researchers as to how they view statement of the problem and the methodological approaches which will be used to respond the research questions (Ritchie *et al*., 2013; Hennink *et al*., 2011; Patton, 2002).

To explore and understand phenomena researchers could orient themselves as positivists or interpretivists. Interpretivists consider as the aim of inquiry is to understand a particular phenomenon than drawing generalized conclusions to a given population while the positivists believe that the findings of an inquiry that helps to understand a particular phenomenon represents a given population under study. Usually the research design will be determined based on the position of researchers as either interpretivist or positivist (Nickson, 2014). Hence, further explanation on the context of this thesis research design is put forward in the following section since the research process will determine the method of inquiry while executing the research process (Jennings, 2010).

4.4. Research Design

Research design shows as to how a study will be conducted, the main elements of the research such as samples, measures, experimental treatments, procedures, etc. which are portrayed to respond to the research questions of a study and help to enhance the validity of research findings. It also gives the direction from the assumptions of the research subject to data collection and analysis. Depending on the nature of the research, researchers can also relate to the positivist or interpretivist research paradigm or a combination of both. This in turn will also guide the type of methodological approaches (qualitative and quantitative or a combination of both which will be deployed for the materialization of the research (Tuli, 2011).

Quantitative methods are generally related to positivists while qualitative approaches to interpretivists. These approaches also supplement or complement each other, and it is the researcher who decides to use one or a combination of them depending on the nature of the study. Quantitative research approaches are mostly based in biology, geology and other natural sciences while the majority of qualitative researches focus on social related fields (Neuman, 2011; Jennings, 2010).

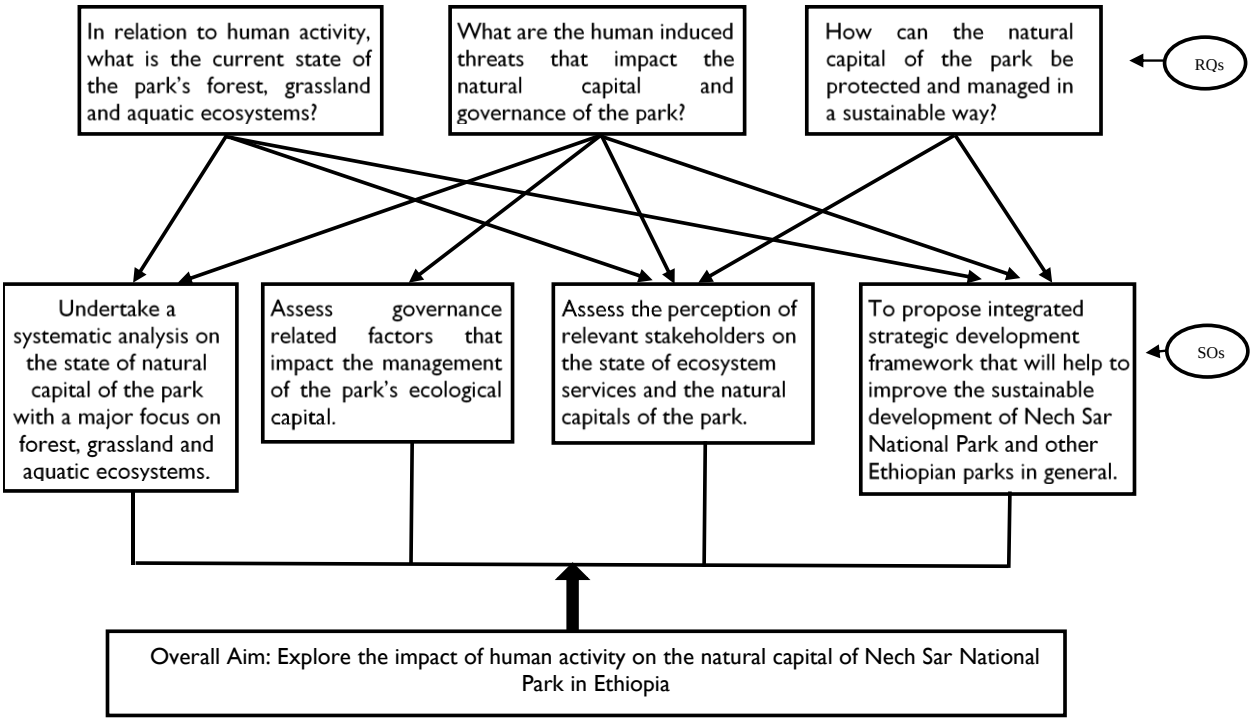


Figure 19: Relationships between overall aim, specific objectives (SOs) and research questions (RQs)

Following the aforementioned research design perspectives, the philosophical assumptions of this research considered the positivist and interpretivism paradigms since the study will be looking at the interplay and perspectives of the natural capitals of Nech Sar national Park (forest, grassland, aquatic ecosystems) and the human induced anthropogenic effects (Figure 19) that caused the degradation of the park's resources as explained earlier in Chapter 3: Section 1 - the conceptual framework of the research. In line with this the research also based itself on the utilization of quantitative methodological approaches since quantitative measures on the status of the natural capitals and local communities' views and perspectives are considered to ensure the validity and reliability of this research.

4.4.1. Using Case Study as a Research Method

Case study, narratives, and ethnography are among research designs which can be deployed to answer research questions. The type of data which researchers will collect, however, will dictate the type of approach to be used. In narrative research for instance, researchers usually focus on the stories told by the respondents and organizes them in a sequential manner. In the case of

ethnography, the focus of researchers is to set the stories within the context of the culture sharing groups. A case study on the other hand explores the details of a bounded setting or system by deploying a range of data sources (Cresswell, 2003).

Most researchers would think of a case study as an attempt to understand and interpret a spatially and temporally confined set of events. Yin (2009) defines case studies "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". Gillham (2000) put forward a more simplified definition of a case study "as an investigation to answer specific research questions which seek a range of different evidences from the case settings". In reality, a case study helps researchers to have a closer look at specific contexts and their relationship in a specific geographical area as a focus of a study (Zaidah, 2007)

Often case studies are considered to be associated with qualitative research, but they are also related with quantitative research or a combination of both, hence the particular understandings and undertakings of a researcher for a particular context will play a significant role on the results of a given study (Adrijana, 2013).

Case studies are known to provide researchers with a room of gaining a sharpened and deep understanding as to why a certain instance has occurred since it deploys multiple tools of data collection and analysis procedures for the case, unlike many of the other approaches. Apart from this, case studies are known to achieve conceptual validity, help to explore causal relationships of a given system and are proven ways of conducting indepth investigation (George and Bennett, 2005).

Hence, following the above justifications and by embracing the view of Yin (2003) "you would use the case study method because you deliberately wanted to cover contextual conditions-believing that they might be highly pertinent to your phenomenon of study", the case study approach is adopted by this thesis as it fits well with the case of Nech Sar. The researcher adopted a single case study with embedded units since the study is dealing with a particular (single) issue of human activity on Nech Sar National Park which encompasses embedded units in it (forest, grassland, aquatic ecosystems, etc. of the Park).

4.5. Sampling

Having a proper sampling is among the factors that help ensure the representativeness and validity of a given research (Robson, 2002; Ezzy and Liamputtong, 2005). As the aim of this research is to explore the impact of human activities on the natural capital of Nech Sar, a mix of ecological assessments was implemented. Based on the objective and research questions of the research, the heart of the thesis is anchored on the quantitative ecological assessments. The research also engaged qualitative studies as the views and perceptions of the local communities and concerned partners constitutes a share on the overall validity of the research. This requires having representative samples which can reveal the existing situation of the park. Hence, as explained in the case study section of this chapter, data from the embedded units of the case such as the forest, grassland, indigenous communities (Kore, Gamo and Guji), stakeholders, park authority staff, etc. was collected by deploying sampling procedures explained in the following sections.

4.5.1. Ecological Assessment

After the signing of the Memorandum of Understanding (MoU) between the researcher and Ethiopian Wildlife Conservation Authority (EWCA) a scoping mission to the park was conducted by the researcher in November 2015 for a couple of weeks. During the trip the researcher conducted a reconnaissance survey by making use of field observations and preliminary discussions with the park management staff and park rangers.

Based on the results of observation and the discussions with the park staff, the researcher found out that the two extreme tips of the park are being affected by anthropogenic impacts. This impacted the geographical landscape and the composition of the park's ecosystems (as explained in chapter 2). One can observe from the map below (Figure 20), that the western edge of the park is surrounded by Lakes Abaya and Chamo which in fact has contributed to the conservation of the forest resources in that portion of the park since the forest is inaccessible as a result of this natural barriers. However, in between these two lakes, there still exists about a 15 kilometers of open forest land of the park (ground water woody vegetation) which shares an immediate open border with the town of Arba Minch (Figure 20), a town where its 98% of household energy supply comes from fuelwood and charcoal produced in the protected area (NSNP, 2015). This is one cross-section of the park which is going through immense deforestation in order to satisfy

the household energy demands of the town of Arba Minch. Hence, this part of the park (ground water woody vegetation) is selected to explore the impact of human activity on the status of the woody vegetation natural regeneration, species diversity and density.

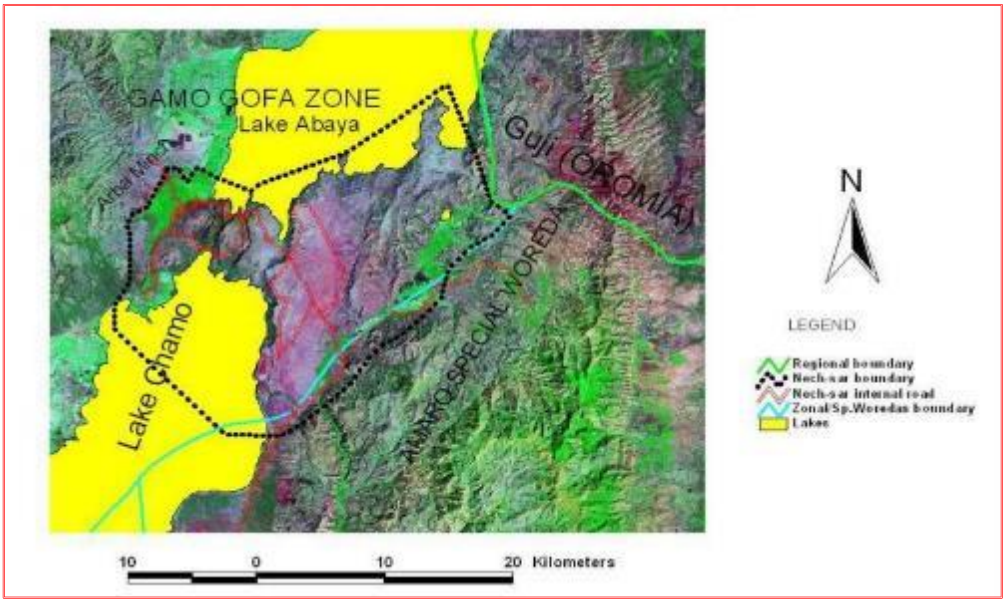


Figure 20: Location map of Nech Sar with demographic features (Source: park records).

The central landscapes of the park are naturally protected by the water bodies, rugged terrain, distance from the town and existence of aggressive wild animals like crocodiles, hippos, etc. in the nearby of those water bodies and as a result there exists limited or no human activity.

Studies indicate that disturbance gradients potentially influence species composition, reproduction as well as density of woody vegetation (Janet *et al.,* 2007; Shackleton *et al*., 2004; Harmon *et al.,* 1999; Shibu *et al*., 1996). Following this assumption, based on the personal observations during the reconnaissance survey on the level of human interference, the researcher has set three land management categories: protected, less human interference and high human interference gradient levels.

Protected land management is the area of the park that falls under close supervision of the park management as a result of its proximity to the park's main office and the natural barriers such as lakes. This area is believed to be undisturbed by human interference. Less human interference is part of the park with a bit of human interference (not very far from the main office of the park) whereby fuel wood collection can be practiced sometimes; and high human interference is part

of the park which is under high human interference because of its distance from the park main office and it is the cross-section of the park where one can easily observe fuel wood collection, charcoal making and livestock grazing activities.

The eastern end of the park has also a different landscape which is called the Nech Sar plain, an open grassland which attracts the livelihood of the pastoralist Guji and Kore local communities. This part of the park is also considered for the ecological study since there exists a rigorous human interference because of the heavy livestock pressure in the area. Therefore, these two sections of the park are purposely sampled for the ecological survey and the details of the sampling techniques will be presented in the subsequent sections.

There are different methods which can be used to define the representativeness of samples in forest research. This includes methods like the cruise-design technique which makes use of remote sensing technologies in determining the representativeness of the samples. Others like the US Forest Services also use a fixed portion of hectarage or acre of forest land to be considered in forest inventory techniques. These methods are known to consume a significant budget and time. Apart from that, it also requires to have a good knowledge of remote sensing (Bogdan, 2014; Jan *et al*., 2012; USDA, 2000; Robertson, 2000) and for this very reason the research deployed the conventional sampling methods of experimental plots (Kindeya, 2003; Emiru, 2003; Demil, 2005).

4.5.1.1. Sampling Techniques: The species-area curve technique

In the case of this research, due to financial and time considerations, to ensure the representativeness of the ecological assessment samples, the species-area curve technique was adopted as follows. The use of species-area curve is one of the oldest methods used in ecological studies (Lomolino, 2000, Williamson *et al*., 2001). The system deploys quadrats which will help to represent a plant community to be sampled. Since a single quadrat will not represent the entire plant community in a given landscape, it is mandatory to sample additional repeated quadrats as a source of information. The critical question to ask here is how do we know whether we have representative sample quadrats or plots to represent the plant community under study? Scientist are making use of the species-area curve method as proof of enough sampling when conducting

similar studies. The system works by recording the number of species which are present in the first designated plot mostly where there exists low species diversity as a result of human or animal interference and then continue doing same in the other quadrats until there are no new plant species. In here usually species composition increases from high to low disturbance gradients and it will start to plateau which shows as enough area of land is considered as a sample (see Figure 21 below). Then one can be confident that as appropriate area of land is sampled for a study (UM, 2018; Samuel *et al*., 2000; Even, 2003).

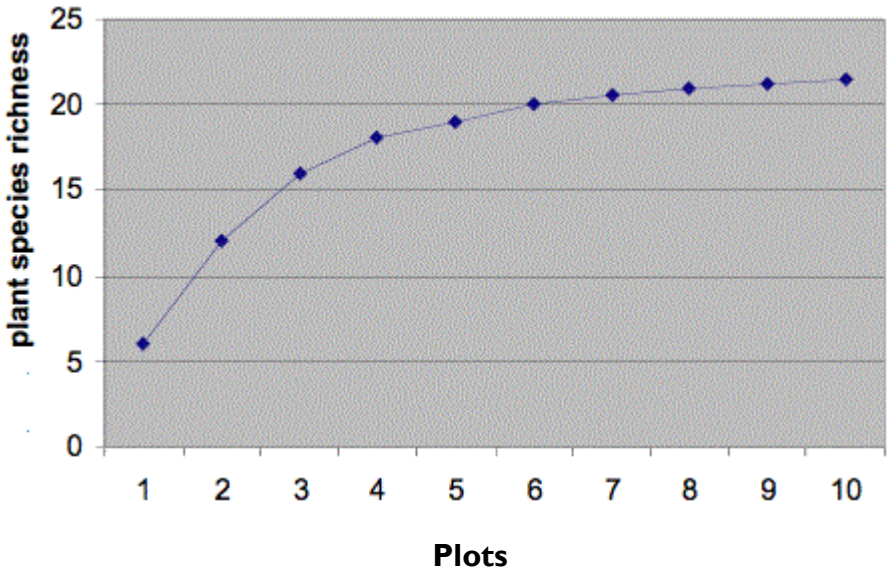


Figure 21: Species-area curve

In the case of this research, the species-area curve of the different ecological survey sample plots have started to plateau around the 10th experimental plot, however, in order to increase the reliability and validity of the information 66 experimental plots were deployed for the ecological surveys undertaken in the ground water woody vegetation and details of the sampling procedures will be provided in the different sections of the ecological data collection techniques of this chapter.

To assist the field level ecological assessments, three technical staff of the park who have the background on ecology and plant science were engaged. Prior to the actual ecologal assessment, in May 2016, a thorough training on the ecological data collection methods followed by a practical

exercise on the different parameters was given to them by the researcher in the park office. The training mainly focused on measuring the basal area of trees and saplings, counting the number of individual trees in each experimental plot along with the identification of the vernacular name of trees. They were also trained on how to operate the GPS as that was used to locate the experimental plots inside the park. Apart from them, two park rangers have also participated in the training and the assessment exercises by giving safeguarding services in the field operations too.

4.6. Ethical Considerations

Ethical issues are among the technical issues which researchers should adhere too. Boeije (2010) said that, in the research process, trust among participants can be formed when ethical considerations such as the rights, dignity, values and needs of participants are respected. It also includes the placement of informed consent, confidentiality of the information and respecting the privacy of participants. As an international development practitioner, the researcher is well acquainted with these ethical aspects and has adhered to them in this research.

Prior to conducting the ecological and qualitative studies, in November 2015, a Memorandum of Understanding (MoU) was entered between the researcher and the Ethiopian Wildlife Conservation Authority which is based in Addis Ababa, the capital of Ethiopia (Annex 1). This agreement has provided permission for the researcher to conduct the research in the park by detailing the responsibilities of the researcher for conducting the study in accordance with the Ethiopian wildlife law and research guidelines.

The researcher had also gone through the DMU Faculty of Computing, Engineering and Media ethical approval process which requires researchers among others to "providing participants with full details of the objectives of the research; voluntary participation with informed consent; written description of involvement; freedom to withdraw; and signed acknowledgement and understanding by participants". Hence, the researcher has adhered to these ethical considerations of the study (Annex 4 and 5).

4.7. Reconnaissance Survey

The actual field research of this work was carried out by having initial field level scoping activities in November 2015 where the researcher was able to establish network with the different partners in the management of protected areas in general and the Nech Sar National Park in particular. Introductory meetings with the park authorities and other relevant institutions, signing of a MoU with the Ethiopian Wildlife Conservation Authority (Annex 1), and initial field tours inside the park were among the activities performed at this stage. This process has enabled the researcher to develop the relationship with the authorities and also to have a closer look at the ecology, livelihoods, and the management activities inside the park. Additionally, this exercise has also helped the researcher to design the data collection strategies, techniques and tools.

4.8. Data Collection Methods

Data collection methodology and the execution of case study are the crucial elements of a research. There are a range of methods which can be deployed in quantitative and qualitative research and the choice of the methods depends on the research paradigm and design. It also involves having a strong hold of the research questions to be answered and by creating the enabling environment for the research to be valid and not be biased. The methodology should also give the researcher the opportunity to be more flexible and adopt better ways of gathering the evidence from the data collection proceeds (Grant and Osanloo, 2014; Ezzy and Liamputtong, 2005).

Data collection measures should also be directed by study protocols such as field procedures, triangulation (utilising multiple sources of information to corroborate the findings) and databases (notes, interview notes, observation records, transcripts, measurements, etc.). Ethical considerations are also vital elements that need to be taken care during the data collection process (Ravitch and Carl, 2016; Jennifer, 2002).

Based on the nature of the research (natural capitals and human activities in the park) and the objectives of the thesis, the researcher decided to use multi-method data collection techniques since it enabled him to have multiple quantitative and qualitative sources of information and triangulate the findings by maintaining the validity of the research.

The research methods employed by the research hence includes ecological assessments (vegetation density, diversity, regeneration, satellite images, etc.) and techniques such as focus group discussions, interviews, questionnaires, observation, textual analysis and triangulation (Table 13). The details of each method are provided in the following sections.

Table 13: Summary of data collection approaches

Type of Assessment	Focus Areas of the Research	Objective and Chapter the Results are Reported	Data Sources
Ecological Assessment	Species Diversity and Natural Regeneration Potentials of Woody Vegetation	Examine the changes in regeneration and diversity of the vegetation across the different disturbance gradients (from low to high human induced disturbance areas of the park). Results presented in chapter five.	36 quadrates (experimental plots) measuring 20 m X 20 m (400 m^2) were laid down along 5 transects.
	Vegetation Density	To assess the impact of energy demand on the woody vegetation density of the park. Results presented in chapter five.	30 experimental plots measuring 20m X 20m were laid out randomly along 4 transects lines which were laid systematically.
	Invasive Plant Species	Assess the types and distribution of invasive plants in the park. Results presented in chapter five.	Two transects were laid out in the grassland plains of the park along with 35 experimental plots (2M X 2M)
	Status of Ground Cover of Herbs	Assess the proportion of ground cover of herbs in the human interference and none-human interference areas (availability of feed for wild animals). Results reported in chapter five.	38 experimental plots measuring 3m x 3m were placed along 2 transects.

Type of Assessment	Focus Areas of the Research	Objective and Chapter the Results are Reported	Data Sources
	Fuelwood collection	Assess the impact of fuelwood collection on the ground water woody vegetation of the park. Results reported in chapter six.	Survey on fuelwood collection.
	Lakes of the park	To assess the anthropogenic effects on the water volume of Lake Chamo surface area. Results reported in chapter five.	satellite images downloaded from http://glovis.usgs.gov/.
Respondents Views Assessments	Questionnaires	To collect information from operational staff of the park (Park Rangers and technical people) on the factors that caused the degradation of the natural capital in the Park. Results reported in chapter six.	Questionnaires were administered for 28 (6 female) operational staff of the park (Park Rangers and technical people).
	Interviews	To collect information on policy related issues and challenges of the park from central and local level park management staff and other stakeholders. Reported in chapter six.	58 (9 female) central and local level park management staff and other stakeholder's attended interviews.
	Focus group discussions	To gain the views and perceptions of the local and indigenous communities residing in and around Nech Sar National Park (Gamo, Kore and Guji). Reported in chapter six.	Women, youth and elders group were formed and data collected from the participants.
	Textual Analysis	Assess park related policy, governance and park management issues that have an impact on the sustainable development and management of the park. Reported in chapter six.	A desk review of documents relating to the parks and protected areas conducted.

Type of Assessment	Focus Areas of the Research	Objective and Chapter the Results are Reported	Data Sources
	Observation	Note and capture incidents or cases during the ecological assessment transect walks which will help to enrich the information collected by other tools.	Ground truths and direct observations by the researcher.
	Triangulation	To ensure that the information collected is comprehensive and well-developed in capturing the different dimensions of the findings.	Involved ground-truthing, examining the consistency of different data sources; comparing with different viewpoints.

4.8.1. Data from Ecological Assessments

Forest ecological assessments can be done by making use of experimental quadrats (plots), remote sensing techniques, photographs, etc. The choice of the methods usually depends on the access to the technology, purpose, level of accuracy, finance and time considerations. The use of satellite remote sensing techniques as for instance is known to provide data in a timely fashion. However, these methods have also their shortfall in capturing some of relevant characters like tree height, diameter, etc. Due to the weakness of the techniques above, the researcher made the decision to make use of experimental plots for conducting the ecological assessment. This is mainly because, deploying experimental plots will enable the researcher to take physical and accurate measurements on different parameters of the research that includes height, diameter, and species diversity of the vegetation - the focus areas of the ecological studies of the thesis (UM, 2018; Andrew *et al*., 2012; Michael *et al*., 2006; Kindeya 2003; Weaver, 1918).

In line with this, to explore the impact of human activities on the ground water woody vegetation of the protected area, experimental plots along with transect lines were deployed. Accordingly, data on the woody vegetation natural regeneration potential, vegetation density, prevalence of invasive plant species, etc. were collected during the field missions carried out in May 20, 2016 – August 30, 2016 and from February 13– March 30, 2017. The main ecological assessments were

undertaken during the rainy season, when most of the plants were germinating, flowering and making the identification of species possible.

These ecological assessments are also designed in way of responding to the research questions of the thesis by systematic analysis of the state of natural capital in the park and by identifying the threats which are being posed on the resources of the park. This was achieved through an in-depth and closer look at the current state of the woody vegetation by deploying the experimental plots in areas of high human interference, low interference and the protected land management categories of the park.

4.8.1.1. Human Interference on Natural Regeneration Potentials and Species Diversity of Woody Vegetation

Examination of the population structures of plants by employing either height or diameter classes, is the commonly used measure to provide a rough idea about the status of the natural regeneration potentials of woody plants (Aklilu, 2013; Kindeya, 2003; Tefera Mengistu, 2001; Alemnew Aleligne, 2001 Tamrat Bekele, 1994; Demel, 1998; Mekuria Argaw *et al*., 1999).

After the reconnaissance survey, five transects were laid out by making use of Arc view, a GIS software (Annex 2). The transects were laid using systematic sampling for having a closer look at the human interference on the ecology of the Ground Water Woody Vegetation of Nech Sar National Park. Accordingly, the transects were laid out in a radiating pattern by representing a gradient from low to high disturbance areas of the park (Figure 22). The aim of this activity is to examine the changes in regeneration, density, basal area and diversity of the vegetation along an interior to edge gradient in relation to changes in disturbance gradients (Rahman *et al*., 2009; Shackleton *et al*., 2004; Shibu *et al*., 1996;). Along the transect lines, a total of 36 quadrates (plots) measuring 20 m X 20 m (400 m^2) were laid down.

Based on the level of human interference (explained in section 4.1.1), the experimental plots were also categorized under three land management categories including a) protected, b) less human interference and c) high human interference gradient levels. Therefore, Protected land management is categorized as the area which is believed to be undisturbed by human interference. The area with less human interference is described as the area of the park that has a bit of human

interference on fuelwood collection whereas the area of high human interference is labeled as the part of the park which is under high human interference because of fuel wood collection, charcoal making and livestock grazing activities. Hence, the total number of plots were categorized into the three land management types: protected (17 plots), less human interference (9 plots) and high human interference (11 plots).

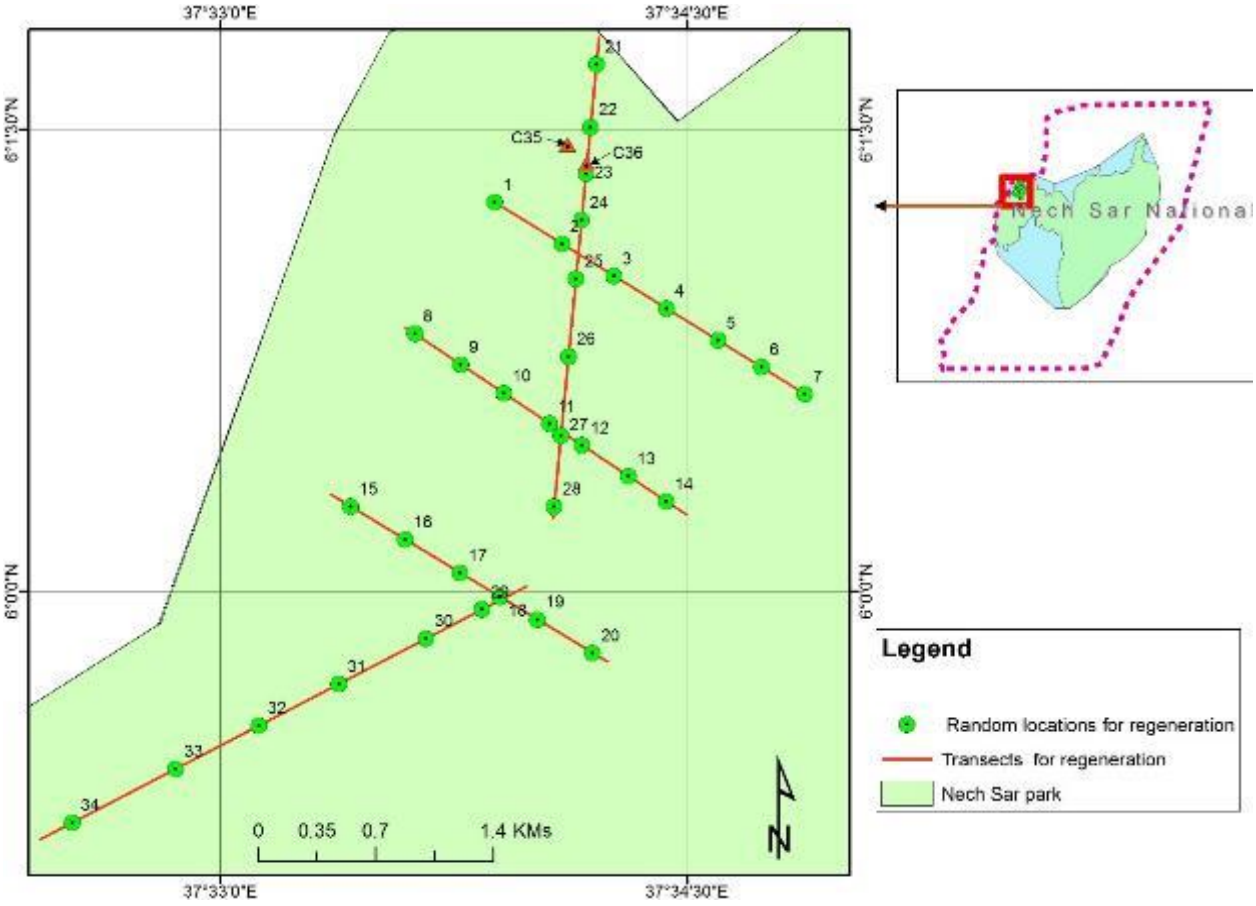


Figure 22: Species diversity and natural regeneration assessment transects lines with corresponding experimental plots

Thus, in each quadrate for each land management scheme: (I) all woody plants were determined and the total number as well as height of individuals (using a graduated stick) of each species was recorded; (II) the diameter of saplings and trees was measured. For saplings, diameter was measured just above the ground (basal diameter) using a caliper. Diameter of trees was measured at breast height (1.3m from the ground). For regenerated seedlings (height < 0.5 m), only their number was recorded. To assess the regeneration status of woody plants, all individuals

encountered in the quadrates were grouped into: (i) height classes: < 0.5 m (seedlings), 0.5 - 3 m (saplings) and > 3 m (trees) (Aklilu, 2013; Kindeya, 2003; Emiru *et al*., 2002).

4.8.1.2. Human Interference on Density of Woody Vegetation

In order to assess the impact of energy demand on the woody vegetation of Nech Sar National Park a total of 30 experimental plots measuring 20m X 20m were laid out randomly along 4 transects lines which were laid systematically so as to capture the impact from high human interference area to the protected areas of the park (Annex 3). Then the total number of individuals in each quadrant was recorded (refer to below Figure 23).

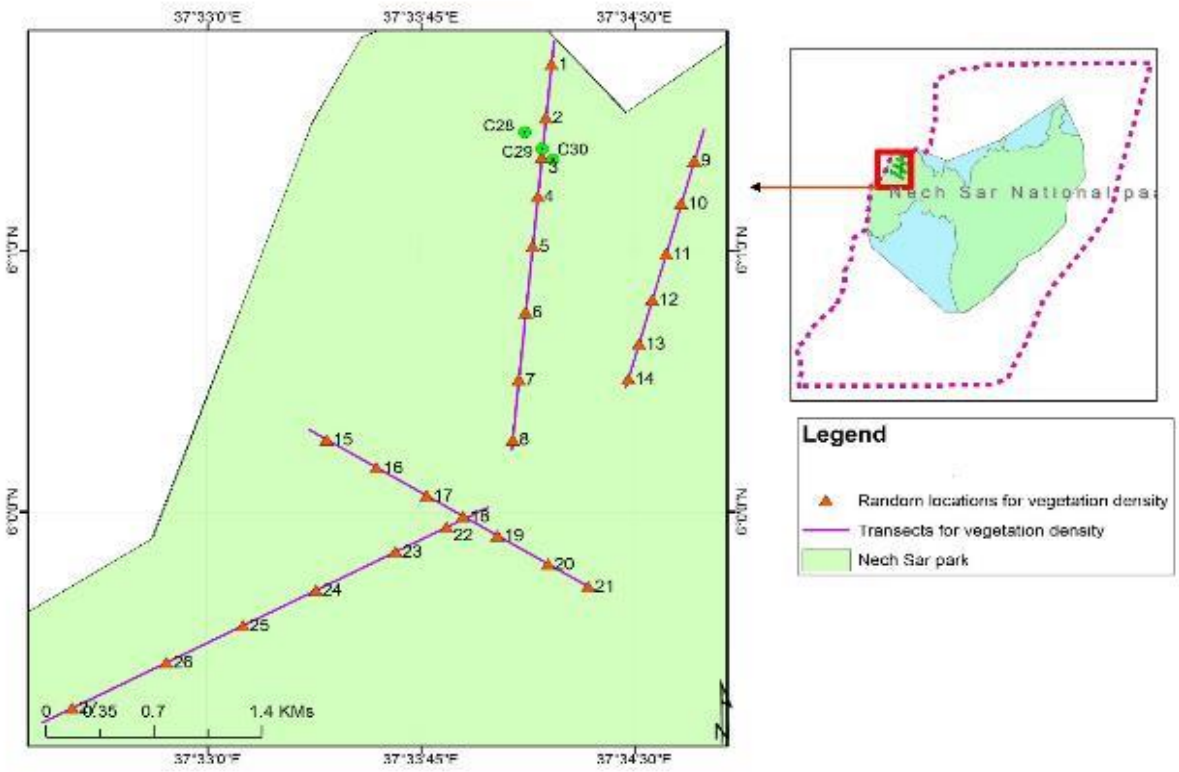


Figure 23: Vegetation density transects lines along with corresponding experimental plots

4.8.1.3. Status of Ground Cover of Herbs

To estimate the abundance of the major herbaceous plant species in the Nech Sar grassland plains of the Park, the researcher established 38 experimental plots measuring 3m x 3m and placed them along 2 transects. In these plots, the proportion of cover by the herbaceous species was estimated visually. Thus, to explore the major herbaceous species, two vegetation coverage

classes were predetermined as per the outcomes of the reconnaissance survey as follows: Class I (80-100% coverage as controlled) and Class II (0-70% coverage as livestock interfered) (Sutherland, 2000; Emiru, 2002).

One of the well-organized camp sites of the park is located in the Nech Sar Grassland plain. In the nearby locations of the camp site there is no livestock interference as the park rangers will always be around to take all the legal actions and enforcement of protection activities. That portion of the park is categorized as Controlled area since it has a very dense proportion of the ground cover of herbs as a result of the protection (17 plots). To the contrary, as the researcher proceed to the middle of the grassland and then towards the peripheries of the area he observed the livestock pressure competing with the feed of the wild animals. This area of the park according to this study is categorized as Livestock Interfered area since the landscape has a thin proportion of the ground cover (21 plots).

4.8.1.4. Satellite Images

In order to substantiate the anthropogenic effects on the volume of the Lake's surface area, Lake change were extracted from Landsat 5-TM, Landsat-ETM and Landsat 8-OLI_TIRS satellite images acquired on 14/03/1985, 27/01/2000 and 28/01/2015 were downloaded from http://glovis.usgs.gov/. The last available image was found only in the year 1985 and hence it was considerd as the baseline for comparing the available data on decade basis.

In addition to that, during the ecological assessment transect walks the researcher also captured incidents or cases which are affecting the aquatic resources of the park. The researcher also made a boat tour on the Lake Chamo and its surroundings in order to observe and capture the ground realities that are affecting the wellbeing of the resources. Pictures and notes were taken in the process.

4.8.1.5. Invasive Plant Species as a threat to the Natural Capitals

The eastern edge of the park, where the Nech Sar grassland plain is located, is also a major attraction for human interference due to the availability of the grass in an open field. It is not uncommon to see the livestock of the Guji community competing with the wildlife feed. Apart

from that, invasive plant species are being disseminated vigorously as a result of this interference. Therefore, two transects were laid out in the grassland plains of the park along with 35 experimental plots (2M X 2M) which enabled the research to collect data on the types and coverage of the invasive plant species.

4.8.1.6. Fuelwood Extraction and Household Energy Demand

Arba Minch town shares an immediate boarder of about 15km with Nech Sar National Park. The urban, peri-urban and rural communities are highly dependent on forest resources for construction as well as to meet their household energy demand. Fuelwood collection is also being considered as the major source of livelihood for many inhabitants of the town. People from neighboring districts are also believed to come to Arba Minch town and be engaged in fuelwood collection as a source of additional income generation and means of livelihood. Thus, the number of fuelwood bundles which comes out of the park was recorded from the three outlets of the park (Kulfo bridge, Highland and Jinka road) where the fuel wood collectors are taking their routes to and from the city for fuelwood collection activities.

To estimate the volume of the fuelwood carried by each person, the weight of the 3 commonly marketable bundle sizes were measured initially and a category 20-30kg, 31-40kg and 41-50kg were set accordingly to visually estimate the volume of the fuelwood which comes out of the park by each collector. Information was then collected in March 2017 for 20 consecutive days from 6AM in the morning until 8:00PM in the evening by deploying the three data collection assistants (staff of the park) in the three fuelwood outlets. The summarized compiled data is annexed in Annex 14.

While collecting this data, the major encountered challenge was, there were few occasions where we encountered different volumes of fuelwood than the fuelwood volume categories explained above. To overcome this and avoid information biase, these differently volumed fuelwoods were recorded under the nearest lowest category. In addition to that, standing under the hot sun throughout the day was also another challenge.

Qualitative and quantitative data on fuelwood was also collected from the inhabitants of Arba Minch, local community members and government officials as part of the overall interviews, focus

group discussions and questionnaire which were deployed for the collection of data in the entire research process (Annexs 6 - 8).

4.8.2. Data Collection Methods from Respondents

Ritchie *et al.* (2013) mentioned that qualitative research helps to understand and examine a phenomenon since it will help to let the researcher having a better understanding about the experiences and views of the participants on the issues to be explored by the research. Identification of the major human activities that affect the natural capitals of the park and the policy and strategic barriers research questions will be answered through the data collected from the respondents and textual analysis. Hence, by making use of questionnaires, interviews, focus group discussions and textual analysis data were collected from May 20, 2016 – August 30, 2016 and from February 13 - March 30, 2017 and the details are presented as follows.

4.8.2.1. Questionnaires

In commenting on the importance of using questionnaires, Blaxter *et al.* (2001) contend that "the idea of formulating precise written questions, for those whose opinions or experience you are interested in, seems such an obvious strategy for finding the answers to the issues that interest you".

Questionnaires are one of the most widely used techniques in social research. Using questionnaires is an obvious strategy for finding the answers to the issues that matter and can provide straight forward descriptive information about the questions (Ravitch and Carl, 2016; Blaxter *et al*., 2001; Todd, 1979; Munn and Drever, 1990; Adams and Schvaneveldt, 1991).

The research utilized a semi-structured questionnaire (Annex 8) to collect information from 28 (6 female) operational staff of the park (Park Rangers and technical people). The intention was to capture the views of the entire park staff available at the time of data collection. However, due to work and personal reasons since all the staff were not on duty at the time of data collection, it was not possible to engage all the staff in this process and hence all the available staff at the time of data collection were recruited for the questionnaire. This method is believed to fit in to the tight schedules of operational staff since they usually have less time to spend on extended

discussions and interviews as they can easily fill out the questionnaires in a shorter period of time. The questionnaires were administered in Amharic (the national language of the country) for an average of thirty minutes time.

4.8.2.2. Interviews

In their commentary on the types of interviews, Siraj-Blatchford and Siraj-Blatchford (2001) contend that interviews can be entirely structured, entirely unstructured or semi-structured. They claimed that unstructured interviews often referred to as conversation with a purpose and are considered to provide the respondents with maximum freedom in determining their response.

Opportunities arise during an interview so that the interviewer can probe answers and use prompts to encourage and expand responses (Siraj-Blatchford and Siraj-Blatchford, 2001). This will add significance and depth to the data obtained (Saunders *et al*., 2000, Robson 2002). Unlike questionnaires, interviews tend to be open-ended questions in which participants are able to express their views freely, thus reducing confusion.

The researcher has the chance to interact with participants during the interview session. This allowed the researcher to observe behavior and body language so as to modify his line of enquiry and follow-up interesting responses during the interview process (Robson, 2002).

Although interviews are viewed as an appropriate data collection method for conducting qualitative research, it has its disadvantages such that it can be time-consuming and require careful preparation before and during the implementation of the research process. It is also very difficult to rule out biases when using the research method (Robson, 2002).

58 (9 female) central and local level park management staff and other stakeholder's views on policy related issues and challenges of the park were, therefore, involved in the semi-structured interviews (Annex 6).

The Gamo Zone Administration Office in collaboration with the park authorities has identified the major stakeholders of the park and also established the Nech Sar National Park Participatory Park Management, Law Enforcement and Rehabilitation Committee which is being chaired by the

Gamo Zone Administrator. This includes Zone Administration Office; Culture and Toursim Office; Agriculture and Environmental Protection Office; Security Affairs Office; Social Affairs Office; Women and Children Affairs Office; Justice Office; Police; etc. (source: park records). This researcher has, therefore, used this already identified partners and established committee members for the in-depth interview. Participants of the interview were selected by making use of purposive sampling based on their level of authority and decision-making power. Office heads, department and unit leaders were intentionally considered. However, there were occasions where convenience sampling was also deployed as there were cases where the higher officials were unavailable for the scheduled interviews due to urgent assignments. In those cases, willing deputies and other senior technical people who have a closely working relations with the park issues were considered for the interview.

4.8.2.3. Focus Group Discussion

Focus group discussions are believed to enable the exploration of information from local communities as it will enable researchers to get the views, opinions and ideas of a community which are usually living as a group (Andrew, 2018; Miles and Huberman, 1984). To identify the Focus Group Discussion participants of this research initially the Kebeles (the smallest administration unit in the country) which are located in and around the park area were identified by making use of park records. Accordingly, a total of 7 rural Kebeles (Table 14) which are located in the two Regional States were identified for having a direct and indirect impact on the park (livestock grazing, fuelwood, grass mowing, etc.) because of their close proximity as well as their adjacent location with the park. In addition to this the town of Arba Minch is also bordering with the park, one of its Kebele sharing an immediate border. Secondly, Kebeles that are adjacent to the park were purposively selected for this research. Finally, the FGD participants for each category (Men, Women and Youth) were selected randomly from each local and indigenous community groups (Kore, Gamo and Guji). The number of FGD participants could range from 7 – 13 (WVI, 2008). In line with this, to attain the participation of the community members in the FGDs, the highest number of FGD participants (13 people) were invited to attend each category of the focus group discussion. However, in many cases all the invited participants did not appear for the discussion. Thus, though the highest number of participants (13 people) was not obtained

in all the groups, the people who showed-up in each group were beyond the minimum required number to conduct the focus group discussion.

Table 14: List of Kebeles located in and around Nech Sar

S.N.	Name of Kebele	Community	Regional Location	Location
1	Ergensa	Guji	Oromia	Inside the park
2	Derbe Menene	Kore	SNNPR	Adjacent to the park
3	Tifetie	Kore	SNNPR	Close proximity to park
4	Yero	Kore	SNNPR	Close proximity to park
5	Alfacho	Kore	SNNPR	Close proximity to park
6	Abulo	Kore	SNNPR	Close proximity to park
7	Ganta Kanchame	Gamo	SNNPR	Close proximity to park
8	Wuha Minch	Gamo	SNNPR	Adjacent to the park

*SNNPR – Southern Nations and Nationalities People's Regional State

Source: park records

As explained in chapter two section 2.6., based on the geographical proximity to the park, cultural set-ups, and language considerations, the focus group participants were grouped in to four clusters. The Guji are residing inside the park and even though they are the smallest in terms of population, they still own the highest number of livestock population (about three-fold of the others) among the other communities (Table 4 and 5 of chapter 2). As a result of this, the researcher decided to increase the number of focus group discussions with the Guji by one-fold as compared to the other indigenous communities (Table 15).

Cognizant of the fact that, the research considers as the views of community may vary on gender and age perspectives, the participants were grouped under men, women and youth categories, with each group comprised of 7 – 13 members. This has enabled to capture the views of the different segments of the community towards the natural capitals of the park.

Table 15: Cluster of the focus group discussion participants

Cluster	Indigenous Community	District	Language
Cluster: 1	Guji	Galan	Oromigna
Cluster: 2	Guji	Galan	Oromigna
Cluster: 3	Gamo	Arba Minch	Gamogna and Amharic
Cluster: 4	Kore	Amaro	Koyira

Hence, representative participants from each community group and categories were randomly selected for the discussions as follows (see Table 16).

Table 16: Number of FGD participants by category

Cluster	FGD Category			
	Male Group	Women Group	Youth Group	Total
Cluster: 1	10	8	12	30
Cluster: 2	7	7	8	22
Cluster: 3	11	11	13	35
Cluster: 4	11	7	7	25
Total	**39**	33	40	112

The Kore communities speak Kore and the Guji also speak Oromigna but, the Gamo can speak Gamogna and are also fluent in Amharic (the national language of the country). Accordingly, to overcome this barrier, the researcher used staff of the Nech Sar park management who belong to these local communities to assist with translation during the implementation of the focus groups discussions and taking notes in Amharic. The discussions were held in each of the locality for an average of 1.5 hours. Accordingly, a total of 12 focus group discussions were held and a total of 112 indigenous community members participated in the FGDs. These discussions were conducted in the local language. The discussions were held in the morning, usually after the participants took their cattle to the open grazing fields. The data collection assistants were given different roles such as one to facilitate the discussion and the other two to take notes in Amharic language while the fourth was observing the process and forwarding probing questions as per the FGD guiding questions (Annex 7). This process helped to minimize any form of missing

information before the completion of the field work. Data was then typed-up in Amharic on a computer right after the completion of the field work since the analysis was conducted on the original Amharic texts and few of the records were transcribed in English (Annex 13)

Although Focus Group Discussion is deemed a viable participatory methodology for the collection of data from local and indigenous people and their communities, it has weaknesses that are rooted in the application of the methodology itself. It is time-consuming and possibly costly when implemented. Mobilizing respondents can be time taking and budget consuming. This will be dependent on the population size and the geographic spread of the areas where the research is to be implemented. Most importantly, due to the participatory nature of the methodology the researcher would need specific facilitation skills to implement the research project successfully. Also due to the closeness of the issues/problems the researcher is investigating, there may be incidence of biasedness on the part of the researcher (Creswell, 2013).

4.8.2.4. Textual Analysis

A desk review of documents relating to the natural capital of parks and protected areas and the factors that caused the degradation of the natural capital was thoroughly conducted. This included Government protected areas strategy and policies, reports and other related documents (Table 17). Content of the aforementioned documents was systematically examined so as to familiarize the researcher with the strategies and their impact on the natural capital of the protected area and human activity that influence the sustainability of the park's resources.

In doing so, the researcher adopted the following process steps developed by Mckee (2003).

1. Select the related topics to the study.
2. When necessary and for the interest of time narrowing the focus of the question to be answered by the text to make it more specific.
3. Listing the texts that are relevant to the topic under discussion.
4. Finding more texts by examining other sources.
5. Populate / gather related texts obtained from the different sources.
6. Trying to get as much sense and views of the topic from the sources.

Textual analysis is a useful method as it allows to discover the focus of institutions and individual, groups and is useful for examining trends and patterns in documents (Kasper *et al*., 2017; Weber, 1990). Textual analysis has also its own share of weaknesses. It can be time consuming and tends to be expensive. This would depend on the size of the research to be conducted and the number of documents to be reviewed. Equally, it tends to neglect new developments of the context under review that happened after the text is produced (Andrew, 2018; Weber, 1990).

Table 17: List of documents used for textual analysis

Name of Document	**Producer of the Document**	**Focus Areas**
Development, Conservation and Utilization of Wildlife Proclamation No. 541/2007	Federal Democratic Republic of Ethiopia Council of Ministers	Protected areas governance arrangements and utilization
Ethiopian Wildlife Development and Conservation Authority Establishment Proclamation No. 575/2008	Federal Democratic Republic of Ethiopia Council of Ministers	Establishment of EWCA
Wildlife Policy and Strategy (2005)	EWCA	Protecting the wildlife resources and their habitats, maintaining the balance of nature in accordance with international wildlife conventions and agreements to which the country is a signatory
Nech Sar National Park visitors flow, and revenue generated (2016)	Nech Sar National Park	Number of visitors, revenue generated from the park, livestock population
Gamo Gofa Zone Culture, Tourism and Communication Affairs Department 2016 annual report	GGZCTC	Tourist flow and income generated

4.8.2.5. Observation

Observation is viewed as a handy research instrument by different researchers (Andrew, 2018; Nickson, 2014). In the case of this research direct observation was carried out by physically observing the ground realities that affect the natural capitals of the park. During the ecological assessment transect walks, the researcher has observed the natural capitals, human activities and took notes and pictures which served as a source of information.

4.8.2.6. Triangulation

Central to a multi-method approach is the concept of triangulation which helps to address the deficiencies in any single technique. Therefore, to ensure that the information collected is comprehensive, well-developed and captures the different dimensions of the findings, data obtained were triangulated by making use of different methods. These strategies involved ground-truthing; examining the consistency of different data sources at different points in time; comparing with different viewpoints and using multiple theoretical perspectives to examine and interpret the data (Cohen, 2006).

4.9. Summary of Data Collection Approaches

A range of ecological assessment methods and qualitative assessment tools were deployed in exploring the current state of the natural capital of the park along with assessing the major human activities which are affecting the natural resources base of the park. The ecological assessment deployed transect lines along with experimental plots which enabled to gather information on the natural regeneration, density and species diversity of the woody vegetation. Experimental plots were also deployed to assess the invasive plants which are affecting the ecosystems of the park. Qualitative data is also collected by making use of focus group discussions, questionnaires and interviews. The following section will discuss the data analysis processes.

4.10. Data Analysis

Patton (2002) mentioned the importance of data analysis in research process as it is a stage whereby data or information is transformed into research findings. These research findings are also the enablers in justifying the assumptions of the research. As this thesis is composed of

quantitative ecological assessments and qualitative studies the data analysis methods are described in the following sub-sections.

4.10.1. Ecological Data Analysis

The ecological data analysis procedures include analyzing data on the natural regeneration status, species diversity and density of the ground water woody vegetation of the park. Data on the ground cover of herbs, prevalence of invasive plant species, water level of Lake Chamo, etc. is also analyzed as follows.

4.10.1.1. Human Interference on Natural Regeneration of Woody Vegetation

Population structure, defined as the distribution of individuals in systematically defined height or diameter classes, provides the size/frequency profile of a species, used to analyse the structure of the population, also can explain the potentials and/or constraints of the future population dynamics of a site (Aklilu, 2013; Kindeya, 2003; Aklilu, 2008).

Hence, examination of the population structures of plants, employing either height or diameter classes, was used to provide an idea about the status of regeneration of woody plants (Kindeya, 2003; Swamy *et al*., 2000 cited in Emiru, 2002; Demel, 1998;). To examine the status of the natural regeneration of trees histograms were constructed by making use of the frequency distribution of diameter classes of the different tree species. Natural forests have trees in all diameter as well as growth stage categories (seedlings, saplings and trees). Their frequency also follows an inverted J-shape distribution.

In line with this, inverted J-shape frequency distribution is an indicator of a healthy regeneration and good recruitment (Van Laar and Akca, 1997, cited in Sarah, 2003). However, if the shape of the histogram does not appear an inverted J and if there are discontinuities in the inverted J shape, it shows that some of the trees that fall in the different diameter classes are missing and hence there will be a gap in maintaining the different natural growth stages of plants from seedlings to saplings and then to matured trees which will produce sufficient amount of seeds that will maintain the natural regeneration potential of trees.

Thus, to assess the regeneration status of woody plants, through examination of their population structures, all individuals encountered in the quadrats were grouped into: (i) height classes: < 0.5 m (seedlings), 0.5 - 3 m (saplings) and > 3 m (trees); and (ii) diameter classes: < 2cm, 2-4, 4-6, 6-8, etc. centimeters (cm). To comprehend the regeneration status of the ground water woody vegetation of the park in general and at a species level for some of the ecologically important species the population structures were constructed using the frequency distribution of diameter classes. Then, histograms were drawn to see the population structure of the major woody plants.

4.10.1.2. Human Interference and Woody Vegetation Species Diversity

Density, defined as the number of individuals of a species per unit area, provides a quantitative estimate of the stocking of the species in an area (Kent and Coker, 1992; Dowdeswell, 1984).

The Importance Value Index (IVI) was calculated as the sum of the relative basal area (%), relative density (%) and relative frequency (%) of each species (Comiskey *et al.,* 2003, Kindeya, 2003; Emiru *et al*., 2002).

$$IVI_i = \left[\frac{B_i}{\sum B_j} x100\right] + \left[\frac{n_i}{\sum n_j} x100\right] + \left[\frac{f_i}{\sum f_j} x100\right] \ldots\ldots\ldots\ldots\ldots (1)$$

Where:

IVI_i = the Importance Value Index (IVI) of the i^{th} species. Thus, species with the highest IVI values are considered ecologically dominant species in a given site

n_i = the number of individuals of the i^{th} species; n_j = the sum of individual trees of all species

B_i = the basal area of the i^{th} species; B_j = the total basal area (m^2) of all specie

f_i = the absolute frequency of the i^{th} species; f_j = the total sum of the absolute frequencies of all species

The basal area of each species was calculated and summed up as: (Kent and Coker, 1992).

$$Basal\ area = \sum \frac{\pi D^2}{4} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where: D = diameter of each tree in the sample

π = 3.14

The diversity values of woody plants in the land management types were calculated using Shannon diversity index (Magurran, 1996).

Shannon diversity index calculated by:

$$H = -\sum pi \ln pi \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where p_i is the proportional abundance of the i^{th} species = $\frac{ni}{N}$; ni = number of individuals or amount (e.g. biomass) of each species (the i^{th} species) and N = total number of individuals (or amount) for the site, and ln = the natural log of the number.

This is the most commonly used index in ecological studies and values range from 0 to 5, usually ranging from 1.5 to 3.5. The method is fairly sensitive to actual site differences, even though there are several instances where H' is similar between sites even though sites are different (Magurran, 1996).

4.10.1.3. Density of Woody Vegetation

Based on the level of human interference the experimental plots were categorized under high (13 plots), less (8 plots) and protected land management types (9 plots). Protected land management is the area of the park that falls under close supervision of the park management as a result of its location to the park's main office and the area is believed to be undisturbed by human interference. Less human interference is part of the park with a bit of human interference, not very far from the main office of the park whereby fuelwood cutting can be practiced sometimes; and high human interference is the part of the park whereby the area is under high human interference due to fuelwood collection, charcoal making and livestock grazing activities can be seen very easily. Then data was analyzed by making use of descriptive statistics on excel and SAS.

One-way ANOVA test was also done by SAS to assess any statistical differences in the density of the woody vegetation across the protected, less human interference and high human interference areas of the park.

4.10.1.4. Ground Cover of Herbs

The collected data was organized based on the level of human interference categories (I. Protected and II. Livestock interfered areas) and the analysis of variance was computed for the two sets of data. This has also enabled the researcher to see the proportion of the ground cover of herbs which is meant to satisfy the feed of the wildlife. The grass species encountered in the transect walks were also identified.

4.10.1.5. Satellite Images

The satellite images were used to see the water level across decades as human interference is affecting the aquatic ecosystems of the park. Images band that fall in the visible and near-infrared wavelength were stacked. The interpretation and extraction (delineation) of the lake change area was made by visually interpreting the conventional false color composite image and by making use of the supervised and unsupervised classification of the images into water and land. Then the boundary, from both supervised and unsupervised classification of the images into water and land, was digitized on-screen and mapped. The satellite image pre-processing and classification was done by using Erdas Imagine while the digitizing, area calculation and final mapping were done using ArcGIS.

4.10.1.6. Invasive Plant Species

The species types and amount of invasive plant species encountered in the experimental plots of the transect walks were identified and an estimation of the area coverage by the invasive species was computed.

4.10.1.7. Fuelwood Extraction and Household Energy Demand

Data on the fuelwood collection was analysed based on gender, timeing and volume of the wood being extracted from the park. For computing the volume, 5 bundles of the 20-30kg, 4 bundles of the 31-40kg and 3 bundles of the 41-50kg are assumed to be a M^3 of fuelwood for each category (Annex 14). On the other hand, 3 individual trees with an average height of 5 meters and basal diameter of 30-40 centimeters are estimated to account for a M^3 of wood. Then the total amount

of wood that comes out of the park on daily basis was computed in terms of number of trees which are being cut for fuelwood consumption.

4.10.2. Data Analysis from Respondents

The qualitative research of the thesis was carried out by deploying multiple techniques as interview, questionnaire, focus group discussions, and textual analysis. Discussions were meant mainly to identify the prominent threats of the park's natural capital.

Based on the context of the objectives and the research questions, the primary information collected through interview, questionnaire and focus group discussion was separately organized and transcribed. The focus group discussion and questionnaire notes were transcribed in Amharic but, the analysis was done in English (Annex 13).

The research utilized thematic analysis approach to assess the governance challenges that affect the natural capitals of the protected area. Moira and Brid (2017:2) defined thematic analysis as "the process of identifying patterns or themes within qualitative data". It is a qualitative analysis method that focuses on what is said rather than focusing on how it was said. Thematic analysis is also focused on what the participants said or what has been written. This is also believed to allow the emergence of key themes from the available data (Andrew, 2018).

The interviews with the officials were held in English and Amharic based on the comfort of the participants and the notes were also transcribed in both English and Amharic. The FGD and questionnaire noted were also transcribed. Then these transcriptions were printed to enable an in-depth familiarization and understanding and initial coding by making use of pencils, pens, coloured markers, pictures, post-it-notes and papers. Due to the volume of data handled for this sub-section, the analysis was done manually. The initial codes were comprised of one word or a phrase which summarize a cluster of quotes that emerged from the focus group discussions, questionnaire and interviews. The codes were also framed into a coding framework by defining each code as well as quotes that echoed the specific thematic areas (Creswell, 2013; Gibbs, 2007) (details in Table 40). Then respondents (individual and group) opinion, view, and perspectives were described.

The analysis also deployed descriptive statistics, namely computation of percentages, categories and average outcomes (Boeije, 2010; Flick *et al*., 2004; Roulston, 2001). Summary of the participants' educational status, gender and their number are presented in the following Table 18 and Figures 24 and 25.

Table 18: Summary and demographic features of participants in the assessment

S.N.	Type of survey instruments	Participants		
		Male	Female	Total
1	Interview	49	9	58
2	Questionnaire	22	6	28
3	Focus Group Discussions	89	33	112

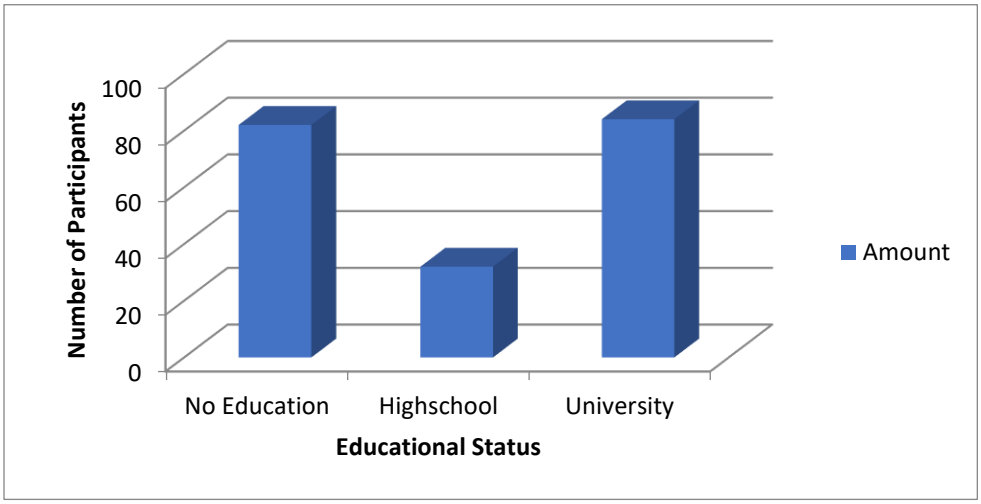


Figure 24: Educational status of qualitative survey participants

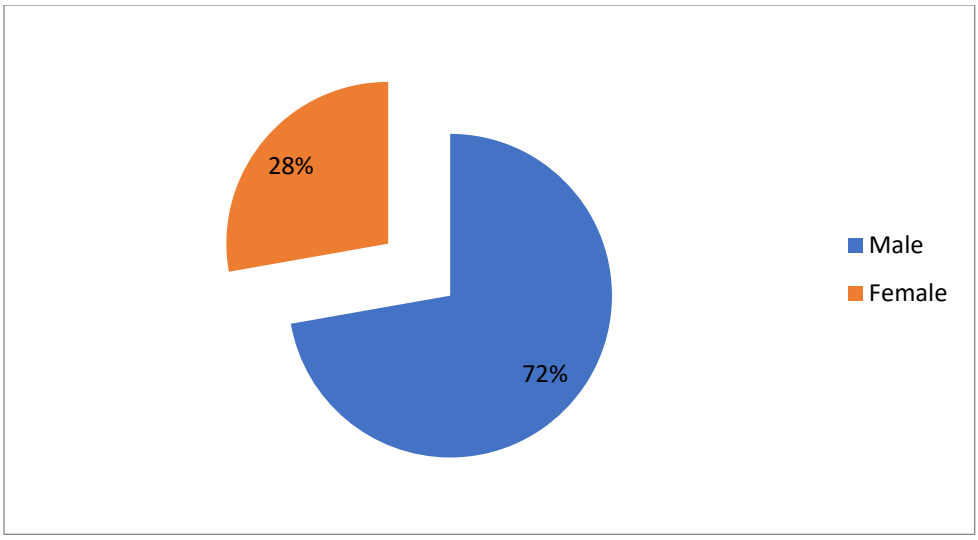


Figure 25: Female to male proportion of qualitative survey participants

As part of the qualitative analysis, different legal and policy documents which are related to the park management were also assessed. Policy, regulation and strategic documents relating to the natural capital of protected areas were examined for their practicality in safeguarding the natural resources of the protected areas and their impact on curving human activities that influence the sustainability of the park's resources.

4.10.2.1. Problems Analysis

Generally, problem analysis is the process of identifying problems, analyzing their magnitude, importance, frequency, causes and effects as a means of understanding the existing situation for development purposes. It is a system which will help to analyze the cause/effect relationships between problems. It is illustrated by a tree, whereby the roots represent the different levels of causes for the problem, the trunk represents the focal problem and the branches and leaves represents the effects of the different levels of problems (Figure 26). Once the focal problems are identified it will be a matter of asking the cause and effect questions as follows - 'what and what factors caused the prevalence of focal problem?' and what are the effects of the different identified causes?

Analyzing problems in this way will help in the understanding of the current context; identify negative factors affecting opportunities, vulnerabilities, capacities and resources; in setting priorities; it facilitates a holistic approach to assessment and it also facilitates the analysis of cross

cutting issues (USAID, 2015; DFID, 2011; WVI, 2007; NORAD, 1999; Wendy *et al*., 2008; SIDA, 2004; Alan, 2000).

Figure 26: Problem analysis tree (WVI, 2007)

Hence, as one of the objectives of the thesis is to identify the major problems that caused the degradation of the park's natural capital, based on the summarized response of the surveys, five prominent problems that caused the degradation of the natural capital were identified from the exhaustive data collection process. According to the problem analysis tools, these problems hereafter are called "the focal problems".

In collaboration with the park authorities a three days local level stakeholders' workshop was organized in February 2017 in the town of Arba Minch for 21 technical expert participants which were selected purposively from the main stakeholders of the park described in the data collection section of this chapter. This includes, different disciplines/institutions (natural resources management, animal production, forestry, fishery, administration, law enforcing offices, agriculture, land-use experts, livestock specialists, etc.). The participants were recruited based on their direct technical roles in park protection and development activities. In this workshop the preliminary findings of the research such as impact of human activity on the natural regeneration of trees, density and diversity were presented by the researcher. In addition to that, findings on the invasive plants expansion and fuelwood extraction were presented.

Then the problem analysis was done by making use of the problem tree analysis steps (Table 19) as follows. Since the participants of the workshop are the technical people who have a good knowledge of the park's challenges, the primary, secondary and tertiary level (as need be) root

causes and their corresponding effects were identified through group level discussions, presentations and validation exercises. In the group discussions, a range of views and opinions were demonstrated, however agreement will be reached after evaluating the individual views at the group level since the voice of the majority will hold the ultimate decision in making the conclussions. Besides, the outcomes of the problem analysis exercise were also validated at the bigger group level presentation where the views of other participants will be incorporated after reaching consensus. The problem analysis trees (Annex 14) were then synthesized and finalized based on the inputs from the group and general discussions held with the workshop participants.

Figure 27: Problem analysis exercise by the workshop participants

Table 19: Tabular presentation of problem analysis steps

Steps	Activities
Step I.	Exhaustive field data collection
Step 2.	Data organization and summary
Step 3.	Identify the focal problems based on the available information (Various problems can be identified and discussed)

Steps	Activities
Step 4.	Limit the scope of the focal problems so as to give it sufficient depth in order to get root causes and concomitant effects which in turn, will enable better project designing
Step 5.	Identify immediate and direct causes of the focal problem (beneath)
Step 6.	Identify immediate and direct effects of the focal problem of the area (parallel above the focal problem)
Step 7.	Construct problem tree showing cause and effect relationship
Step 8.	Review and verify for validity, logical linkage and completeness

4.10.2.2. Ecosystem Services Analysis

Literature presents a range of technical approaches in analyzing the ecosystem services of a given natural resources. This includes the Simple GIS Mapping method which deploys the major GIS software for mapping the services of ecosystems. This system, however, can be used only if a spatial-explicit data / information is available for a given ecosystem service. In the case of Nech Sar, this system is not applicable due to the unavailability of the spatial explicit data on the different services of the ecosystems (Paula, 2017).

There is also an assessment system called production function method which relates the outputs of marketed services and goods with the ecosystem service inputs by making use of econometric approaches (Bateman *et al*., 2011). This system however is in shortfall of providing methods for capturing the views of local and indigenous communities on the different ecosystem services of protected areas.

The Millennium Ecosystem Services (MEA) (MEA, 2005) on the other hand is found out to be an ideal approach to assess and analyze the ecosystem services of Nech Sar since it will give the chance to engage local communities through qualitative data collection and analysis procedures. The views and perceptions of the local communities and stakeholders which was captured through the FGDs, interviews and questionnaire was guided by the MEA framework since it helped to explore the goods and services obtained from ecosystems and develop the linkages

between the different services and human wellbeing by categorizing the ecosystem goods and services into provisioning, supporting, regulating and cultural functions of ecosystems (details to be provided in chapter six).

4.11. Limitation of the Study

The focus of this research is to explore the impact of human activities on the natural capitals of Nech Sar. The research hence has engaged ecological assessments and qualitative studies by engaging the local and indigenous communities who live inside and the vicinities of the park. However, since this study is a self-sponsored research project, there were issues like finance, time, and language constraints which affected the smooth execution of the research as per the below details.

4.11.1. Financial and Time Constraints

The issue of time and financial related challenges are recognized by many researchers since they have a considerable influence on the success of a research. The availability of these resources in an acceptable amount will determine the success and failure of research endeavor since shortages will always lead to reduction in the quality and quantity of the research work. These challenges are usually manifested during data collection stages of a research and can affect the reality of findings (Nickson, 2014).

In the case of this research time was a constraint during the period of data collection. At the stage of ecological data collection mobility from the town of Arba Minch to the interiors of the park and the far end of the grassland was almost nearly impossible at some instances as a result of the prevalence of unusual heavy rainfall. There were occasions where the vehicle was stuck in the muddy roads and substantial amount of time and financial resource were wasted. To overcome this challenge of mobility to the far grassland landscape, boat transport which crisscrossed the lake Chamo was utilised. There were also travelling, and accommodation related financial constraints where the researcher had to find alternative support from family members.

These factors on occasions affected scheduled interview sessions with the government officials. On several occasions governmental officials have to postpone planned interviews due emergency meetings. This was particularly challenging as most the office heads were engaged in planned and

unplanned meetings and missions with external visitors whose meetings will usually go over the time that was allocated to them initially. To overcome this, the researcher had to follow-up with them to reschedule the meetings for later that day or another day.

4.11.2. Language

Communicating with respondents whose language is not the language that is being used by the researcher can be a challenging experience (Temple and Young (2004). Language barrier could be a challenge when conducting qualitative research. This was particularly true when the researcher had to execute the focus group discussions with the indigenous communities who have their own language which is not familiar with the researcher as the case might be in Guji and Kore communities as discussed in the focus group discussion section of this chapter. Thus, to overcome this challenge, the researcher used translaters who belong to the Nech Sar park management.

4.11.3. Cultural Sensitivities

The indigenous communities of the Guji and Kore have their own cultural ways of community engagement and meeting arrangements. For instance, in the context of the Guji, it is uncommon for the elderly men to sit with women and conduct meetings or engage in discussions. In meetings or discussions, women will not usually speak in the presence of men as they will be blamed for being "talkative". The same is true with the youth since culturally they do not go to public discussions with the elderly men. To overcome this challenge, the focus group discussions were organised for the men, women and youth groups in separate settings. The researcher was encouraged by the high level of participation and enthusiasm displayed by the groups during the focus group discussions.

4.12. Summary of Section Two

The section started by discussing the research paradigm utilised by the researcher during the implementation of the research. On the issues of the research design it discusses the main elements of the research including sampling measures and procedures that responded to the

research questions and how it helped to enhance the validation and reliability of the research findings.

The study employs a range of methodology including a range of ecological assessments, review of documents, interviews, focus group discussions, observations and others to collect and analyze data on issues pertaining to the impact of human interference on the natural capital of the Nech Sar National Park. This section of the research also assessed the applicability of the various research methods in the context of this research by highlighting the strengths and weaknesses of the different methodologies.

It also highlighted the ethical considerations through which the study is implemented and the importance of adhering to these ethical considerations throughout the implementation of the research process. The assurance of anonymity both in the design of the interview, focus group discussions and the other methodologies administered ensured responses were given by respondents without any influence of anxiety and distress.

In conclusion, this section of the research highlighted the limitations of the research as time and financial constraints, languages, cultural sensitivities in terms of how these issues affected the overall outcomes of the study and the measures implemented by the researcher to reduce the impact of these constraints on the outcomes of the research.

4.13. Chapter Summary

This chapter presented the methodology of the research. It discussed the four different elements of the conceptual framework of the research and the strategies to be implemented to operationalize the conceptual framework.

In line with the research questions and objectives of the thesis, the chapter highlighted the research paradigm, research design, and utilization of case study as a methodological approach, sampling procedures, ethical considerations, data collection and analysis techniques. Hence, quantitative data on the current state of the natural capitals of the park (forest, grassland, and aquatic ecosystems) were collected and analyzed.

Qualitative information was also collected from the indigenous communities, park authority and other stakeholders' staff by the utilization of focus group discussions, interview and questionnaires. The chapter concludes by highlighting the limitations to the research.

The following chapters will present the findings of the research.

Chapter 5 - Status and Prospects of Natural Capitals in Nech Sar National Park

This chapter is divided in two sections. Section one deals with analyzing the status of the natural capitals of the park with a major focus on the impact of human activities on the woody vegetation natural regeneration, species composition and density. The section also assesses the proportion on the ground cover of herbs, type and proportion of invasive plants as well as the impact of human activities on the aquatic ecosystems of the park.

Section two of chapter five explores the impact of household energy demand on the ground water vegetation of the park. It assesses the proportion of fuelwood being collected from the park, major sources of household energy supply in the study site and the type of trees used for fuelwood by the local community.

This section one and two responds to specific objective one and research questions one and two (Table 20). In addition to these, chapter five forms stage one and two of the conceptual framework of this research which mainly focusses on assessing the state of the natural capitals of the park with a major focus on forest, grassland and aquatic ecosystems and identify the impact of human activities on the natural capital of the park.

Table 20: Relationships between sections of chapter five and objectives and questions

Sections	Objectives	Questions
Section one and two	1) To undertake a systematic analysis of the state of natural capital in the park with a major focus on forest, grassland and aquatic ecosystems.	1) In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems? 2) what are the human induced threats that impact the natural capital and governance of the park?

5.1. Section One - State of the Natural Capitals

Diverse topography, its location in the Rift Valley region and highlands along with the surrounding lowlands have given Ethiopia a wide range of ecosystems which harbor a considerable number of endemic plants and animal species (EBI, 2016; EFAP, 1994; Demel, 1999). The country, however, has a limited achievement in protecting its biodiversity potential owing to the rigorous human activities on many of its protected areas including Nech Sar National Park (Asebe, 2012).

The results discussed in this chapter are computed from quantitative data obtained from the ecological surveys as well as from interviews, quesionnaire and focus group discussions respondents to capture their perceptions, views and experiences within and around the park. Tables, pictures, graphs, bars and statistical tests are also used to visualize the findings of the study.

5.1.1. Composition and Important Value Index of the Woody Species

The data from the field study shows that, the Ground Water Woody Vegetation of Nech Sar National Park consists a total of 28 woody plant species in the different land management practices as shown in Table 21 below. Of the total tree species six are being used as a medicinal plant (to be discussed in chapter six).

Table 21: List of tree species in the Ground-water Vegetation of Nech Sar national Park

No.	Tree Species	No.	Tree Species
1	*Acacia albida*	15	*Mimusops kummel*
2	*Acacia mellifera*	16	*Lonchocarpus laxiflorus*
3	*Acacia tortilis*	17	*Maytenus undata*
4	*Balanites aegyptiaca*	18	*Papia capensis*
5	*Celtis Africana*	19	*Prunus Africana*
6	*Celtis zenkeri*	20	*Rhus natalysis*
7	*Coffea arabica*	21	*Sclerocarya birrea*
8	*Cordia mixa*	22	*Syzygium guineense*
9	*Croton macrostachyus*	23	*Tamarindus indica*
10	*Euclea divinorum*	24	*Teclea nobilis*
11	*Euphorbia tirucalli*	25	*Trichilia dregeana*
12	*Ficus sycomorus*	26	*Ximenia Africana*
13	*Grewia bicolor*	27	*Ziziphus mucronate*
14	*Kigelia Africana*	28	*Ziziphus spina-christi*

In order to examine the impact of human activities on the composition and structure of the trees, the researcher divided the site in to three management categories. This includes (a) the protected, (b) less human activity and (c) high human activity zones. In reference to chapter four of the methodology section, these categories were defined based on the level and magnitude of human activities in the site. Thus, protected is the area of the park where there is no human induced threat that affects the woody vegetation while the less and high human activity are areas of the park that are being affected at varying levels of the local communities' human activities such as cutting of trees for fuelwood and cattle grazing. As discussed in the methodology (data analysis section) Important Value Index (IVI) is one of the approaches which the researcher agreed to use to identify the dominance and composition of trees across the different management categories listed above.

Figure 28: Partial view of the protected (left) and human interference (right) areas of the vegetation (Photo by researcher - 2016)

Species with the highest Important Value Index (IVI) are referred to as the most dominant / important at a specific site (Comiskey *et al.,* 2003). Hence, the figure below shows the composition and structure of matured trees in the protected area of the ground water vegetation of the park.

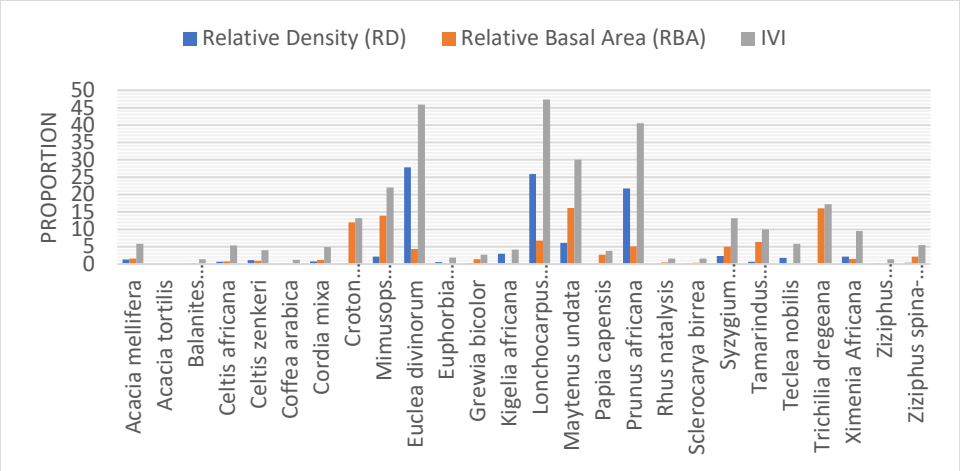


Figure 29: Composition and structure of matured trees in the protected area

From the above figure, *Lonchocarpus laxiflorus, Euclea divinorum, Prunus Africana, Maytenus undata* and *Mimusops kummel* are the most dominant tree species in terms of order in the protected zone of the park since they possess the highest IVI values as compared to other trees found in the protected zone of the park (Figure 29 and 30). It is important to note that this protected management category of the park is undisturbed by human activities. Observation of the Nech Sar park vegetation also shows that, these trees are indigenous to the park since they seem to be well established in the woody vegetation ecosystem of the park.

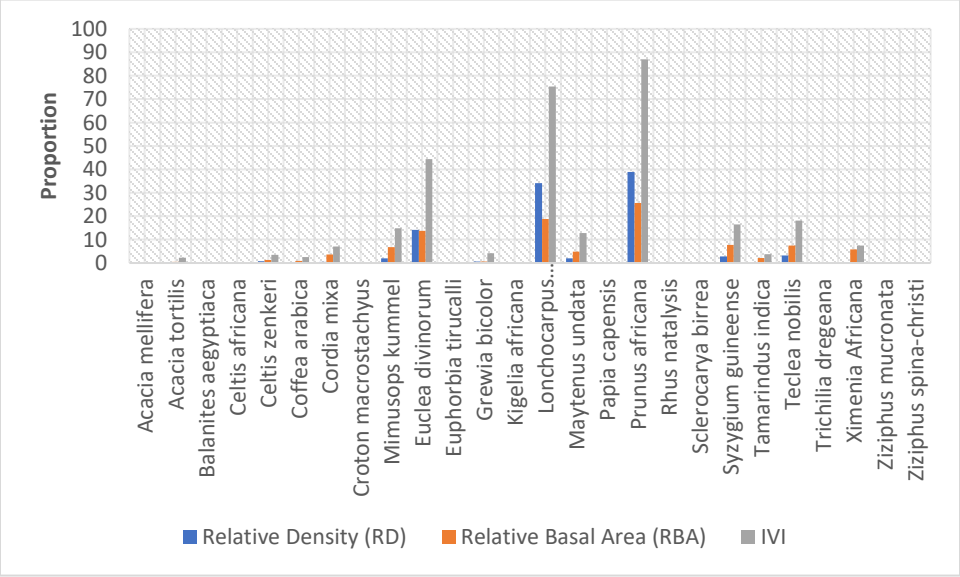


Figure 30: Composition and structure of saplings in the protected area

The above figure (30) on the composition and structure of saplings in the protected management category also shows that *Prunus africana*, *Lonchocarpus laxiflorus,* and *Euclea divinorum* are the dominant tree species. The presence of a significant number of saplings in this area of the park is an attribute of the presence of seed-bearing matured trees. This category of the park is undisturbed by human activities such as cutting of trees for fuelwood which in turn favored the germination of seeds, growth of seedlings and maintenance of the natural regeneration of trees in the site.

Due to the absence of human induced threats in this protected land management category of the woody vegetation of the park, a total of 27 tree species are also observed. This number is the highest species composition as compared to the less and high human activity areas of the park.

The below figure shows vegetation structure in the less-human activity management category of the site.

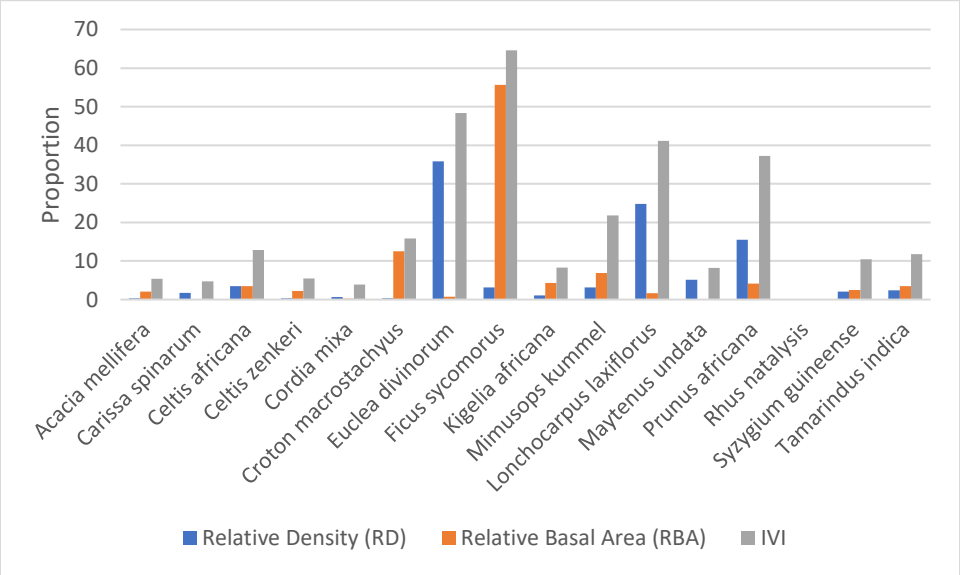


Figure 31: Composition and structure of matured trees in the less-human interference area

In the less human activity areas of the vegetation, *Ficus sycomorus, Euclea divinorum, Lonchocarpus laxiflorus* and *Prunus Africana* are dominant trees in terms of order (Figure 31). The composition and structure of trees in this category is partially different than the protected category since

there exists a certain level of human activity as a result of fuelwood collection. Even though, *Ficus sycomorus* has the lowest density in the site (only two trees) since it has the highest basal area (a tree measures up to 2 meters) it is the additional dominant species which is found in this category.

The below figure also explains the composition and structure of saplings in the less-human activity category of the site.

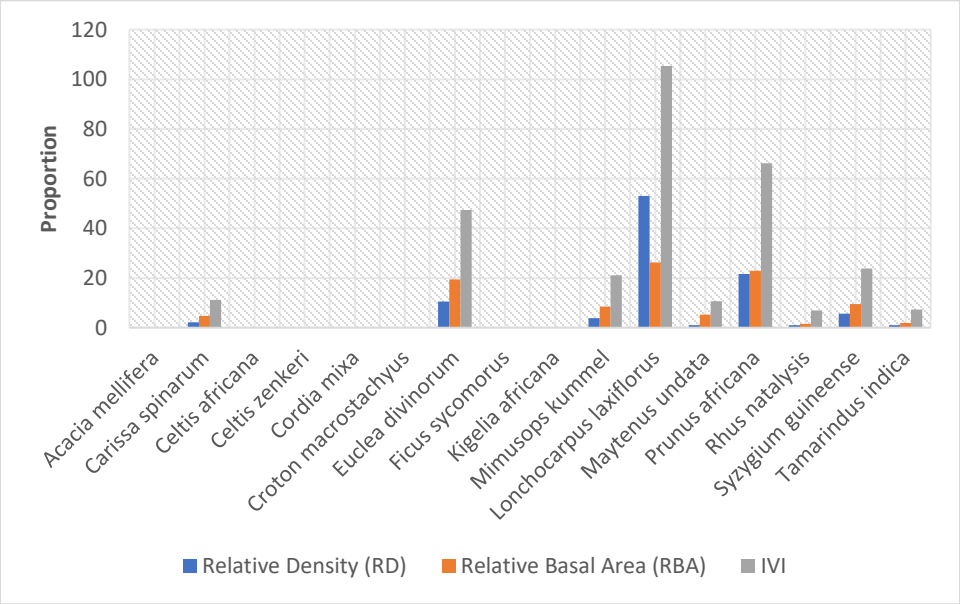


Figure 32: Composition and structure of saplings in the less-human activity area

From the above figure 32, *Lonchocarpus laxiflorus, Prunus Africana, Euclea divinorum* and *Syzgium guineense* are the most dominant sapling tree species. In this land management category of the vegetation the other tree species have exhibited a significant absence of saplings since the area is facing human activities such as cutting of trees for fuelwood. This phenomenon will have a direct impact on the natural growth and regeneration of trees from seedlings to saplings and from saplings to matured trees.

The below figures show the composition and structure of trees and saplings in the high human activity management category of the site.

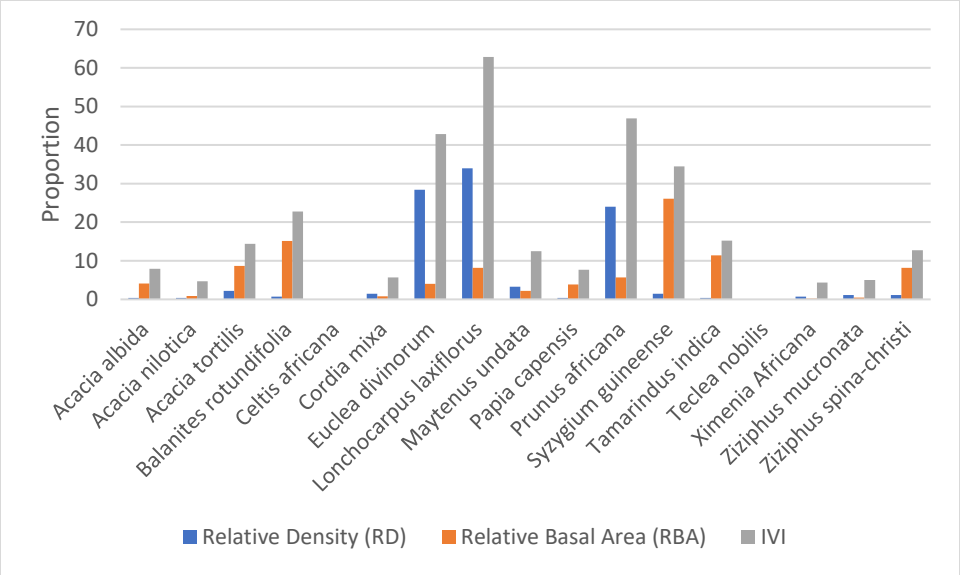


Figure 33: Composition and structure of matured trees in the high-human activity area

In the high human activity areas of the park *Lonchocarpus laxiflorus, Prunus Africana, Euclea divinorum,* and *Syzygium guineense* are the most dominant species (Figure 33 and 34).

The below figure (34) also explains the composition and structure of saplings in the high human interference category of the site. In terms of a healthy composition and amount among the different stages of plants (seedling, sapling and matured tree) the population structure is supposed to exhibit an inverted "J" structure (to be further discussed in the natural regeneration section).

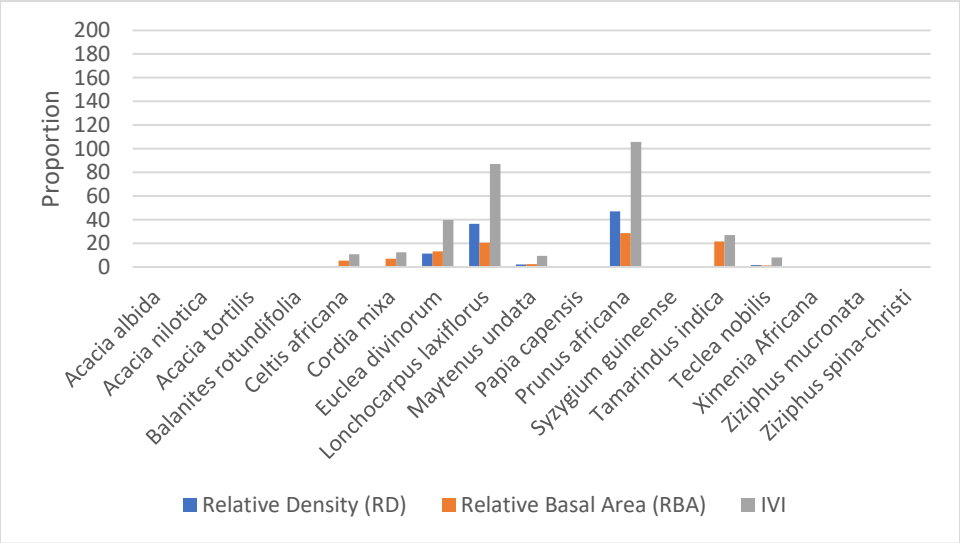


Figure 34: Composition and structure of saplings in the high-human interference area

Prunus Africana, Lonchocarpus laxiflorus, and Euclea divinorum are the dominant species in the high human interference category of the site. Owing to the rigorous fuelwood collection and livestock pressure, the above figures (Figure 33 and 34) also show that the majority of sapling tree species in the high human activity category are absent in the site.

In summary, from this section it is possible to witness that human interference is causing to have variations in terms of species composition among mature trees and saplings across the different management categories. In the protected category of the site, similarity in the presence of mature trees and saplings was observed since that section of the park is undisturbed by human activities. In the less and high human activity areas of the vegetation, a significant number of sapling species are absent from the site. For instance, 9 sapling species of the 17 matured tree species are absent in the high human interference areas of the park. This situation will impact the natural regeneration potential of trees in the area and may also cause for species extinction if the ongoing human activities remain unabated. Thus, the results in the different management categories (explained in the above figures) have showed that human activity is having a great impact on the composition of the species diversity as one moves from the edge of the park to the interiors where there is a better protection activity by the park authorities.

5.1.1.1 Population Structure of the Woody Vegetation

As a result of the ongoing human reliance on the woody vegetation of the park in satisfying the household energy demand for the town of Arba Minch and surrounding areas, the population structure of the park's woody vegetation showed a considerable variation among the different land management types. Accordingly, in the protected area there exists large number of seedlings (< 2 centimeters diameter) (Figure 35). There was also a steady decrease in the amount of plant population right after the <2 centimeters diameter class. As compared to other categories a significant number of matured trees were found in the protected area (Figure 35). In this land management type, the biggest diameter value was obtained from *Croton macrostachyus* (199 centimeters). As can be seen from Figure 35, this portion of the vegetation is going through a healthy natural regeneration since the area exhibits a proper protection as compared to the other management categories of the park. Even though, the population structure of the protected area shows a healthy regeneration status, when compared with the less human interference area, the relatively smaller number of seedlings could be associated with the shortage of sunlight that

reaches the ground. This is mainly caused by the existence of big trees which can go beyond 20 meters of height and create a closed canopy that inhibits sunlight from reaching the ground and facilitate the germination of seeds.

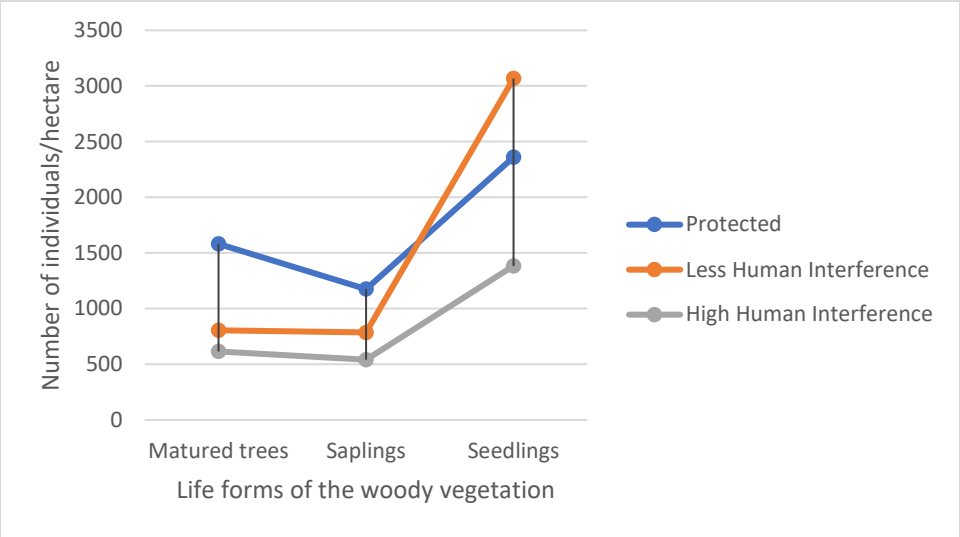


Figure 35: Summary of the population structure for the different life forms of all woody species

In the less human interference area of the vegetation there were also significant numbers of seedlings, however, in this part of the park human interference is affecting the existence of saplings and matured trees which are meant to maintain the natural regeneration and succession of species in the park (Figure 35).

The composition and population structure of trees for the protected, less and human activity categories of the ground water woody vegetation of the park are presented in the following Tables 22 - 24.

Table 22: Population structure of mature trees and saplings in Nech Sar National Park (Protected)

Trees								Saplings						
Type of tree	D/Ha	F	BA	RD	RBA	RF	IVI	D/Ha	F	BA	RD	RBA	RF	IVI
Acacia mellifera	20.6	3	4171.3	1.3	1.6	2.9	5.9	0.0	0	0.0	0.0	0.0	0.0	0.0
Lonchocarpus laxiflorus	408.8	15	17517.6	25.9	6.8	14.7	47.3	401.5	15	434.6	34.2	18.9	22.4	75.4
Euclea divinorum	439.7	14	11247.2	27.8	4.3	13.7	45.9	166.2	11	316.4	14.1	13.7	16.4	44.3
Prunus Africana	344.1	14	13093.4	21.8	5.1	13.7	40.6	457.4	15	591.1	38.9	25.7	22.4	87.0
Maytenus undata	97.1	8	41645.1	6.1	16.1	7.8	30.1	23.5	4	112.1	2.0	4.9	6.0	12.8
Mimusops kummel	26.5	5	35847.2	1.7	13.9	4.9	20.4	19.1	3	107.3	1.6	4.7	4.5	10.8
Trichilia dregeana	2.9	1	41526.5	0.2	16.1	1.0	17.2	0.0	0	0.0	0.0	0.0	0.0	0.0
Croton macrostachyus	2.9	1	31086.8	0.2	12.0	1.0	13.2	0.0	0	0.0	0.0	0.0	0.0	0.0
Syzygium guineense	36.8	6	12809.8	2.3	5.0	5.9	13.2	32.4	4	177.7	2.8	7.7	6.0	16.4
Tamarindus indica	10.3	3	16546.6	0.7	6.4	2.9	10.0	1.5	1	50.2	0.1	2.2	1.5	3.8
Ximenia Africana	33.8	6	3808.2	2.1	1.5	5.9	9.5	2.9	1	132.7	0.3	5.8	1.5	7.5
Teclea nobilis	27.9	4	408.8	1.8	0.2	3.9	5.8	38.2	5	171.6	3.3	7.5	7.5	18.2
Ziziphus spina-christi	5.9	3	5597.8	0.4	2.2	2.9	5.5	0.0	0	0.0	0.0	0.0	0.0	0.0
Celtis Africana	10.3	4	2009.9	0.7	0.8	3.9	5.3	0.0	0	0.0	0.0	0.0	0.0	0.0
Cordia mixa	11.8	3	3161.3	0.7	1.2	2.9	4.9	5.9	2	83.2	0.5	3.6	3.0	7.1

Trees								Saplings						
Type of tree	D/Ha	F	BA	RD	RBA	RF	IVI	D/Ha	F	BA	RD	RBA	RF	IVI
Kigelia Africana	47.1	1	538.3	3.0	0.2	1.0	4.2	0.0	0	0.0	0.0	0.0	0.0	0.0
Celtis zenkeri	17.6	2	2438.2	1.1	0.9	2.0	4.0	8.8	1	29.9	0.8	1.3	1.5	3.5
Papia capensis	1.5	1	6936.3	0.1	2.7	1.0	3.8	0.0	0	0.0	0.0	0.0	0.0	0.0
Grewia bicolor	4.4	1	3629.8	0.3	1.4	1.0	2.7	7.4	2	13.6	0.6	0.6	3.0	4.2
Euphorbia tirucalli	8.8	1	795.5	0.6	0.3	1.0	1.8	0.0	0	0.0	0.0	0.0	0.0	0.0
Rhus natalysis	2.9	1	1194.0	0.2	0.5	1.0	1.6	0.0	0	0.0	0.0	0.0	0.0	0.0
Sclerocarya birrea	2.9	1	1045.8	0.2	0.4	1.0	1.6	0.0	0	0.0	0.0	0.0	0.0	0.0
Mimusops kummel	7.4	1	277.5	0.5	0.1	1.0	1.6	4.4	1	50.2	0.4	2.2	1.5	4.0
Balanites aegyptiaca	1.5	1	854.9	0.1	0.3	1.0	1.4	0.0	0	0.0	0.0	0.0	0.0	0.0
Ziziphus mucronate	4.4	1	346.2	0.3	0.1	1.0	1.4	0.0	0	0.0	0.0	0.0	0.0	0.0
Coffea arabica	2.9	1	153.9	0.2	0.1	1.0	1.2	2.9	1	19.6	0.3	0.9	1.5	2.6
Acacia tortilis	0.0	0	0.0	0.0	0.0	0.0	0.0	2.9	1	12.6	0.3	0.5	1.5	2.3
Total	1580.9	102.0	258688.0	100.0	100.0	100.0	300.0	1175.0	67.0	2302.9	100.0	100.0	100.0	300.0

N.B: No/ha =Density; BA= Basal Area (cm); F= Frequency; RD= Relative Density; RBA= Relative Basal Area; RF= Relative Frequency and IVI= Importance Value Index.

Table 23: Population structure of mature trees and saplings in Nech Sar National Park (Low Human Activity)

Trees								Saplings						
Type of tree	D/Ha	F	BA	RD	RBA	RF	IVI	D/Ha	F	BD	RD	RBA	RF	IVI
Ficus sycomorus	25.0	2	218352.1	3.1	55.7	5.9	64.6	0.0	0	0.0	0.0	0.0	0.0	0.0
Euclea divinorum	288.9	4	2879.4	35.9	0.7	11.8	48.4	83.3	4	129.7	10.6	19.4	17.4	47.4
Lonchocarpus laxiflorus	200.0	5	6411.6	24.8	1.6	14.7	41.2	416.7	6	175.0	53.0	26.2	26.1	105.3
Prunus Africana	125.0	6	16111.0	15.5	4.1	17.6	37.3	169.4	5	153.1	21.6	22.9	21.7	66.2
Mimusops kummel	25.0	4	27067.9	3.1	6.9	11.8	21.8	30.6	2	56.9	3.9	8.5	8.7	21.1
Croton macrostachyus	2.8	1	49062.5	0.3	12.5	2.9	15.8	0.0	0	0.0	0.0	0.0	0.0	0.0
Celtis Africana	27.8	2	13782.2	3.4	3.5	5.9	12.8	0.0	0	0.0	0.0	0.0	0.0	0.0
Tamarindus indica	19.4	2	13750.9	2.4	3.5	5.9	11.8	8.3	1	12.6	1.1	1.9	4.3	7.3
Syzygium guineense	16.7	2	9678.3	2.1	2.5	5.9	10.4	44.4	2	63.1	5.7	9.5	8.7	23.8
Kigelia Africana	8.3	1	16886.2	1.0	4.3	2.9	8.3	0.0	0	0.0	0.0	0.0	0.0	0.0
Maytenus undata	41.7	1	403.3	5.2	0.1	2.9	8.2	8.3	1	34.9	1.1	5.2	4.3	10.6
Celtis zenkeri	2.8	1	8654.6	0.3	2.2	2.9	5.5	0.0	0	0.0	0.0	0.0	0.0	0.0
Acacia mellifera	2.8	1	8167.1	0.3	2.1	2.9	5.4	0.0	0	0.0	0.0	0.0	0.0	0.0
Carissa spinarum	13.9	1	186.2	1.7	0.0	2.9	4.7	16.7	1	31.5	2.1	4.7	4.3	11.2
Cordia mixa	5.6	1	881.0	0.7	0.2	2.9	3.9	0.0	0	0.0	0.0	0.0	0.0	0.0
Rhus natalysis	0.0	0	0.0	0.0	0.0	0.0	0.0	8.3	1	10.6	1.1	1.6	4.3	7.0
Total	805.6	34.0	392274.5	100.0	100.0	100.0	300.0	786.1	23.0	667.4	100.0	100.0	100.0	300.0

N.B: No/ha =Density; BA= Basal Area (cm); F= Frequency; RD= Relative Density; RBA= Relative Basal Area; RF= Relative Frequency and IVI= Importance Value Index.

Table 24: Population structure of mature trees and saplings in Nech Sar National Park (High Human Activity)

Trees								Saplings						
Species	D/Ha	F	BA	RD	RBA	RF	IVI	D/Ha	F	BA	RD	RBA	RF	IVI
Acacia albida	2.3	1	4069.4	0.4	4.1	3.4	7.9	0	0	0	0.0	0.0	0	0.0
Lonchocarpus laxiflorus	209.1	6	8114.2	33.9	8.2	20.7	62.9	197.7	6	191.3	36.6	20.6	30	87.2
Prunus Africana	147.7	5	5654.3	24.0	5.7	17.2	46.9	254.5	6	265.2	47.1	28.6	30	105.6
Euclea divinorum	175.0	3	4000.5	28.4	4.0	10.3	42.8	61.4	3	122.9	11.3	13.2	15	39.6
Syzygium guineense	9.1	2	25815.7	1.5	26.1	6.9	34.5	0.0	0	0.0	0.0	0.0	0	0.0
Balanites rotundifolia	4.5	2	14972.3	0.7	15.2	6.9	22.8	0	0	0	0.0	0.0	0	0.0
Tamarindus indica	2.3	1	11304.0	0.4	11.4	3.4	15.3	2.3	1	201.0	0.4	21.7	5	27.1
Acacia tortilis	13.6	1	8599.8	2.2	8.7	3.4	14.4	0	0	0	0.0	0.0	0	0.0
Ziziphus spina-christi	6.8	1	8060.7	1.1	8.2	3.4	12.7	0	0	0	0.0	0.0	0	0.0
Maytenus undata	20.5	2	2203.6	3.3	2.2	6.9	12.4	11.4	1	21.2	2.1	2.3	5	9.4
Papia capensis	2.3	1	3799.4	0.4	3.8	3.4	7.7	0.0	0	0.0	0.0	0.0	0	0.0
Cordia mixa	9.1	1	742.3	1.5	0.8	3.4	5.7	2.3	1	63.6	0.4	6.9	5	12.3
Ziziphus mucronate	6.8	1	427.4	1.1	0.4	3.4	5.0	0	0	0	0.0	0.0	0	0.0
Acacia nilotica	2.3	1	854.9	0.4	0.9	3.4	4.7	0	0	0	0.0	0.0	0	0.0
Ximenia Africana	4.5	1	188.6	0.7	0.2	3.4	4.4	0	0	0	0.0	0.0	0	0.0
Celtis Africana	0.0	0	0.0	0.0	0.0	0.0	0.0	2.3	1	50.2	0.4	5.4	5	10.8
Teclea nobilis	0.0	0	0.0	0.0	0.0	0.0	0.0	9.1	1	12.6	1.7	1.4	5	8.0
Total	616	29	98807	100	100	100	300	541	20	928	100	100	100	300

N.B: No/ha =Density; BA= Basal Area (cm); F= Frequency; RD= Relative Density; RBA= Relative Basal Area; RF= Relative Frequency and IVI= Importance Value Index.

In reference to the above tables (Table 22 – 24), in the high human activity areas of the vegetation, one can clearly see the negative and deleterious impacts of human activity on the general population structure of the park. For instance, in terms of vegetation density *Lonchocarpus laxiflorus* exhibited 409 adult trees per hectare in the protected category (Table 22) while it has 209 trees per hectare in the high human activity areas of the vegetation (Table 24). *Euclea divinorum* showed 440 and 175 trees per hectare in the protected and high human activity areas respectively. Similar patterns were obtained for *Prunus Africana* (344 and 148) and *Maytenus undata* (97 and 21) in the protected and high human activity zones of the vegetation.

Further to this, the impact of human activities on the vegetation can be explained by the complete absence of saplings for many of the tree species such as *Acacia albida, Syzygium guineense, Balanites rotundifolia,* etc. in the case of the high human interference areas of the vegetation (Table 24). Some experimental plots in this management type were found without any woody vegetation. Some of the higher diameter classes of the woody vegetation were also found missing and showed discontinuity in the diameter classes at various ranges indicating as many of the matured trees are being cleared to satisfy the needs of the local communities.

In line with this, the high human activity category of the vegetation also showed a complete absence of *Celtis Africana* and *Teclea nobilis* matured trees from the area (Table 24). This will have a direct impact on the natural regeneration potentials of the vegetation since the seed-bearing plants are being cleared from the ecosystem by the ongoing human activity.

Efforts were made by the researcher to find historical data on the structure of the vegetation so as to compare the trend with the current situation of the park. However, since there has been no research done previously in this aspect, the researcher is not able to present a comparative time trend analysis on the impact of human activities on species composition of the site. Thus, the findings have indicated that human activity is having a negative impact on the continuity of the woody vegetation biodiversity.

5.1.2. Natural Regeneration Status of the Ground Water Woody Vegetation of the Park

The ground water vegetation of the park has a very dense green canopy cover which is dominated by long and matured trees. The vegetation also shares an immediate border with the town of Arba Minch. Based on the findings of the above ecological assessment results, *Lonchocarpus laxiflorus, Euclea divinorum, Prunus Africana, Maytenus undata and Mimusops kummel are* the most dominant trees in the protected areas of the ground water vegetation of Nech Sar National Park as they have exhibited the highest IVI values in the analysis. These major trees will be considered in discussing the status of the natural regeneration potential of the vegetation and the characteristics of these trees is briefly described in the below tables and figures (Table 25 and Figures 36 – 40).

Table 25: Dominant trees of the ground water woody vegetation of NNP

Scientific Name	Characteristics
Lonchocarpus laxiflorus	well known for being one of the sources of fodder for wildlife. It is a tree plant which falls under the Plantae Kingdom, Fabaceae family and Class Angiosperm and a species of legume. It is a plant which can go up to 5-6m of height. The bark of the plant is used as a sauce and spice for human food. Extracts from the bark, root and leaf of the tree are used to treat skin infections, parasitic infections, and liver complications for humans. In the field of agriculture, leaf and bark extracts can help as an insecticide (Burkill, 1995).
Maytenus undata	Can have a height of 5m. It belongs to family Celastraceae and Class Angiosperm. Extracts of the plant are believed to be used as anti-asthmatic, stomach treatment and anti-tumour (Tsholofelo *et al*., 2013).
Mimusops kummel	Can grow up 35m in height. It falls under the family Sapotaceae. Its fruits are edible by humans and animals. The extracts of the plant have medicinal values (Govaerts *et al*., 2003).

Scientific Name	Characteristics
Prunus Africana	It is spiny tree which can go up to 10-25m height. It is an angiosperm which belongs to the *Family Rosaceae* and Kingdom Plantae (Cunningham and Mbenkum, 1993*).* The different parts of the plant have been used for a lot of medicinal values. For instance, the bark can be used to treat chest pains. Extracts of the bark are also used to treat benign prostate hypertrophy (Van Wyk *et al.,* 1997).
Euclea divinorum	The tree can reach up to 6-15m height and it belongs to the family Ebenaceae. Extracts from the bark serve for dyeing skin, hides, wool, fibres, etc. The root extracts known to treat wounds, gastro-intestinal disturbances, cancer, skin infections, headaches, toothaches, arthritis, miscarriage, jaundice, snakebites and gonorrhea (Njuguna, 2005).

To analyze the natural regeneration potential of the ground water woody vegetation of the park data was collected from the protected, less human interference and high human interference categories of the vegetation. The data collection involved the complete inventory of seedlings (< 0.50 m height), saplings (>0.5 – 3m height) and trees (>3m height) (Kindeya, 2003; Emiru *et al*., 2002) in the 20 X 20meter experimental plots (36 plots). The population structure of the major trees across the different human activity gradient levels is analyzed and put forward in the following figures whereby inverted J-shape frequency distribution is an indicator of a healthy regeneration and good recruitment status (Aklilu, 2013; Demel, 2005 and Sarah, 2003).

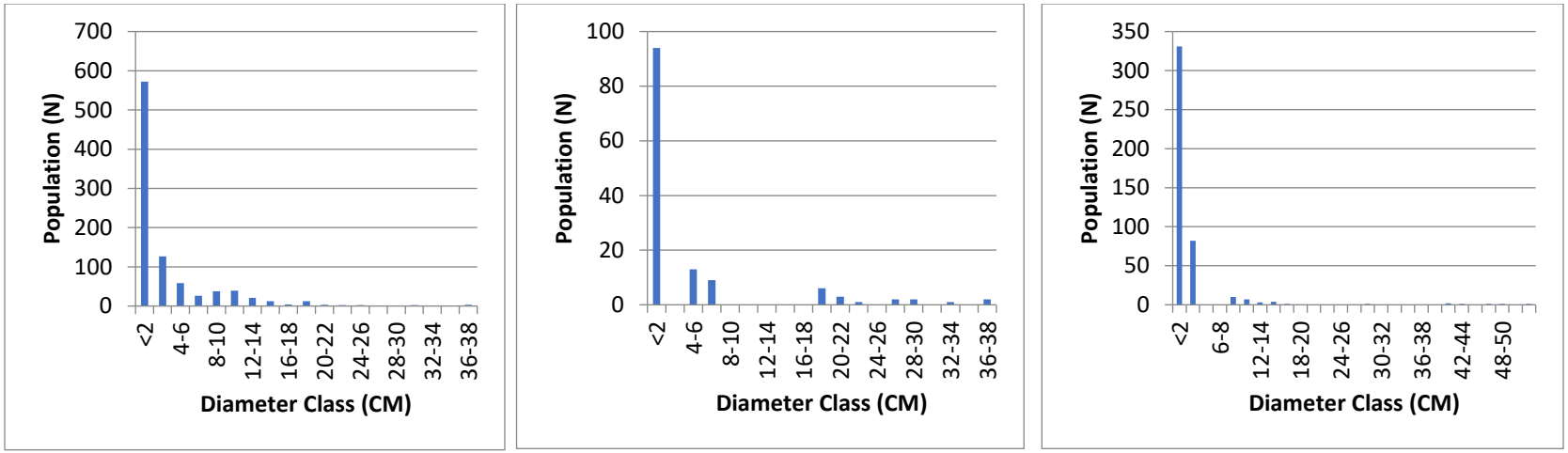


Figure 36: Population structure of *Lonchocarpus laxiflorus* in the protected (left), less interference (middle) and high interreference (right) areas of the park

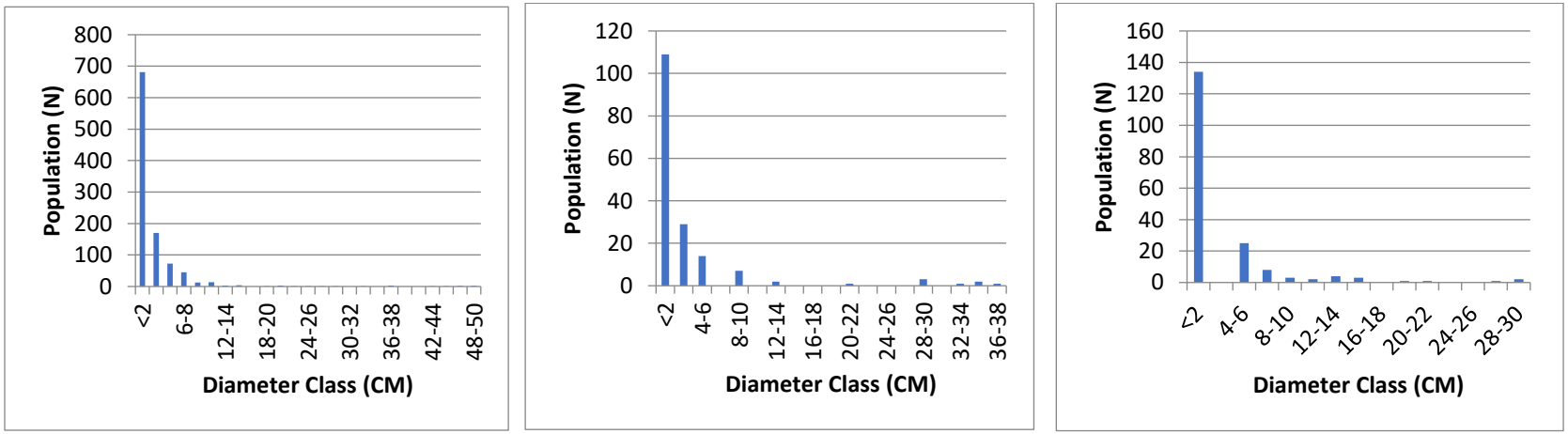


Figure 37: Population structure of *Prunus africana* in the protected (left), less interference (middle) and high interreference (right) areas of the park

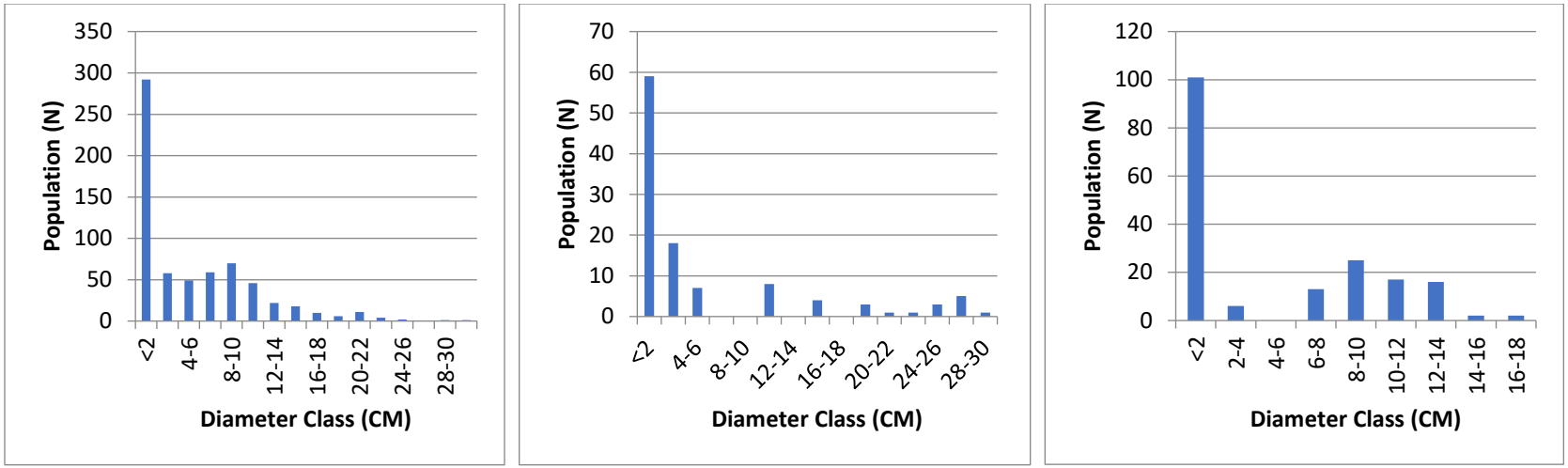


Figure 38: Population structure of *Euclea divinorum* in the protected (left), less interference (middle) and high interreference (right) areas of the park.

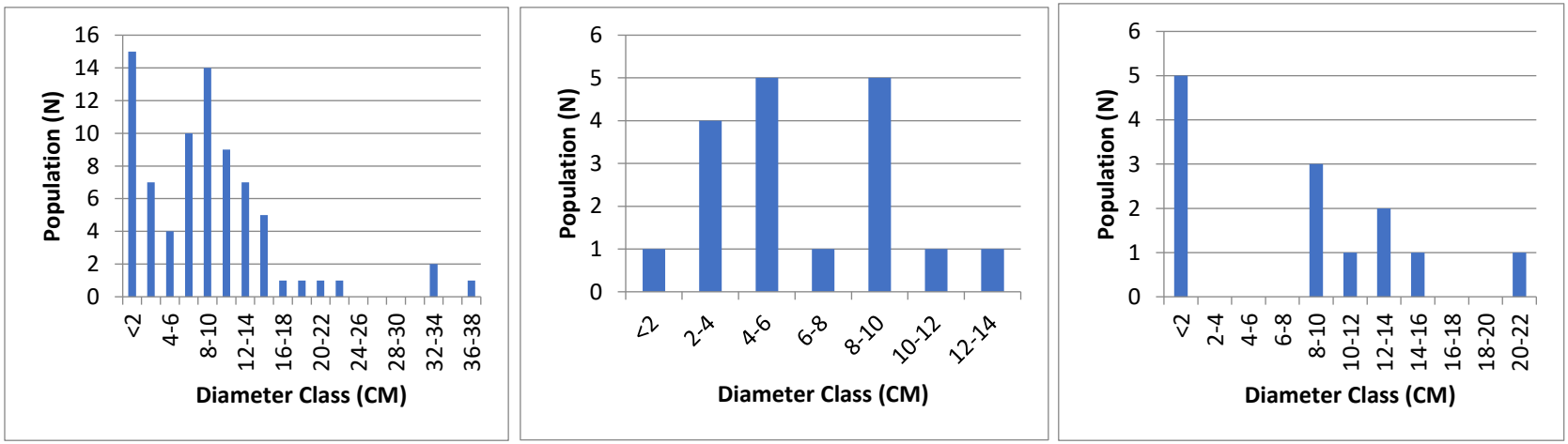


Figure 39: Population structure of *Maytenus undata* in the protected (left), less interference (middle) and high interreference (right) areas of the park

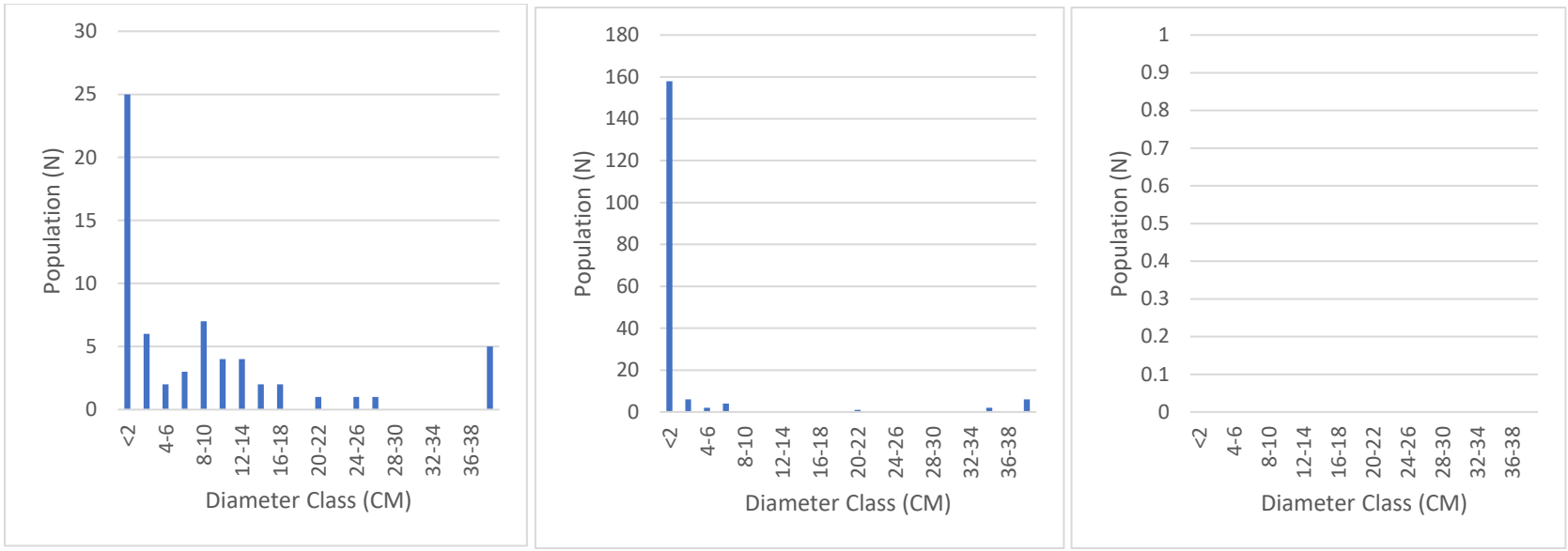


Figure 40: Population structure of Mimusops kummel in the protected (left), less interference (middle) and high interreference (right) areas of the park.

The natural regeneration pattern of trees is dependent on the occurrence of enough number of seedlings, saplings and matured trees (Popradit *et al.*, 2015). In reference to the above Figures 36 - 40 in the protected zone of the research site, the population structure of *Lonchocarpus laxiflorus, Mimusops kummel and Prunus africana* showed an inverted J structure. There exists a considerable number of mature trees in this part of the vegetation as the area is undisturbed by human activities. This phenomenon is an indication of the fact that, these species are in a proper natural regeneration status. *Maytenus undata and Mimusops kummel* (Figures 36 - 40) also exhibited a healthy regeneration status but, with a bit of discontinuity on few of the middle and upper diameter classes which is still fine as there exists a significant number of seed-bearing matured trees. As this area of the park is dominated by mature and long trees, there is a very low probability for sunlight to reach the ground as a result of the closed canopy. Thus, this could have contributed for a lesser number of saplings as enough amount of sunlight is needed for seed germination, growth and development of plants. Since this part of the park is undisturbed by human activity, the area will also be preferred as a habitat for the remaining wild animals, and hence depending on their level of palatability the seedlings and saplings may also be prone to frequent grazing by the wild animals.

In the less human activity area of the vegetation, *Lonchocarpus laxiflorus, Prunus Africana,* and *Mimusops kummel* have a high number of seedlings. In this area, *Lonchocarpus laxiflorus, Euclea divinorum* and *Prunus africana* have a structure which resembled an inverted J population structure with a bit of discontinuities in lower and higher diameter categories which shows as the regeneration potential in this area is being affected by human activity. In the less human activity area, the population structure of trees like *Maytenus undata* indicates their inability to make it up to the higher diameter classes as their case might be in the protected areas of the park. Had it not been the impact of human activities, the regeneration potential of the trees in this category should have showed a similar pattern with the protected area of the vegetation. As compared to the protected areas, in this part of the vegetation, selective cutting of trees is practiced seldomly during the night hours since the park rangers will not be on duty at nights. This indicates that, had it not been institutional capacity issues, the management practices of the park authorities could have also saved this cross section of the park from human activities. The local community's perception assessment on the state of the vegetation also indicated that the community are aware

of the dwindling trend of the vegetation (to be discussed in chapter six). If remedial measures are not taken, since the trees are being cut for fuelwood and other consumptions, the succession potential of the vegetation in this zone of the park will be jeopardized in the near future.

The population structure of the major trees in the high human activity areas of the vegetation had a discontinuous structure across the different diameter classes which showed the trees are not maintaining their natural regeneration (Figure 36 – 40). In this area of the vegetation, there still exists a good number of seedlings, however, these seedlings on later days will be grazed by the livestock and they will also be damaged by the trampling effects of the livestock pressure. As seen from the population structure figures of individual trees (Figures 36 – 40) and the population structure of trees in under each land management groups (Figure 35), in the high human activity zone of the park, one can hardly see matured trees and saplings as the area is going through a silent deforestation trend. These remnant seed bearing matured trees in this area of the park might even have vanished by the time when this report is organized. In the high human activity areas of the park, the population structure of the major trees indicates that none of the tree species are able to make it to the higher diameter classes as it has been observed in the protected and less human activity areas. Apart from this, one of the major trees of the woody vegetation (*Mimusops kummel*) is completely absent in this category of the vegetation (Figure 40). This indicates that, if counteractive measures are not going to be placed, some of the tree species are highly likely to disappear from the park in the very near future since the natural regeneration potential may crack soon because of the ongoing human induced impacts.

Though, it is subject to further discussion in section two of this chapter, in light of the issues discussed above the researcher observed that urban, peri-urban and rural communities of the Arba Minch town area are highly reliant on the woody vegetation of the park for meeting their household energy demand and grazing of livestock. This finding is in line with different reports which estimated that 98% of the household energy demand of Arba Minch city is met from fuelwood that mainly comes from the forest of Nech Sar National Park (Abraham, 2015). Selective cutting of trees for fuelwood, charcoal making, and construction are among the factors affecting the natural regeneration potentials of the woody vegetation of the park (to be further discussed in section two of this chapter).

5.1.3. Impact of Human Activity on Density of the Ground Water Woody Vegetation

Based on physical observation by the researcher and supported by the findings of the analysis on the density of trees in the ground water vegetation, the park is under immense human impact as a result of the dire need for household energy supply.

The density of matured trees in the park was found to be dense in the protected land management areas of the park while the less and high human activity management categories exhibited a very less density of trees. To this effect, in 3 of the experimental plots which have fallen under the high human interference part of the park, there were zero matured trees as well as saplings.

It was found out that the highest number of matured trees, saplings and seedlings are present in the protected area of the vegetation (Table 26). On the other hand, there exists significant reduction on the density of the vegetation as one goes through the less and high human activity categories of the vegetation.

Table 26: Summary of woody vegetation density

Land Management Type	Density of woody vegetation life form (hectare)		
	Mature trees	Saplings	Seedlings
Protected	1,581	1,175	3,067
Less Human Interference	806	786	2,360
High Human Interference	616	541	1,384

The one-way ANOVA on the density of trees for the three human activity gradients showed that there are significant differences on the density of trees, saplings and seedlings across the different land management categories of the park ($P < 0.05$) (Table 27, 28 and 29).

Table 27: ANOVA for density of seedlings

Source	DF	SS	Mean Square	F Value	Pr > F
Model	2	36571258.5	18285629.3	5.19	0.0124
Error	27	95168929.0	3524775.1		
Corrected Total	29	131740187.5			

Table 28: ANOVA for density of saplings

Source	DF	SS	Mean Square	F Value	Pr > F
Model	2	6949750.13	3474875.07	7.12	0.0033
Error	27	13186166.53	488376.54		
Corrected Total	29	20135916.67			

Table 29: ANOVA for density of trees

Source	DF	SS	Mean Square	F Value	Pr > F
Model	2	95610.4287	47805.2143	13.19	0.0001
Error	27	97873.7380	3624.9533		
Corrected Total	29	193484.1667			

In line with this, fuelwood and charcoal are the predominant household energy sources for Arba Minch and other neighboring towns (to be further discussed in section two of this chapter). Many people are also reliant on fuelwood collection and charcoal making as their main stay of livelihoods. As a result of this, while the protected section of the park exhibited the highest density of matured trees, saplings and seedlings since this cross section of the vegetation is being protected from human interference by the park authorities, the others (less and high human interference) categories showed a decreased pattern of vegetation density as a result of the areas close proximity to the community (Arba Minch town).

5.1.4. Status of the Woody Vegetation Species Diversity

To examine the impact of human activity on the species diversity of the woody vegetation the Shannon Diversity Index was calculated for the different management categories.

According to the results of the Index, the highest species diversity of matured trees was obtained in the protected areas of the park (1.76) followed by the less and high human activities management categories (1.14 and 1.10 respectively). Also, the highest species diversity in the saplings and seedlings was again found in the protected category (Table 30). The results confirm that, the protected zone of the vegetation holds diverse species than the human interference areas of the park. In the protected management category of the park a total of 27 species were encountered while 18 (two at seedling stage) and 17 were found in the less human interference and high human interference areas respectively. This is a direct indicator as there is a high human interference that presently affects the natural vegetation species diversity of the park. If human

activity has not affected the species diversity, the values in the less and high human interference areas should have been similar with the values obtained from the protected areas of the park.

Table 30: Shannon diversity index values of Nech Sar's ground-water woody vegetation by management type

Management type	Index values per lifeforms of the vegetation		
	Mature Trees	Saplings	Seedlings
Protected	1.76	1.47	1.36
Less human interference	1.14	1.09	1.10
High human interference	1.10	0.92	0.95

From Table 30 one can infer that the species diversity of the protected areas is better than the less and high human interference areas. The protected area of the woody vegetation not only has the highest number of species composition, but the species are also distributed in a more equitable pattern. Hence, in the woody vegetation of Nech Sar, the different levels of disturbance gradients have a direct effect on the species composition. Therefore, knowledge on the impact of different management strategies will serve as a valuable tool in protecting the biodiversity of the park as the existence of these different species will also have its own direct effect on the existence of other resources like the wildlife which depends on the vegetation for their own natural preference in terms of getting their feed as well as habitat preferences.

Thus, data on the state of the vegetation showed that, in parts of the park where the park authorities are able to do the protection works, the forest resources are conserved well and hence showed a healthy growth. This also shows that, if effective monitoring systems are extended in the entire territories of the park, the biodiversity resources could be protected in a sustainable way. However, park management and governance related factors (to be discussed in chapter six) are contributing for the degradation of the park's natural capital. However, to counter the ongoing degradation of the forest, park authorities should explore the possibilities of collaborating with the local and federal authorities. The purpose of this collaboration should be (a) to develop and implement a programme of awareness development on the importance and relevance of forest resources of the park to the localities and (b) to designate land through the creation of buffer zone which can be used for the planting of fast-growing trees and shrubs that

will help to satisfy the fuelwood and fodder demands of the local communities. This programme can be funded by-part through resources generated by tourism activities in the park.

5.1.5. Ground Cover of Herbs in the Nech Sar Grassland Plain

Ground cover is one of the most important habitat components of conservation areas (Mackinnon, 1986, cited in Arega, 2005; Emiru, 2003). However, its importance for wildlife feed depends on the type of species that constitute the ground cover of herbs. Even though, this study did not assess the quality of the ground cover of herbs, the study evaluated the major grass species of the park.

To examine the abundance of the grass species in the Nech Sar grassland plains of the Park, 38 experimental plots measuring 3m x 3m were deployed along two transect lines and in each experimental plot, the proportion of cover was estimated visually. In line with this, to explore the proportion of the coverage in the human activity affected area and the protected portion of the grassland, two vegetation coverage classes were initially predetermined as per the outcomes of the reconnaissance survey as follows: Class I (80-100% coverage as controlled) and Class II (0-70% coverage as livestock interfered) (Sutherland, 2000; Emiru, 2002).

Apart from this, specimen of the grass species which were encountered in the transect walks were collected and taken to park office for further scientific identification. Thus, the study also identified the most dominant grass species visually. Accordingly, 20 grass species were identified in the Nech Sar grassland plains of the Park (Table 31) and of which *Chrysopogon plumulosus* and *Bothriochloa insculpta* being the most dominant grass species of the area. These grass species are the most palatable herbs for wildlife as well as domestic animals.

Table 31: Grass species identified from the Nech Sar plains of the Park

S.N.	Scientific name	Remark
1	*Chrysopogon plumulosus*	Dominant
2	*Bothriochloa insculpta*	2nd dominant
3	*Digitaria macroblephara*	
4	*Lintonia nutans*	
5	*Sehima nervosum*	
6	*Brachiaria deflexa*	
7	*Heteropogon contortus*	

S.N.	Scientific name	Remark
8	*Cenchrus ciliaris*	
9	*Aristida kenyensis*	
10	*Chloris virgate*	
11	*Ischaemum afrum*	
12	*Cynodon nlemfuensis*	
13	*Tetrapogon villosus*	
14	*Eragrostis tremula*	
15	*Setaria incrassate*	
16	*Themeda triandra*	
17	*Cynodon dactylon*	
18	*Brachiaria serrata*	
19	*Digitaria abyssinica*	
20	*Eragrostis sp.*	

The grassland supports a diverse faunal and floral species. It covers a total area of about 270 km^2 which is about 52.5% of the total area of the park. Burchell's Zebra, Swayne's Hartebeest, Grant's Gazelle, Greater Kudu and Hunting Dogs are also among the wild animals that dominate the area. The grassland, however, is being degraded because of the ongoing overgrazing by the pastoralists who reside in and around the park and use the grassland to graze their animals.

The degradation of the ground cover of herbs is caused by the dwindled availability of the wildlife feed. This phenomenon will also directly impact the tourism potentials of the park. Wildlife/ecotourism would suffer due to the reduction of wildlife that may result from the reduction of wildlife feed. This situation compounded by the impact of climate change such as reduced availability of rainfall, increased temperature and prevalence of longer drought periods would have serious consequences on the availability of feed for the survival of the wild animals in the park (Girma and Tell, 2012; Abiyot, 2009).

On the other hand, as per the ground cover of herbs assessment results of the study which compared the controlled area of the grassland with the livestock interference area, only 45% of the plots in the grassland were found out to have good ground cover of herbs while 55% of the experimental plots were under thin and degraded cover of herbaceous plants.

An analysis of variance was also computed in the below table for the protected and the livestock affected areas of the grassland.

Table 32: ANOVA for the controlled and livestock interfered area of the grassland

Source	DF	SS	Mean Square	F Value	Pr > F
Model	1	21230.6	21230.6	101.09	<0.0001
Error	36	7560.7	210		
Corrected Total	37	28791.3			

The above one-way ANOVA on the proportion of the grass coverage between the controlled and livestock interference plots (Table 32) also showed a significant difference ($P < 0.05=0.0001$). As shown above the reduction in the ground cover of herbs would result in the reduction of the availability of wildlife in the park. This would have serious implication for wildlife and ecotourism and other forms of livelihood opportunities for the local and indigenous communities.

Apart from the direct grazing of the livestock in the grassland, as shown by the below pictures a significant amount of grass is being taken out of the park through the illegal cut and carry system which is being exercised by the local communities and Arba Minch city inhabitants.

Figure 41: Dense coverage of grass in the protected area of the park (left) and degraded coverage of grass (right) – photos by researcher on same day (June, 2016)

Figure 42: Illegal cutting of grass from the Park and cattle population inside the Park

Since pastoralism is the main stay of livelihood for the local communities, they highly depend on the vegetation of the park in feeding their livestock. This in turn is affecting the ecosystem since the natural food chain is being disturbed by the diminishing availability of feed for the herbivore wild animals.

Official reports of Nech Sar National Park indicated that a total of 207,295 livestock population is currently dependent on the park's resources as source of feed (NSNP, 2016). In the Nech Sar grassland plain, one can easily see the prevailing fact that the major part of the grassland carries too many domestic animals of the different tribes and hence, overgrazing and erosion are apparent in many places (refer to the above Figures 41 and 42). Thus, the increased proportion of bare ground in the landscape is the end result of the long and continuous overgrazing activities within the territories of the park. If this situation is not averted in the near future, it is likely that the wild animals will be facing shortage of feed and subsequent reduction on the density of wild animals in the park would be apparent.

5.1.6. Invasive Plants and Bush Encroachment in the Grassland Plains

Documented evidence shows that the grassland plain was once full of native grass species which used to be a feeding ground for the Zebras and other herbivore wild animals and has contributed for the continuity of the food-chain in the ecosystem for ages (NSNP, 2016). The researcher has also visited the park a decade ago and witnessed the Nech Sar grassland habitat modification

within this short period of time, since the area was mainly dominated by the native grass species by then (Figure 43).

Figure 43: Partial view of Nech Sar grassland plains a decade ago before invaded by alien species (left - photo from Park records, 2008 and after invasive plants (right – photo by researcher, 2016)

Based on the findings of the research, currently the Nech Sar grassland plain is invaded by invasive alien plant species (Table 33, Figures 43 and 44). Human interference as a result of the heavy livestock pressure is the prime underlying cause for this habitat obliteration and modification. Apart from that, because of the livestock pressure, the Nech Sar grassland plains are being infected with ticks and other parasites which are affecting the wellbeing of the park's wild animals. The park staff explained that, the wild animals are very less adaptable to these pests and once their mouth area is attached by the parasitic insects, they will find it hard to feed themselves and sustain their life. As a result of this, many wild animals are losing their life in some locations (informants, park photo; NSNP, 2016).

Figure 44: Abutilon species expanding aggressively in the Nech Sar grassland plain (photo by researcher, 2016)

Table 33: List of invasive and encroaching plants in Nech Sar plains of Nech Sar National Park (complied from the ecological assessments).

Invasive and Encroaching Species	Nature of the Species	Remark
Abutilon sp.	Invasive	Found in the grassland
Parthenium sp.	Invasive	Mainly observed around the main gate of the park
Prosopis sp.	Invasive	Mainly observed around the main gate of the park
D. cinereal	Encroaching	
Commelina schweinfurthii	Encroaching	
Solanum incanum	Encroaching	
Rhynchosia minima	Encroaching	
Indigofera sp.	Encroaching	
A. mellifera	Encroaching	
A. tortilis	Encroaching	

Guji and the Kore people are the indigenous community who live inside and in the vicinity of that part of the park. As these communities are mainly pastoralists they largely rely on their livestock as their main stay of livelihood. Traditionally, in these communities, having high number of livestock is a symbol of a high status of wealth, with no consideration about the quality and

availability of resources like grazing land and these communities are using the Nech Sar grassland ecosystem as the main source of green pasture for their livestock.

The livestock of this local and indigenous communities will be feeding in that part of the park during day times and will only go back home in the evening and hence there is a frequent in and out movement of the domestic animals in the park by competing for feed with the wildlife. This phenomenon has favored the dissemination of seeds, diseases and parasites from domestic animals to the wildlife and the grassland.

One elder of the area said that "*Nech Sar National Park used to be 'Nech' (white) as its name indicates but, now it is not white…!*" which refers to the abundance of the indigenous ground cover of grass in the past as compared to present day degraded landscape of the grassland. He continued saying on how beautiful the landscape was and how resourceful it was for the wild animals as well as their cattle in the past. This view is also supported by the data collected from the 35 experimental plots (2M X 2M) which enabled to assess the frequency of observation as well as identification of the invasive plants in the grassland landscape of the park. In line with this, the below figure (Figure 45) shows the frequency of observation of invasive and encroaching plants in the experimental plots during the field assessment.

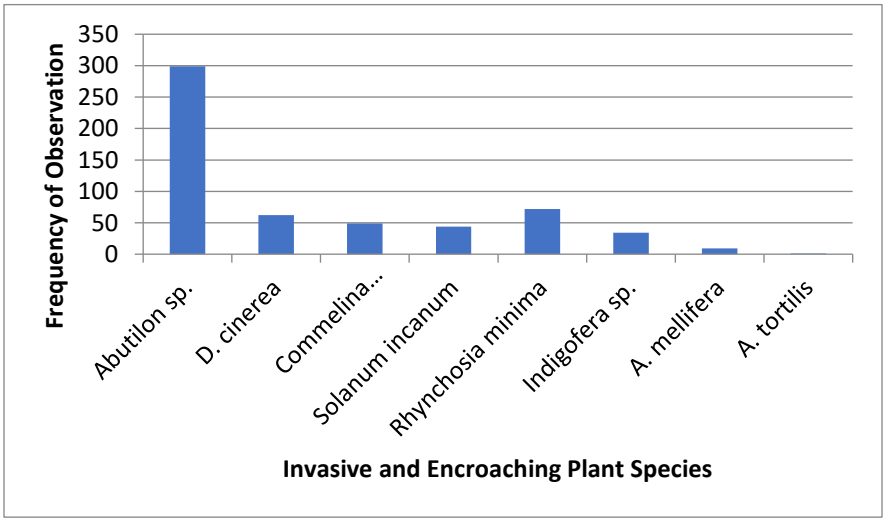


Figure 45: Invasive and encroaching plants frequency of observation in the Nech Sar plains of Nech Sar National Park

The above frequency figure indicates as Abutilion species is spreading in higher rate which may soon overtake the entire grassland landscape of the park which hosts the diverse range of wild

animals. In addition to that, GPS coordinate points of the experimental plots were taken by the researcher and the information was encoaded in to ArcView by a GIS specialist to produce the below map (Figure 46) which shows the location of the invasive plnats in the grassland areas of the park. Hence, bush encroachment is also another threat that is being observed in the landscape and the combination of these challenges will affect the mobility of wild animals as well as availability of feed.

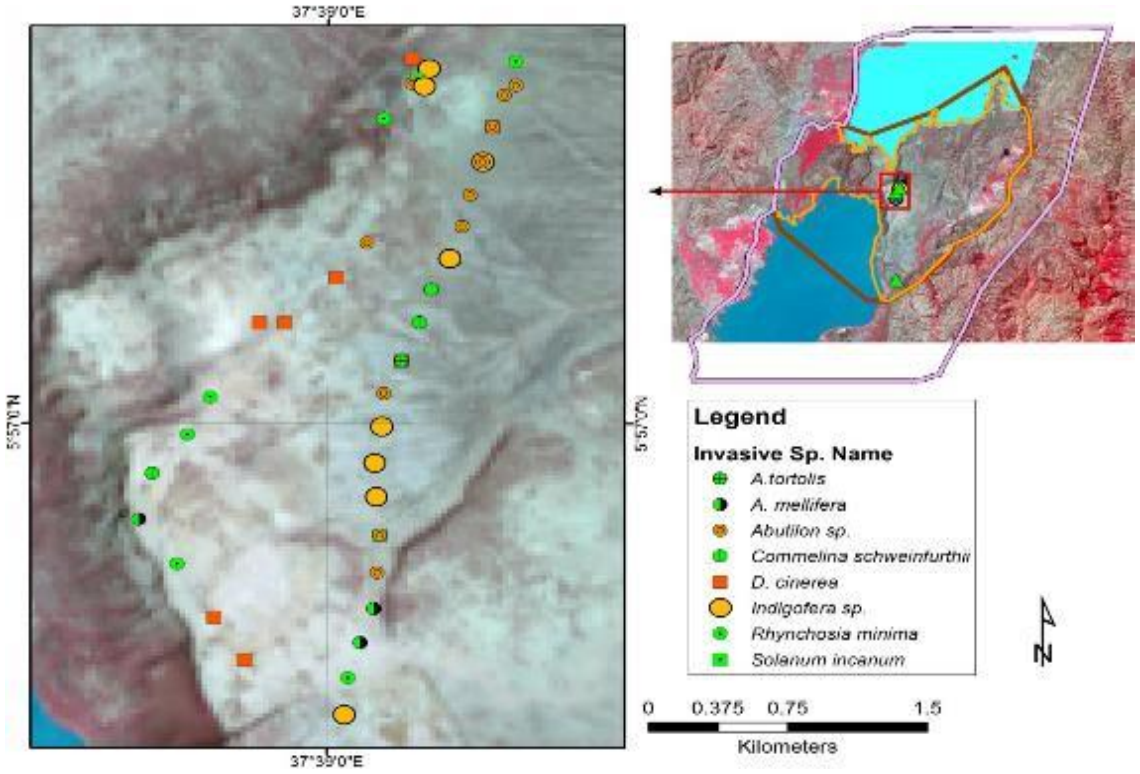


Figure 46: Location of invasive and encroaching plants in the sampled plots of the Nech Sar grassland plain

Besides, the focus group participants were asked to vote on the proportion of the grassland which is being covered by the insavie plants (40-50%, 50-60%, 60-70%, 70-80%, 80-100%). The same question was also directed through questionnaires to the operational and support giving staff of the park. Their view on the proportion of invasive plants coverage is thus summarized in the below figure and thus, 87 % of the respondents agreed as 70-80% of the grassland is currently already covered by invasive plants and encroaching bushes (Figure 47 and 48).

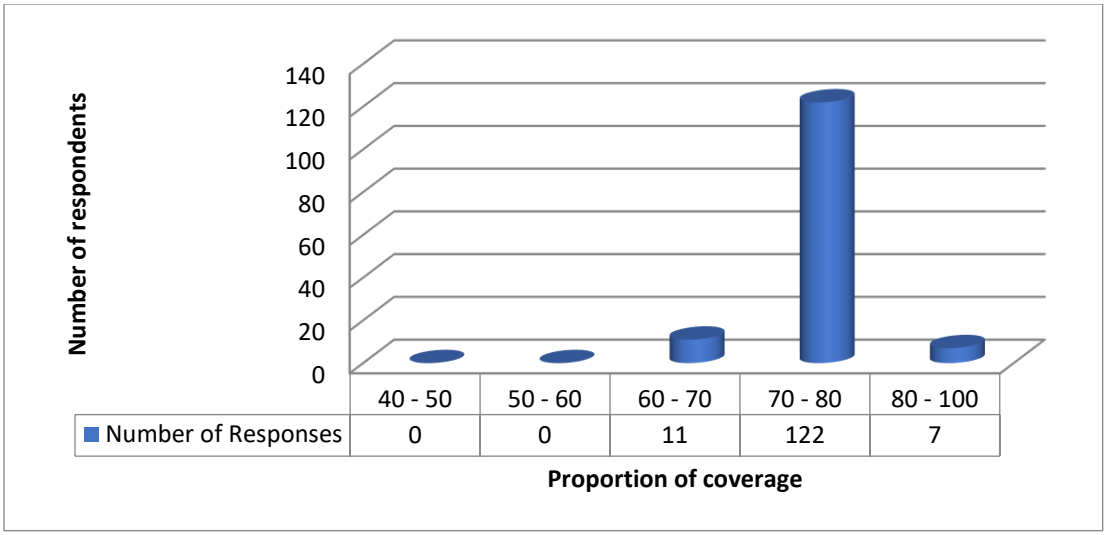


Figure 47: Respondents view on the proportion of the grassland covered by invasive and encroaching plants.

The total number of invasive and encroaching plants encountered in each experimental plot is also plotted in the following map by making use of ArcView with the aim of showing as to how the grassland is being invaded from its peripheral areas towards the heart of the landscape as indicated in the below Figure 48.

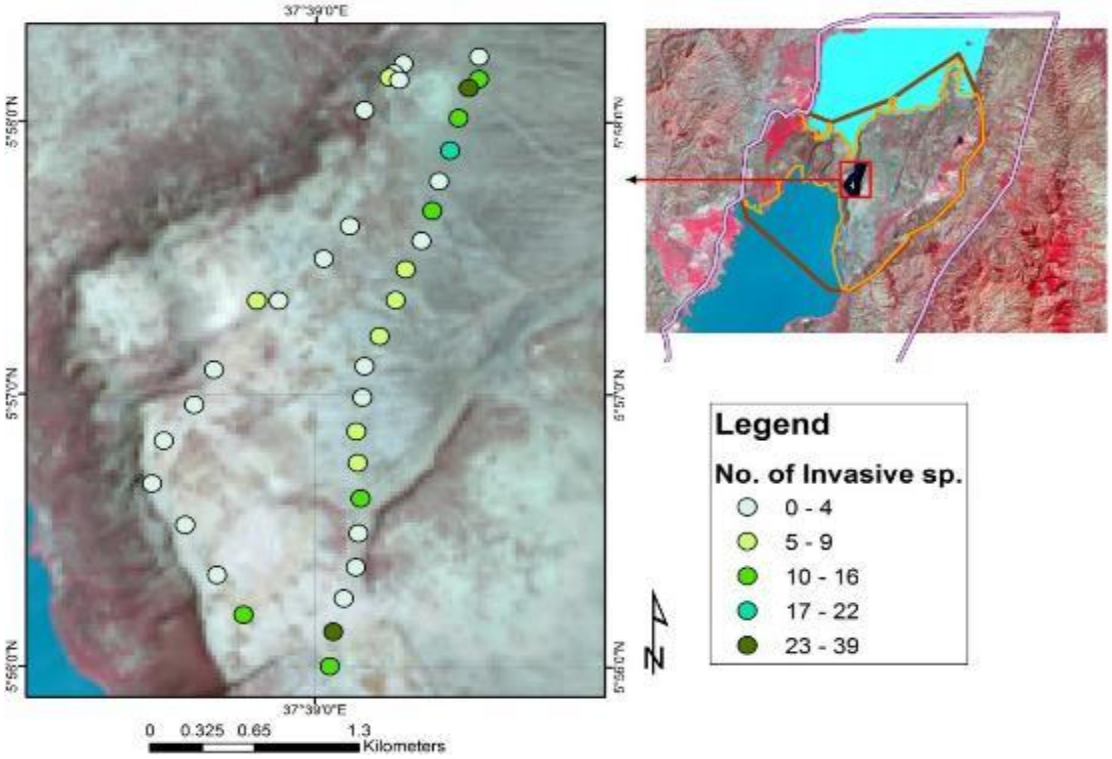


Figure 48: Map showing the density (number of invasive plants) in the sampled plot

Accordingly, the highest concentration of invasive plants is observed in the high human disturbance areas of the grassland since the seeds of the invasive plants can easily be disseminated by the frequent in and out movement of the livestock. Therefore, with the current alarming trend of invasive plants expansion and bush encroachment, it is very apparent that the natural ecosystem which used to support the wild animals will be modified into a different landscape in the very near future. The values of the ecosystem in terms of tourist attraction and biodiversity conservation will also be lost if remedial actions are not taken with utmost urgency.

In terms of habitat modification, this could mean a lot of damage with regards to the availability of feed that ensures the wellbeing of the grazing wild animals such as the Zebras in one hand and the carnivores in the entire food chain on the other hand. The encroachment will also affect the once used to be easy movement of the wild animals from one place to the other as seen from the below Figure 49.

Figure 49: Bush encroachment affecting the mobility of Zebras (before and after)

5.1.7. Aquatic Ecosystems of the Park and Human Interference

Out of the total area of 551km^2 of Lake Chamo 310 km^2 of it falls under the Nech Sar National Park administration boundaries (Abraham, 2015). Lake Chamo, a resource with significant role in the ecological and economical aspects, is being fed by many temporary and annual rivers and springs. Kulfo, Sego and Sile are the major tributary annual rivers. The overflow of Lake Abaya usually carried by River Kulfo is also another source of water to the Lake. Lake Chamo and Lake Abaya are separated from each other by a narrow isthmus of land called "God's Bridge" or "ye-Egzer Dildy" which measures about 1km by 65m (Brigitta and Stefan, 2006). Elders of the area

also mentioned that this isthmus of land used to be channel for the overflow from Lake Abaya to Lake Chamo.

Economically, Lake Chamo plays a significant role through fishery activities. Many are making their livelihoods through this as the Lake is now among the major suppliers of fish to Addis Ababa, the capital of the country. However, various human induced factors are diminishing the ecological and economic importance of the Lake. According to observation and the respondents, due to over exploitation of fish, siltation and the expansion of illegal fishing activities in the Lakes, the availability of fish in the Lake has been considerably reduced. There are about 8 fisheries who are legally registered cooperatives that are producing fish to Arba Minch city and Addis (the capital). These cooperatives perform the fishing activities as per the standards set by the Government fishery authorities; this includes the utilization of the recommended net size which will only allow catching fish who reached a certain recommended size.

Figure 50: Illegal fishing activities (Photo from Park repositories, 2016)

Illegal fisheries on the other hand (Figure 50), however, are making use of illegal net sizes to perform their fishing activities and catch immature and baby fishes which will directly affect the future succession and reproduction potentials of the rich fishery biodiversity of the Lake. These illegal fishing activities are mostly done within the Nech Sar's National Park administrative areas of the Lake. The increase in illegal fishing activities is the result of high unemployment being experienced within the local communities (Asebe, 2012). This is also being attributed to the low human and financial resources capacity of the park in defending illegal activities on the Lake.

As per the observations of the researcher, another factor that contributed to the challenges of the lake is the improper land-use practices in the different watersheds of the tributary rivers. This improper land-use practices resulted in the increased siltation of the Lakes. As can be seen from the below photos (Figure 51), farming activities on hilly slopes, deforestation and low levels of soil and water conservation activities on farmlands of the watersheds are among the causes of soil erosion.

Figure 51: Improper land-use practices (left - hillside farming and right - gully formation)

All the way from the lowland of the Lake area up to the highest peaks of the Amaro highlands, farming activities are being done with less attention to proper land-use and it is not uncommon to see crop lands in steep and hilly lands (Figure 51). As a result of this, during the rainy season, the eroded soil sediments will be transported by the runoff and the tributary rivers and be deposited on the floors of the Lakes, which in turn affects the aquatic biodiversity potential as well as volume of water in the Lakes.

The computation on the differences in water surface coverage from the three layers satellite image analysis of the last three decades also showed that, Lake Chamo for instance has lost 2,465.46 hectares of its surface area coverage in between the years of 1985 – 2015 (Figure 52). Climate change related impacts such as shortage of rain, occurrence of drought, etc. may have also contributed to have low stream flow of water in to the lake. The reduction in the volume of

water could mean a great loss in terms of the availability of aquatic biodiversity resources such as fish, crocodiles, hippopotamus, etc. as well as the other ecological functions of the Lake.

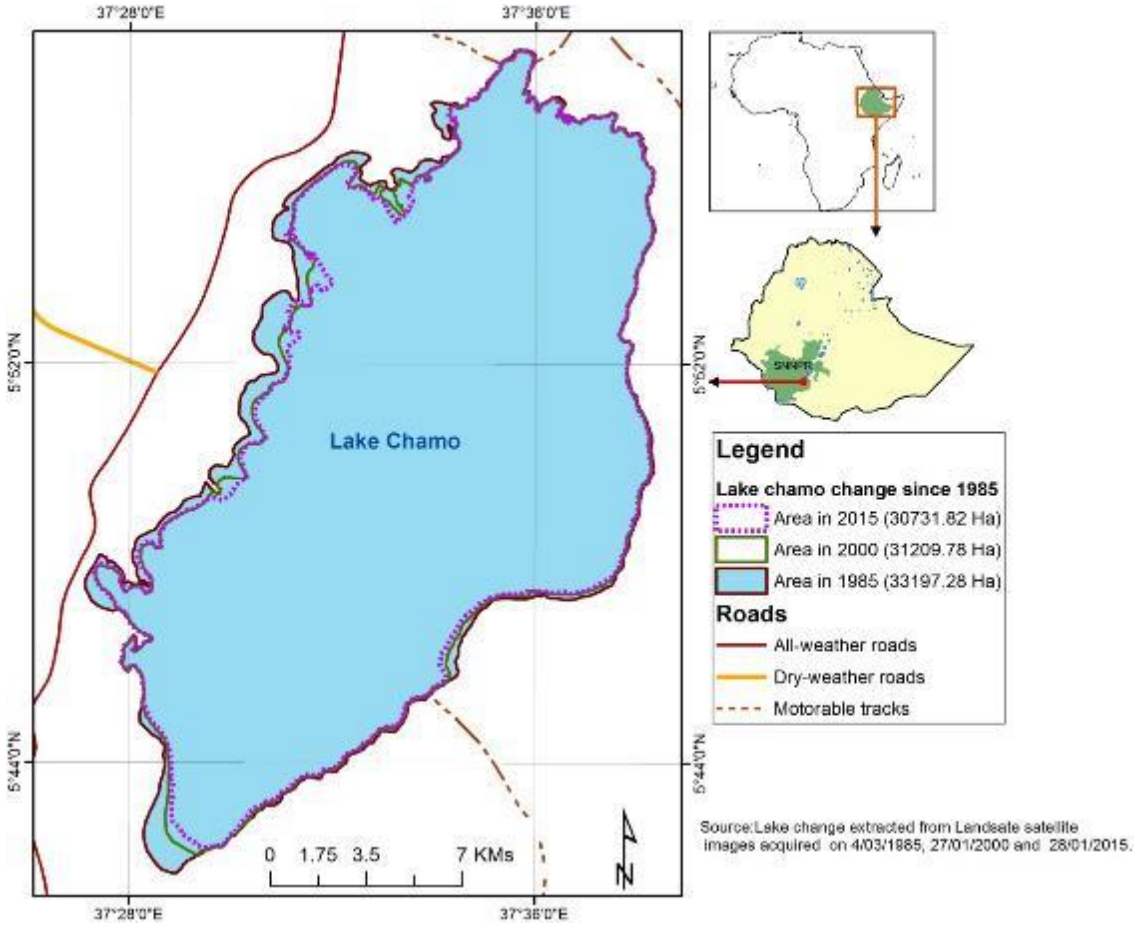


Figure 52: Surface area changes of Lake Chamo (1985 – 2015)

Figure 53: Kulfo River heading to Lake Chamo along with the sediments (Photo from Nech Sar Park repositories, 2016)

Due to the low levels of soil and water conservation activities in the nearby watersheds of the Lakes, gullies are being formed since the soils are being washed away and deposited on the floors of the Lakes (Figure 54).

Figure 54: Gully formation in farmlands located about 5kms away from the Lake

This sedimentation is favouring the growth of hydrophytic plants which could consume a considerable proportion of the lake's water. Hence, in the seemingly "deep" areas of Lake Chamo one can observe hydrophytes like Cyperus and other reeds, which indicates the Lake is receding from time to time (Misikire and Tesfu, 2015).

Apart from that, because of this sediment deposition, the once sand covered offshore crocodile breeding grounds ("Crocodiles' Market") of Lake Chamo are now being covered with mud and water weeds by posing a threat for the continuity of biodiversity resources of the Lake (Figure 55).

Figure 55: The Crocodiles' Market before (top) and after (bottom) siltation and invasion by plants

While infrastructure development forms the basis for the progress of human capital, it also needs to be managed in an environment friendly way. In the case of the Lake Chamo area, however, one can observe the poorly designed road development works causing a significant contribution for soil erosion. This and the above-mentioned challenges are contributing to the siltation of Lakes (Figure 56).

Figure 56: Poor road construction opening-up huge gully water ways to Lake Chamo

According to Article 7.2 of the Fish Resources Management, Development and Control Proclamation No. 78/2004 and Regulation No. 62/99 of the Southern Nations and Nationalities Peoples Regional State, any farming activities are strictly prohibited within one-kilometer radius of a water body (Misikire and Tesfu, 2015). This decision was aimed at having a buffer zone in protecting the aquatic ecosystems. However, in the case of Lake Chamo the researcher has witnessed that farming activities are being practiced within a radius of 10 meters from the Lake offshores. Both local farmers as well as national and international investors are engaged in the production of banana, cotton and other crops production in the very immediate borders of the Lake. This activity will cause for pesticides and other farming residues to directly flow into the lake and potentially pollute the aquatic ecosystems. These practices will also have implications on the production of fishes and other aquatic ecosystem services like tourism. These lands used to be the grazing lands for the hippopotamus population of the Lake. The researcher has also seen the footprints of hippos on these converted farmlands. Based on the information collected from the respondents and other sources, these hippos are also being hunted by the local communities (Romulus, 2007).

5.1.8. Summary of Section One

Section one of chapter five is designed to respond to the research objective number one (1) which states "undertake a systematic analysis of the state of natural capital in the park with a major focus on forest, grassland and aquatic ecosystems". Accordingly, the findings showed that, human activities are affecting the natural regeneration, species composition and density of the

woody vegetation. Deforestation activities in satisfying the household energy demands of the inhabitants are the major cause for the degradation.

The findings on the ground cover of herbs also revealed that overgrazing by the Guji and Kore pastoralist communities is affecting the availability of feed for the wild animals in the grassland ecosystem of the park. The frequent in and out livestock movement in the grassland has also inoculated invasive plants, animal diseases and pests into the ecosystem of the park.

It is also evidenced that the lakes of the park are going through devastating modifications. Lake Chamo for instance was found to experience substantial loss in its water surface coverage in the past decades. Therefore, the findings of this chapter showed that, human activities are affecting the existence of the biodiversity potentials of the park. Hence, strategic actions are deemed important if the remaining natural capitals of the park have to be protected from the ongoing degradation. The following section two of chapter five will discuss energy demand of the localities and its impact on the natural capital of the park.

5.2. Section Two: Household Energy Demand and its Impact on Nech Sar National Park

The present section is aimed at presenting the findings of the research on the trends of the fuelwood collection by the local and indigenous communities of the park. The section will explore the severity and magnitude of the ongoing deforestation caused by fuelwood collection and its impact on the density and diversity of the woody vegetation of the park.

5.2.1. Household Energy Sources and Nech Sar National Park

According to the information collected through FGD with the local community representatives and questionnaire administered for the park's operational and management staff, findings of the analysis showed that, fuel wood is the predominant source of energy followed by charcoal. The votes for the different sources of energy is presented in below figures (Figure 57 and 58).

Discussions with the wardon of the park indicated that, because of the high cost for kerosene and shortage of availability at the local level, very few respondents only use kerosene for very light cooking purposes such as making tea and for warming food items. Due to its intermittent supply, high cost, lack of access by rural households and lower current capacity, electricity is mainly used for lighting, watching television and charging mobile phones in the urban communities.

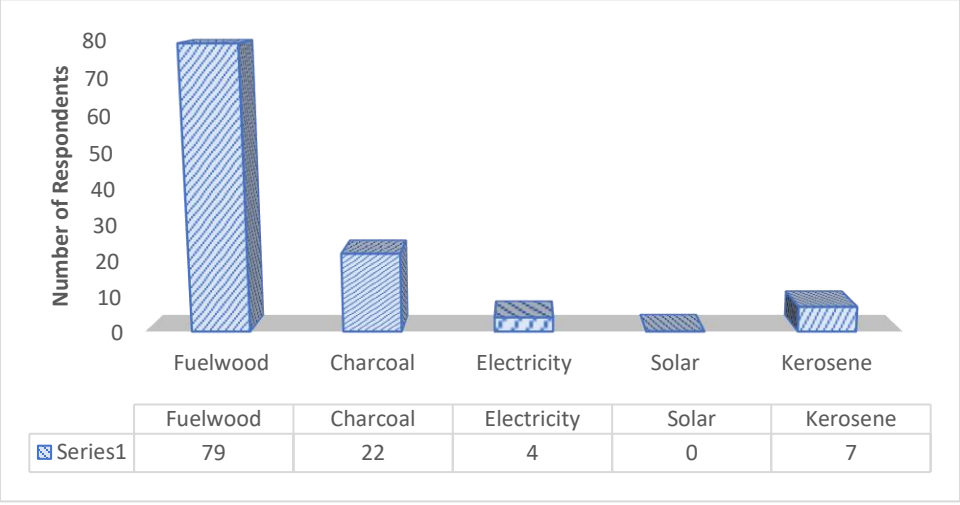


Figure 57: FGD respondents view on the sources of household energy

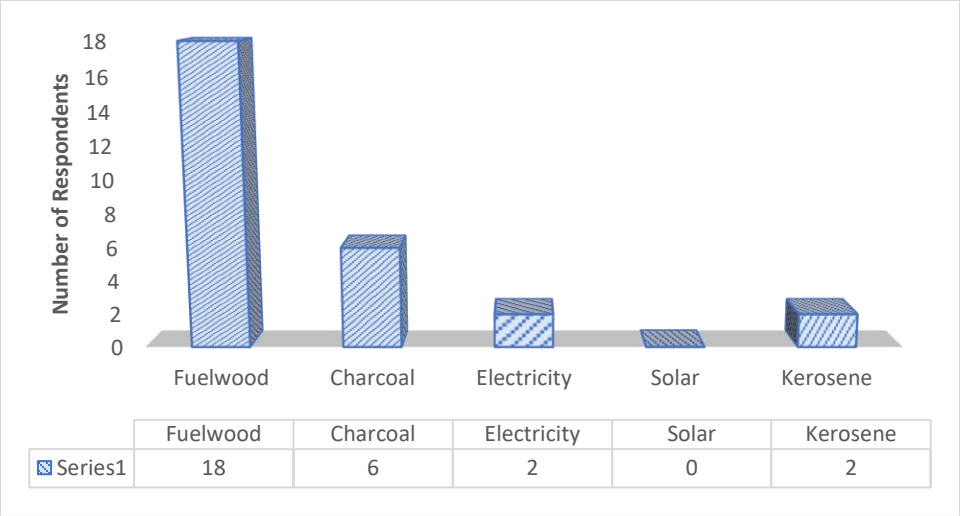


Figure 58: Summarized view of the park staff on the sources of household energy

The comparative analysis of the FGD participants and the views of the park staff on the sources of energy response has not showed differences and it showed that fuelwood is the widely used source of energy in the area.

The above figures show the major proportion of the local communities are dependent on fuelwood and charcoal for satisfying their energy demands. In line with this, in responding to the sources where they can get fuelwood, 91% of the FGD respondents and 93% of the questionnaire respondents mentioned that the fuelwood comes mainly from the Park while the rest of the respondents mentioned other sources such as the forests found in the neighboring mountains are the additional sources of the fuelwood supply in the locality.

From direct observation by the researcher, other sources of fuelwood (mountain forest) are found in a bit far distance from the localities (5 – 10 kilometeres). Because of this, due to the proximity of the park to the community, there is a tendency for the community to use the forest of the park in satisfying the fuelwood and charcoal energy needs.

Observation in the forest area indicated that, trees (both live and dead), and branches are being cut for fuelwood supply from the Ground Water Vegetation of the park. The impact of this challenge is directly affecting the natural regeneration potential, density and diversity of the woody vegetation. This impact is being observed as one goes from the outskirts of the park into the interiors. Though the Park authorities are exerting their capacity for the protection of the

forest and its associated resources, the fuelwood collectors will always find their way to do their regular fuelwood collection activity by changing the routes and going at nights in accessing the forest resources of the park. In some of the inaccessible and hidden pockets of the park, it is very common to see the smokes of charcoal making during evenings since the Park Rangers will not be on duty at night times (Figure 59). The human and financial resources of the park are not also in a position to support the patrolling activities in the entire ecosystems of the park.

Figure 59: Charcoal making smokes inside the ground water vegetation of Nech Sar National Park (photo by researcher, 2016)

5.2.2. Traditional Energy Utilization and Efficiency

The natural forests are being cleared to meet the ever-increasing energy demand of households (Asebe, 2012). Household energy sources and its utilization in least developed countries like Ethiopia, Sierra Leone, etc. is posing a major environmental challenge along with health-related problems. The traditional stoves and kitchens are not efficient in using the generated energy in an efficient way. Energy will always be wasted because of the wide openings between the stoves and the cooking utensils. Kiflu *et al.* (2009) explained that, the smoky kitchens are also affecting the breathing system of people engaged in cooking. They are also known to cause eye diseases and in this case women who are believed to be the primary caregivers of a household are the

primary victims (Kiflu *et al*., 2009). Due to the flame which comes out of the open stoves, it is also not uncommon to find a scar on the front side of the lower legs of many women of the area.

Based on the findings of the study, none of the respondents of the survey are making use of solar energy for cooking with the exception of using solar charged torch lights. This is mainly caused by the high cost and unavailability of the solar appliances in the locality.

Though all woody plants can be used as a source of fuel wood, when the focus group discussion and questionnaire participants were asked if there are preferred trees for fuelwood and charcoal making (Annex 7, 8 and 13), responses showed that (Table 34 and 35), there is still a preference on some tree species to be used as a source of fuel since the amount of fuel energy which can be generated varies from species to species. Some tree species may not also yield the required amount of energy in a timely fashion. This also shows as some tree species like Lonchocarpus and Prunus are facing the highest rate of threat because of the high amount of energy which can be generated from these species of trees.

Table 34: Type of trees preferred for fuel wood

S.N.	Scientific Name	Local Name
1	*Lonchocarpus laxiflorus*	Hasso
2	*Prunus africanus*	Tikur Enchet
3	*Acacia polycanta*	Deleme
4	*Rhus natalensis*	Ango Fire

Table 35: Type of trees used for charcoal making

S.N.	Scientific Name	Local Name
1	*Lonchocarpus laxiflorus*	Hasso
2	*Prunus africanus*	Tikur Enchet
3	*Balanites aegyptiaca*	Bedeno

Unlike charcoal, there is a steady supply of fuelwood in the markets of Arba Minch and the price of the fuel wood also varies based on the quality of the wood. The availability of charcoal usually fluctuates as the law enforcing bodies sometimes try to control charcoal making and marketing.

As the cost of fuelwood and charcoal is increasing from time to time and for environmental concerns the government of Ethiopia is trying to enhance the use of fuel-saving stoves. In this

regard, the focus group discussion participants when asked if they are using improved fuel-saving stoves, only 55% of the respondents mentioned as they are using fuel-saving stoves for cooking and heating purposes. This data on the otherhand indicates that, a considerable number of the households in the area are still using the traditional stoves of putting 3 stones and burn the fuelwood openly which results for the wastage of energy that could have been tapped and used efficiently by making use of improved stoves (Figure 60).

Figure 60: Traditional stove (left) and fuel saving stove (right) (photo by researcher, 2016)

According to the Zone Water, Mines and Energy Office (2016), in the city of Arba Minch and the Arba Minch Zuriya district in general, there are only 3 fuel saving stove producer cooperatives with a total of 22 female and 3 male members that are established with support from GIZ and VITA (Non-Governmental Organizations). The number of cooperatives, however, as compared to the total population of the city (110,660 in the city and Arba Minch Zuriya district 164,529) is a very low capacity to meet the increasing energy demand as well as to do the market promotion works of the products in the wider community. This indicates that the concerned government authorities should enhance the fuel saving stoves provision sector if the remaining natural resources of the park that have local, regional and global role have to be saved from extinction.

Due to the low level of awareness by the community, people who are engaged in this kind of fuel saving stoves production (pottery) activities will also have a lower stratum within their society since traditionally people who are engaged in handcraft activities are believed to be from a lower-

class social status of the community who are not well to do since their very ancestors. In the case of Arba Minch, for instance, these handicrafts are called "Maze" which has its own pejorative tone of undermining the nature of the work itself. This type of work is also usually considered a women's job and the involvement of men in this activity is very minimal. However, given the very labour demanding nature of the work, awareness development works should have helped in increasing the level of engaging more men to the sector.

Apart from that, cooperatives and officials of the park should work together to develop a programme which should raise awareness on the relevance of the park resources to the overall development of the community and to develop sustainable development strategies in providing alternative livelihood opportunities to community.

Figure 61: Female fuelwood collectors on their way to home and market

The results of the fuelwood collection survey which was conducted for 20 consecutive days from the three outlets of the park (Kulfo bridge, Highland and Jinka road) showed that, on average a total of 2,909 bundles are being extracted on daily basis from the park. In other words, an average of 824 trees are being cut on daily basis to satisfy the fuelwood demand of Arba Minch town and its surrounding inhabitants. Annually it means that a total of 300,760 trees are being cleared from the park. Thus, this indicates that, a significant number of trees are being cut every day from the park (Figure 62).

In this regard, some of the issues which contributed for the destruction of this forest are (a) according to the discussions with the warden of the park, a significant percentage of the park rangers are from the local community and they are biased to their community in terms of vigilance

to enforce the rules and regulation in protecting the park resources (b) some of the informants have also mentioned that the wood collectors would bribe park rangers to look the other way while they move wood out of the park territories.

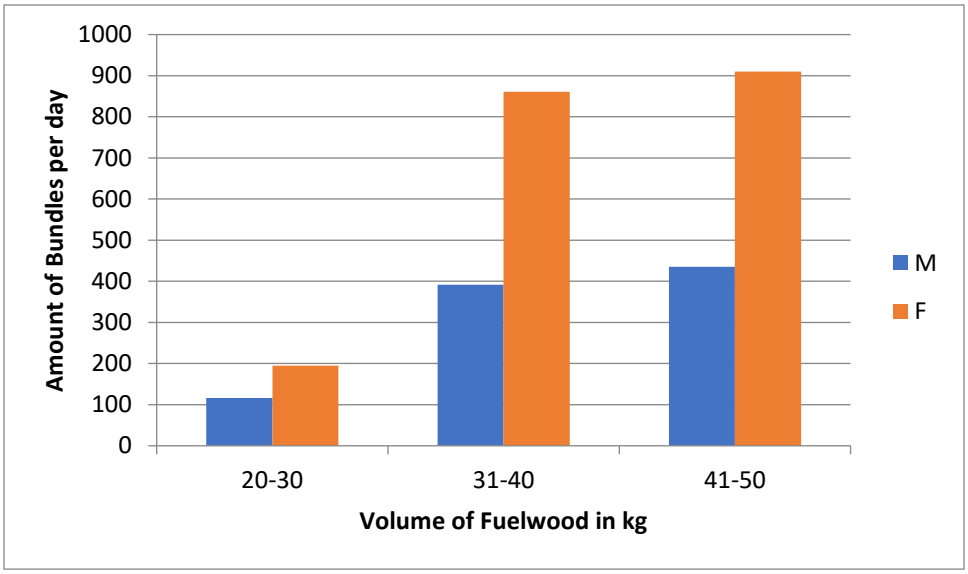


Figure 62: Daily average amount of fuelwood bundles extracted by men and women

The results of the study showed that a larger proportion of women are engaged in the fuelwood collection (Table 36). This is mainly because of the traditional consideration of cooking related activities including firewood collection as a women's job by the society. This has contributed to increasing the workload burden on women and therefore, the time that could have been spent in education, improve health standards and build social networks are used for fetching wood.

Table 36: Daily male-female involvement ratio on fuelwood collection

Category	Daily average number of bundles
Male	943
Female	1966
Total	**2909**

The above data (Table 36) on the proportion of male to female involvement on fuel wood collection indicates that 2 females to one male are engaged in fuelwood collection. In most cases, while women engage in extracting fuelwood for the household domestic use, men are usually extracting wood and charcoal for commercial purposes i.e selling of fuelwood and charcoal as well as selling wood for building and furniture purposes.

If other alternative employment opportunities along with credit and microfinance services are strengthened, this human capital can be directed to ecotourism and other environment friendly income generation activities. As the region in general and the district in particular is endowed with natural resources, the development of green jobs and tourism related activities would lower down the traditional reliance of the community on the natural forest resources of the park as their source of direct income.

In terms of timeline, the data indicated that, the highest number of fuelwood collectors was observed after 5pm onwards (Figure 63). This is mainly an attribute of the fact that, the park rangers would work during normal working hours of 7am to 5:30pm. Therefore, most of the park rangers will be off from duty by then and the patrolling activities will be minimal to none afterwards. Local and indigenous communities would use this time slot to cut the trees and perform charcoal making activities as well as extraction of wood for commercial purposes. The below figure shows that, over 1,534 females and 624 males are engaged in extracting fuelwood between 5pm - 8pm as compared to the other periods of the day when the park rangers are on duty.

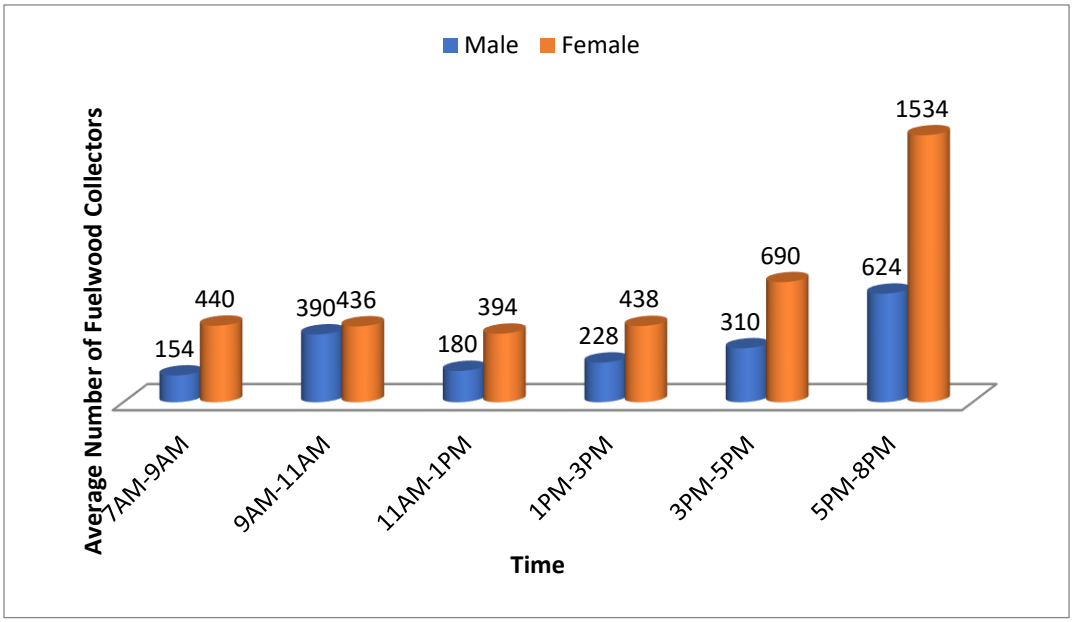


Figure 63: Frequency distribution of fuelwood collectors during the day times

Apart from the increased household energy demand, shortage of alternative income sources is also the other driving force which dragged many into the fuelwood and charcoal making business

(NSNP, 2016). Fuelwood collectors will be able to make an average income of 60 Ethiopian birr which is equivalent to 3 USD from an average size bundle that weighs about 30-40kg of fuelwood. Locally, that amount will be enough to cover food and other minor expenses for the day. The average cost of fuelwood and charcoal was also assessed by the researcher in the markets of the town at the time of data collection (June 2016) and the results are presented in the below Table 37.

Table 37: Average cost of fuel wood and charcoal at Arba Minch city

S.N.	Type	Cost/Kg/Ethiopian Birr	Cost/Kg/USD*
1	Fuel wood	2.00	0.09
2	Charcoal	4.00	0.18

*Exchange rate of $1 to 21.87 Ethiopian Birr on July 28, 2016.

5.2.3. Summary of Section Two

The practice of fuelwood collection has remained to be a continuous practice since there exists a lack of alternative and renewable energy sources in the area. The section has also revealed as the energy saving stoves production in the town of Arba Minch is in its infant stage, showing as there remains a lot of coordination activities in terms of fuel saving stoves production with the concerned local and regional partners. However, it is worthy to note that the provision of alternative livelihood opportunities, ecotourism and the provision of alternative energy sources such as solar and other renewable energy sources could help to reduce the increased reliance of the community on the forest resources of the park. On top of this, awareness development works on efficient utilization of energy will help to lower down the increased dependence of the community on the park's resources.

The research also indicated a significant amount of fuelwood is extracted from the park during the periods of 5-8pm onwards on daily basis since that is the time slot when park officials will be off from work.

The research also showed the need to enhance the awareness of local and indigenous communities on the relevance of the park's resources to the development of the community is of vital importance.

It is important to note that when people benefit from the biodiversity resources, they would participate in the protection of those biodiversity resources. Therefore, partnership development among the local communities, local and federal level park authorities can also be improved by involving the local people in the development and management of the protected areas. Such participation should involve sharing the benefits to be derived from the park with the local community in the form of social services such as establishment of schools and health facilities. Hence, it is important to create the enabling environment to facilitate the involvement of the local communities in the overall management and governance of the park.

5.3. Summary of the Chapter

"Nature makes human development possible but our relentless demand for the Earth's resources is accelerating extinction rates and devastating the world's ecosystems", said Joyce Msuya – Acting Head of UN Environment (www.unenvironment.org).

Findings on the assessment of the status of the natural capitals of the park indicated that, human activity is affecting the natural regeneration, species composition and density of the woody vegetation. Deforestation activities in satisfying the household energy demands of the inhabitants being the major cause for the degradation. The frequent in and out livestock movement in the grassland ecosystem of the park has also inoculated invasive plants, animal diseases and pests in to the ecosystems of the park.

"Research shows that nature fares better when the people most connect to that nature i.e those living within and adjacent to the protected areas are supported as the primary stewards", said Doreen Robeinson, Wildlife Expert at UN Environment. In the case of Nech Sar, however, the local communities are not being involved in the management of the park. This has contributed to low levels of ownership of the park by the local and indigenous communities. It is also viewed as one of the contributing factors for the continued degradation of the biodiversity and ecosystem services of the park.

Chapter 6 - Ecosystem Services and Governance Impediments in Nech Sar National Park

Chapter six presents the findings of the research based on the information gathered from the discussions with the local and indigenous communities, park officials and the different stakeholders by making use of the focus group discussions, questionnaires and interviews. The chapter forms stage three of the conceptual framework which mainly focusses on exploring the governance factors that affect the daily operations in protecting the natural capitals of the park.

The chapter is divided into two sections. Section one identifies the ecosystem services of the park; communities' preference for the ecosystems; and explores the perception of stakeholders on the state of the ecosystem services the park.

Section two of the chapter assesses the impact of protected areas governance, policies and strategies on the natural capital of the park. The impact of the current park management institutional framework is also explored in this section. In addition, this section assessed the current human induced threats on the natural capitals of the park. Therefore, section one of the chapter responds to objective number three and research question two. Section two of the chapter responds to objective number two and research question number two as per the below table (Table 38).

Table 38: Relationship among sections of chapter six, research objectives and questions

Section	Research Objectives	Research Questions
Section one	3) Assess the perception of relevant stakeholders on the state of the natural capitals and ecosystem services of the park.	2) What are the human induced threats that impact the natural capital and governance of the park?
Section two	2) Assess governance related factors that impact the management of the park's ecological capital.	

6.1. Ecosystem Services and Governance Related Challenges Information Analysis Processes and Tools

The ecosystem services and governance challenges that affect the sustainable development of the park were assessed by making use of data collected from focus group discussions held with the youth, women and men categories of the three local communities (Gamo, Kore and Guji), interviews and questionnaires as per the below demographic features (Table 39). Apart from these, as explained in detail in the methodology chapter of this thesis, secondary data such as official reports were also consulted as a source of information. Details of the analytical procedures will be provided in the following sub-sections.

Table 39: Number of Participants

Research Instrument	Number of Participants		Total
	Male	Female	
Focus Group Discussion	72	40	112
Questionnaire	22	6	28
Interview	49	9	58
Total	**143**	**55**	**198**

6.1.1. Ecosystem Services

The Millennium Ecosystem Assessment Framework (MEA, 2005) was found as an ideal approach for this research since it gives recognition for the value of the local communities' views and perceptions for it to be captured while assessing the services of ecosystems. This framework helps to explore the significance of goods and services obtained from ecosystems and aids to develop the linkages between the different services and human wellbeing. It can also be used as a tool to design ecosystem management plans that can help to ensure their sustainable development.

The Millennium Ecosystem Assessment Framework (MEA), hence, categorizes the ecosystem goods and services into provisioning, supporting, regulating and cultural functions of ecosystems. Provisioning services include food, nutrition, water, energy, etc. supplies; regulating services such as moderating climatic conditions, minimizing natural hazards; supporting services like nutrient recycling, oxygen production, etc.; cultural services also include spiritual values, recreation, research and education related benefits (MEA, 2005).

In general terms, the framework is a comprehensive guide which outlines a range of data sources such as remote sensing, GIS, natural resources inventories, socioeconomic data, models, traditional and indigenous knowledge, qualitative data collection tools, etc. All these requirements may not be necessary when dealing with a specific theme of research like this thesis due to time and financial implications. Therefore, in the case of this research the ecosystem services of the protected area were examined by making use of the focus group discussions with the local and indigenous communities of the protected area.

In the context of this local communities, the focus group discussion was also considered as an ideal way of capturing the views of the communities because of its advantages over other research instruments. These communities are leading a traditional way of life which is confined in their own locality. It is culturally sensitive for women to sit together with men to hold discussions. Due to the cultural sensitivity, many women of these communities will not respond to a stranger man. But, they better communicate while they are in groups. Hence, making focus group discussion to be an ideal way of capturing their views is an efficient way than conducting interviews or household survey at individual level. In these communities, it is also culturally immoral for men to sit with women and youth and conduct discussions. Hence, the researcher deployed focus group discussions by classifying the participants into women, youth and men groups. The major challenge encountered in making use of FGDs was that, the discussions can at times be guided by opinion leaders or people who are vocal. To overcome this the facilitators of the discussion had to moderate the flow of the discussion by encouraging all the participants to speak and forward their views on the discussion points. The following section will provide the general overview of the ecosystem services related thematic analysis processes deployed by the researcher.

6.1.1.1. Ecosystem Services Analysis Process Steps

In order to understand the ecosystem services of the park, the researcher followed the following process steps (i) identify the main ecosystems of the protected area (ii) identify the benefits obtained from the different ecosystems (iii) categorize the identified benefits under the four ecosystem services categories of MEA (iv) assess the preference of the communities for the different ecosystems of the protected area (v) examine the perception of the communities on the state of the ecosystem services and (vi) producing the report (ICIMOD and RSPN, 2017).

Step i: Identify the main ecosystems of the protected area

Based on the outcomes of the reconnaissance survey (chapter four section 4.7) done by the researcher in November 2015 and the official communication of the park (NSNP, 2016), forest, aquatic ecosystems (lakes, rivers and hot springs) and the grassland are the main ecosystems of the park. These ecosystems are hence considered for this assessment.

Step ii: Identify the benefits obtained from the different ecosystems

The assessment involved primary and secondary sources of information. The primary data was collected by making use of the focus group discussions held with the indigenous and local communities. A total of 12 focus group discussions were held with the women, youth and men groups of the society whereby 112 (40 female) indigenous community members participated as sources of information. In these discussions the goods and services obtained from the forest, aquatic and grassland ecosystems were identified by the discussion participants. Official reports from the different stakeholders were also used as a source of information.

Step iii: Categorize the identified benefits under the four ecosystem services categories of MEA (2005)

Based on the outcomes of the focus group discussions, the exhaustive list of the ecosystem goods and services was then categorized based on the four ecosystem service categories of the Millennium Ecosystem Services Assessment Framework (provisioning, supporting, regulating and cultural - as per the detail description of this categories given in the above section).

Step iv: Assess the preference of the communities for the different ecosystems of the protected area

The ecosystem services assessment focused on the forest, aquatic resources and the grassland ecosystems of the park. These are also the resources that sustain the livelihoods of the indigenous and the local communities of the protected area. As discussed in chapter two section 2.6 of this thesis, the different communities (Kore, Gamo and Guji) have different cultural and livelihood settings which in one way or another is directly related to the park's ecosystems that ensure their wellbeing.

Based on the level of perception in terms of community level importance, the different ecosystems were ranked by the participants as high, medium and low whereby, high denoting

commonly used by the community as an essential for subsistence; medium for services that are still vital for survival, but could be found from alternative sources and low representing service that are considered to be non-compulsory, but still helpful for the community. This ranking method was adopted from an ecosystem services research approach done by ICIMOD and RSPN (2017).

Step v: Examine the perception of the communities on the current state of the ecosystem services

The indigenous and local communities are dependent on the forest, water resources, and the grassland ecosystems of the park for the wellbeing of their livelihood. The research examined the perception of the communities on the state of the goods and services which are being obtained from these ecosystems. This exercise mainly focused to assess the historical trend of natural resources degradation of the park caused by the ongoing impact of human activity on the natural capitals of the park. Hence, the focus group discussion participants were asked to explain the current state of for instance forest cover by probing them if it is increasing, decreasing or showing no change. This exercise helped to gauge the perceived state of the ecosystems by the communities and helped to understand the current state of the park's ecosystem services.

Step vi: Producing the report

The views and perceptions of the participants was analysed and compiled in the entire body of the analysis process. Data was cross referenced, cleaned and checked by producing tables, graphs and descriptive techniques.

6.1.2. Data Analysis Processes on the Governance Challenges of the Protected Area

In the context of Nech Sar National Park, since the park falls in between two regional states of the country, the park is being governed by the Ethiopian Wildlife Conservation Authority at a federal government level which is based in the capital Addis Ababa. As highlighted in the conceptual framework (chapter 4 section one), the Governance Assessment for Protected and Conserved Areas (GAPA) was selected as an analytical tool.

It is a framework which helps to analyze governance challenges in the context of protected areas. The framework is solely designed to protected areas as per the IUCN governance principles (Borrini-Feyerabend *et al*., 2013).

The approach helps to identify major governance issues by deeply analyzing the root causes that need to be tackled in an efficient way. The system also helps to establish a monitoring system on the changes of the governance issues across different timelines. While this is fundamental to drawing lessons and take corrective measures at various phases, in the case of Nech Sar budget and institutional capacity may appear to be bottlenecks for measuring the changes over time since it is an ongoing work.

The assessment can be done from data obtained through focus group discussions, interviews, and validation workshops. GAPA in general is simple, cost effective and rapid governance assessment approach which is designed to capture governance strengths and challenges.

Based on the nature and context of the protected area, analysis can be done by considering the relevant principles which best suit the context of the protected area out of the good governance principles which are designed to cover different sets of protected areas. Accordingly, the following governance principles were used to assess the governance challenges in Nech Sar.

Good governance principles of GAPA **(**Franks and Booker, 2018:14**)**

1. Effective and fair enforcement of laws and regulations
2. Benefits equitably shared among relevant actors based on one or more agreed targeting options
3. Full and effective participation of all relevant actors in decision making
4. Achievement of conservation and other objectives
5. Effective coordination and collaboration between actors, sectors and levels

GAPA and SAPA has also five distinct interrelated phases which will help to analyze governance related challenges of protected areas (Figure 64).

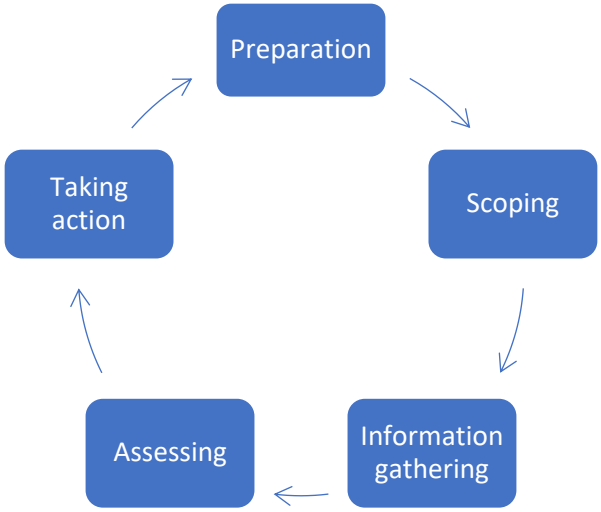


Figure 64: Phases of GAPA (adopted from Franks *et al*., 2014 and Franks and Booker 2018)

In executing GAPA and SAPA one has to go through the preparation, scoping, information gathering and action taking stages of the framework (Figure 64). Cognizant of these stages the assessment of this research has gone through the preparation phase whereby all the necessary procedures such as formalizing the research with the park authority through the signing of an MoU and establishing network with the park management and other stakeholders such as the office of agriculture for their help in the provision of data throughout the research.

As part of the scoping phase the researcher conducted a reconnaissance survey by making use of field tours in the park, observations and discussions with the park authorities and local communities. This phase helped the researcher to ensure that the park authorities (both at head office and park office) have a proper understanding of the research and for the researcher to fulfil all the required legal and ethical pre-requisites to undertake the research inside the park by signing a Memorandum of Understanding with the Ethiopian Wildlife Conservation Authority (EWCA).

The researcher then utilized data collection methods such as interview with policy makers and park officials and deployed focus group discussions to solicit information from the local and indigenous communities of the park. Questionnaire were also administered for the operational and management staff of the park. Information was assessed by probing what is working? What

is not working? And why? This has enabled to identify the major governance issues under each good governance principles.

A 3 days stakeholders' workshop was also held by engaging key technical professionals which are related to the governance and management of the park. In the workshop the problems were analyzed by making use of the problem tree exercise (Annex 15) which helped to identify the root governance causes that aggravated the natural capitals degradation of the park.

Going through these above phases has also enabled the GAPA framework to be action oriented at the end since deeper analysis of the governance challenges has enabled the researcher to generate ideas which will help to counteract the identified governance challenges through the implementation of proposed strategic approaches.

6.1.2.1. Thematic Data Analysis Processes and Tools from Focus Group Discussions, Questionnaires and Interviews

The main purpose of thematic analysis is to identify themes or patterns from a given set of information which are central to a research objective and interest. The approach is also more than drawing summaries of the available data since thematic analysis is focused on interpreting the data by making sense of it. It is, however, known to consume a considerable amount of time and has the tendency of using the interview and other sets of questions as the thematic points (Moira and Brid, 2017).

Clarke and Braun (2014) in Neuendorf, (2019:213) presented a six-stage analysis process and the researcher deployed these stages as it outlines a clear framework for conducting thematic analysis as follows:

1. **Familiarizing oneself with the data (text, transcriptions) and identifying items of potential interest**

Analysis of the qualitative data in identifying the governance challenges of the protected area was started by transcribing the outcomes of the focus group discussion (held with the youth, women and men groups), questionnaire and semi structured interviews with the different stakeholders

and park authorities. The discussion notes were transcribed for coding purposes and this process has helped the researcher to have a look at the patterns of the data.

2. **Generating initial codes**

Clarke and Braun (2014) mentioned that, generating the initial codes will help to identify the important features of the data at hand which are relevant to the research theme. It is also a stage which will help to apply the codes to the dataset by segmenting and tagging it constantly. The process also helps to collate the codes across the different segments of a given dataset.

As part of the coding process, this has helped the researcher to have a general overview of the overall dataset and has given him the chance to identify the preliminary themes developing from the data. These transcriptions were printed to enable an in-depth familiarization and understanding and initial coding by making use of pencils, pens, coloured markers, pictures, post-it-notes and papers. Due to the volume of data handled for this sub-section, the analysis was done manually.

The initial codes were comprised of one word or a phrase which summarize a cluster of quotes that emerged from the focus group discussions, questionnaire and interviews. The codes were also framed into a coding framework by defining each code as well as quotes that echoed the specific thematic areas (refer to the below Table 39 for examples).

3. **Searching for themes; examining the codes and collated data to identify broader patterns of meaning**

The researcher has reviewed the identified codes and grouped them under potential themes and sub-themes by making use of tables. A range of themes and sub-themes emerged from a significante emergence of codes from the transcripts of the focus group discussions and interviews with the officials. This helped the researcher to describe and define the themes.

The focus group discussions indicated that words like deforestation, invasive plants, lack of community participation, and no benefits from the park are mentioned significantly. The transcripts of the interviews with the officials of the park and stakeholders also indicated that deforestation, expansion of invasive plants, decrease of wildlife, weak coordination, lack of

community participation, no benefits shared with the local communities, etc. were the most repeated words (Table 39 for the example of codes and themes).

4. Reviewing themes

Reviewing the themes helped to apply the potential themes of the dataset in determining whether they have a concrete story that responds to the thematic areas of the subject under study (governance challenges). In line with this, themes were rejected, split, combined or refined (Andrew, 2018). This helped to structure the progress towards organizing the information for the writing of the process. Hence, this phase of the analysis involved the repeated reading of the information and review it to check whether it is in harmony with the identified themes. This process has enabled for the notes to form shape that are ready for the analysis against the GAPA principles described below.

5. Defining and naming themes; developing a detailed analysis of each theme

The researcher was able to develop a detailed analysis of each theme at this stage by defining the identified themes along with the information captured by each theme. At this stage, it was also identified if there are sub-themes embedded under each theme. This process has enabled the accurate revision and identification of the themes. As mentioned earlier, resources degradation / conservation objectives, lack of community participation in management and governance, no benefits shared for local and indigenous people, and weak law enforcement were among the fundamental themes. The summary of the coding process which helped to identify the governance and management impediments of Nech Sar National Park is presented in the below table (40).

Table 40: Coding process to assess the governance impediments that affect the natural capital of Nech Sar (template adopted from Andrew, 2018)

Example of quotes	Example of codes	Sub-theme mapping against data	Themes mapping against data
The forest cover of the park is dwindling from time to time due to deforestation	Deforestation	Human activity	Resources degradation / Conservation objectives
Nech Sar National Park used to be	Invasive plants		

Example of quotes	Example of codes	Sub-theme mapping against data	Themes mapping against data
Nech (white) like its name but now covered by the invasive Abutilon.			
There used to be a range of wild animals but these days one can hardly see them except the Zebras	Decreased wildlife		
There is no any opportunity or arrangement for the participation and engagement of the community in park management.	No local community participation	Low level of community ownership	Community participation in management and governance
We have not been engaged in park development activities with the exception of taking part in road construction through the cash for work kind of programme.	No local community participation		
The park is being governed by the Federal level park authorities only.	Governance by federal authorities	Top-down approach	
Revenue generated from the park is directly being channelled to the Federal financial system.	Revenue	No local level benefits sharing mechanism	No benefits shared for local and indigenous people
We never get any livelihood development support from the park	Livelihood development support		

Example of quotes	Example of codes	Sub-theme mapping against data	Themes mapping against data
The park has not provided us any form of training opportunities	Youth Unemployment		
We are willing to be engaged in any form of livelihood opportunities which can be provided by the park or others	Livelihood opportunities		
The regulations and proclamations in many cases remained as a shelf paper and they are not being effectively implemented.	Weak regulations implementation	Resources degradation	Weak law enforcement
Law enforcement, capacity building and infrastructure development in many protected areas are extremely far below expected performance.	Weak capacity		
The delays of the legalization of the park boundaries that need federal and regional government's decision is among the prime contributing challenge that affected the placement of effective coordination arrangements among the stakeholders.	Park boundary	Resources degradation	Coordination among stakeholders
Even the political leaders and federal and regional	Low level of political commitment		

Example of quotes	Example of codes	Sub-theme mapping against data	Themes mapping against data
governments commitment is very low or not away from oral hopes and in many cases the management and governance activities are left for the inefficient grass-roots level protected area offices and scouts.			
The police, justice and other law enforcing bodies do not coordinate in protecting the natural resources of the park.	Weak coordination among stakeholders	Low level of law enforcement	

6. Producing a report

The final stage of the analysis is the weaving together of the analytic narrative and data segments by relating the analysis to extant literature. Thus, these key emerging codes and meanings of the protected area governance challenges were analysed by making use of the Governance Assessment for Protected and Conserved Areas (GAPA) guiding thematic principles described below.

1. Effective and fair enforcement of laws and regulations

This principle is designed to assess the effective implementation of laws and regulations which includes assessing the level of awareness on regulations that govern the protected area.

2. Benefits equitably shared among relevant actors based on one or more agreed targeting options

Sharing the protected areas related generated benefits among the local and indigenous communities is believed to be one of the protected areas good governance principles that can help to ensure their sustainable development. Thus, this principle is aimed at assessing the benefit-sharing schemes that could help to provide benefits for the local communities.

3. ***Full and effective participation of all relevant actors in decision making***

Another key good governance tool is the effective participation of actors who have stake in the governance and management of the protected area. In the case of this principle the participation of local and indigenous communities in decision making, management and governance activities will be given a major emphasis.

4. ***Achievement of conservation and other objectives***

This principle is focused on the achievement of the site-level objectives over which the concerned institutions have a control. In the case of Nech Sar this principle will be assessed based on the current state of the natural capitals of the park as per the findings of the ecological assessments of this thesis.

5. ***Effective coordination and collaboration between actors, sectors and levels***

The effective coordination and collaboration among actors which includes sharing of information, defining mandates, coordination in law enforcement, collaboration among regional states of the country, etc. issues will be assessed under this principle.

6.2. Ecosystem Services of the Protected Area

As indicated in the data processing section of this chapter the ecosystem services assessment followed the following stages (i) identify the main ecosystems of the protected area (ii) identify the benefits obtained from the different ecosystems (iii) categorize the identified benefits under the four ecosystem services categories of Millennium Ecosystem Assessment Framework (iv) assess the preference of the communities for the different ecosystems of the protected area (v) examine the perception of the communities on the state of the ecosystem services and (vi) producing the report. The findings of the research will also be presented by following these stages (ICIMOD and RSPN, 2017).

6.2.1. Major Ecosystems of Nech Sar National Park

Based on the outcomes of the reconnaissance survey (chapter four section 4.7) done by the researcher in November 2015 and the official communication of the park (NSNP, 2016), forest, aquatic ecosystems (lakes, rivers and hot springs) and the grassland are the main ecosystems of the park which are considered for this assessment. The following section will discuss the different services provided by these ecosystems.

6.2.2. Ecosystem Services of Nech Sar National Park

Based on the Millennium Ecosystems Assessment framework category of ecosystem services, the ecosystem services of the park are categorized in the below table as provisioning, regulating, supporting and the cultural services (SCBD, 2019; MEA, 2005).

Table 41: Summary of the ecosystem services provided by Nech Sar

Category of Services	Type of goods and services
Provisioning	Drinking water, fish, fuelwood, charcoal, medicinal plants, wild fruits, grazing, fodder and sand.
Supporting	Habitat for wild animals, habitat for the general biodiversity resources, hydrological cycle, local and national economic development, tourism, livelihoods.
Regulating	Climate regulation, carbon sequestration, stabilizing the land, ground water recharge, and water purification.
Cultural	Holy water, aesthetic value, ecotourism, recreation, education, research.

Details of the goods and services obtained under the four categories of the ecosystem services will be presented in the following sections.

6.2.2.1. Provisioning Services

The provision services of the park include drinking water, fish, fuelwood, charcoal, medicinal plants, wild fruits, grazing, fodder and sand. Details of these services are provided as follows.

Water Supply: The major portion of Arba Minch's city drinking water comes from the "Forty Springs" which are located inside the Ground Water Woody Vegetation of the park. The water from these springs is tapped and pumped by a generator into six water reservoirs which has a total capacity of storing up to 3,400 cubic meters of water (AMCOWS, 2017). In supporting this report, the Warden of the park said that "potable water will be pumped into these reservoirs on daily basis and it is from these reservoirs that water flows into the households of the town of Arba Minch through the pipeline network".

According to the official reports of Arba Minch town water supply office, from these reservoirs on average the water flows from 110-360 liter/second (AMCOWS, 2017). Interview discussions with the representative of the city water works office confirmed that, this water supply which comes from the park ecosystem covers about 50% of the water supply to the city of Arba Minch. He also added, as the other sources of water for the city include household level deep water wells since the water which comes from the park resources is not in a position to meet the water demand of the increasing population of the town.

On the other hand, the focus group discussion participants (Guji and Kore) when asked as to where they are getting drinking water, they said that:

We are using springs as a source of water in satisfying the water needs of our households.

Scientific research affirms the association between the existence of forest resources and availability of clean water (Aramde et al., 2012). This phenomenon is also clearly manifested by the existence of clean water sources in the ground water woody vegetation of Nech Sar whereby forty springs emanate from a single location. However, as discussed in the previous chapter, the density of the ground water vegetation is decreasing significantly because of over exploitation in meeting the household energy demands of the locality. In line with this, based on the information from the Chief Warden and operational staff of the park, the amount of stream flow from these springs have showed a significant reduction because of the ongoing deforestation. Further to that, the Gamo focus group discussion participants who live in the nearby of the ground water vegetation indicated that the water from the forty springs used to flow directly into lake Chamo and served as one of the water supplies for the Chamo lake ecosystem. However, although it is subject to detailed studies, it is also clear that, the construction of the new water reservoirs

which tap the water resources of these springs will have a direct impact on the amount and quality of fresh water supply to the downstream aquatic and terrestrial ecosystems of the park. A recent information from the Chief Warden of the park (November 2019) also indicated that due to water shortage that used to come from the springs of the park, water is currently being pumped in to the five reservoirs only. In addition to that, he also indicated that because of this impact the town is presently facing a significant shortage of potable water supply in meeting the water demands of the inhabitants.

Fishery: Although the researcher was not able to get a recent evidence, lake Chamo and Abaya are known to have a strong potential of fishery resources in the country. Official study done by FAO (1995b) indicated that lake Chamo and Abaya have 3,500 and 9,800 metric tons of potential annual yield respectively. Even though, studies that inform the current potential of the fishery sector of the lakes are lacking, the information gathered from the fish producer association leaders indicated that, this potential is significantly reduced because of over-fishing and lack of the enabling policy and regulation environment that ensure the proper management of the fishery sector. This include the shortage of fishing technologies (cooling, storage and transport facilities) and the weak law enforcement and institutional framework that could help the sustainable development of the fisheries industry. Despite these bottlenecks, the lakes are contributing for the nutrition and food security endeavours of the area. The official catch from the lakes is presented in the below Table 42.

Table 42: Fish Production in Lake Chamo and Abaya (Ton) (GGZOF, 2017)

S.N.	Year	Lake Abaya	Lake Chamo	Total
1	1993	270	342	612
2	1994	270	519	789
3	1995	340	2,138.1	2,478.1
4	2003	216	1,712	1,928
5	2004	213	2,519	2,732
6	2005	186	2,329	2,513
7	2006	168	2,017	2,185
8	2007	176	2,202	2,378
9	2014	444	*	444
10	2015	898	2,462.25	3,360.25
11	2016	723	3,149.52	3,872.52

* data not available for the year 2014

From the above table, it is evidenced that there exists increased fish production on yearly basis which indicates that the local communities are getting more livelihood and additional income generation from the fishery sector. This is mainly observed in the year 1995 where the establishment of fish producer associations have resulted the increase in production (GGZOF, 2017). Because of their proximity to the lakes, fishing is mainly performed by the Gamo communities since the other communities are situated on the other extreme ends of the park. There are established fish producer associations and usually fishing activities in the lakes is performed through the legally recognized associations. These associations are performing the fishing activities by adhering to the rules which includes the use of a government recommended net size which catches only the mature fish.

The associations have also storage facilities and business management offices in the town of Arba Minch which perform the marketing and overall administration of the businesses. As per the information obtained from the leaders of the associations, about 60% of the catch will be dispatched to Addis, the capital while the rest is destined to satisfy the local need. The profits are being shared among members of the associations. However, there are also individual young men who are doing the fishing activities in an illegal way as they make use of smaller net sizes which catch baby and smaller size fish which will have a direct impact on the sustainability of the sector. The produce of the illegal fishermen is meant for the local market.

Respondents of the focus group discussion also mentioned that, the benefits of the fishery activities enhanced the dietary diversification for members of the household by providing rich sources of protein which contributes to enhance the health and wellbeing of the family. In addition to that, the respondents indicated that the sector also contributed to enhancing the income of the households participating in the fishery sector and have better access to health care and education services for the family members.

When explaining the benefits of the fish producer associations, the administrator of the Chamo Fish Producer Association said that "the fishery sector also contributed for the development of social networks among the producers since the members share challenges and opportunities of life". He went on saying that "the establishment of the associations helped to have members who are steward to the water resources". This is mainly because the associations helped to create a

better understanding among the members on the benefits of the lakes on the general wellbeing of their household through improved dietary supply and income generation opportunities.

These cooperatives and associations provide specific benefits to the community including strict environmental practices to be observed by all persons of the cooperatives involved in the fishery sector. This includes conducting the harvesting practices by adhering to standardized use of net size that ensure to catch matured fishes only and pave the way for the immature fishes to slip through the nets. This contributed tremendously to reduce over exploitation of fishes in the lake. This has also favoured to have a continuous supply of fish on yearly basis (as shown in Table 30).

When explaining the impact of the fish producer associations, the representative of the livestock and fishery development unit of Arba Minch city office of agriculture said that "the fisheries associations promoted to adhere into proper hygienic standards, handling, packaging and preservation of fishes in the area". Apart from this, the establishment of cooperatives has helped for the establishment of fish processing businesses.

The emergence of such privately run businesses have also created employment opportunities in the locality and should have also contributed to local economic development ventures. In one way or another, the establishment of such businesses which are based on the ecosystem services of the park is believed to relieve a certain portion of the local community's livelihood dependence on fuelwood collection from the park. Such innovative activities have to be encouraged by policy and decision makers since this are the type of livelihood development activities which can relieve the ongoing degradation of the park's natural capital. For these emerging businesses, the creation of the enabling policy environment such as provision of space or land for the business, energy supply, training, and access to credit services could be considered by the concerned government authorities. This will pave the way for maximizing the benefits which can be accrued by the local communities in one hand and lowers down the increased dependence of the communities on the natural capitals of the park.

On the other hand, the park officials and the management of the fishery cooperatives explained that, one of the major problems facing the fishery sector in the lakes is the prevalence of illegal fisher folks who are not adhering to the fish catching and production standards. These illegal

fishermen are accessing the lake at night times and hide themselves in the islands that are found in the remote corners of the lake.

The researcher managed to meet one group of them in one of the islands in November 2016 (Figures 65 - 67). The researcher approached a young guy who sell fish in the market and asked him if he could help to enable the researcher in meeting his crew. Since the guy noted as the researcher is a stranger with no harm to them, he was willing to take the researcher to the island. We hired a small motorboat in reaching the island.

Figure 65: One of the remote islands in lake Chamo where the illegal fishermen are hiding

Based on the interactions with them, they mentioned in one voice as they are looking only for income generation opportunities by risking their lives as they have to hide in caves which they dug in the islands whenever the park rangers are on duty. These young group of people belong to the local communities but, they mentioned that they do not have any livelihood asset to sustain their life in a legal way.

Figure 66: Fishing gears of the illegal fishermen

They do not also have the opportunity to be part of the fish producer associations since those cooperatives are already saturated by a considerable number of members. Those legally recognized cooperatives also have their own fishing zones and part of the lake is dedicated to the protected area as part of the biodiversity conservation efforts and no fishing activity is permitted in the part of the lake. It is also believed as the portion which is under the park will help to maintain the reproduction potential of the fishery resources and reduce over exploitation.

According to the park officials and the management of the cooperatives, the illegal action of this illegal fishermen is causing for the significant reduction in the availability of fish in the lake. They catch baby fishes by lowering the standardized net size and take them directly to the market without fulfilling hygienic and produce handling standards (Figure 67). Because of this, unlike the earlier time, members of the cooperatives have to spend more time in the lake to perform the fishing activity to their threshold level and this has caused for them to have less time which they are supposed to spend for other household activities and other additional income generation ventures.

Apart from this, the over exploitation of the aquatic biodiversity resources including catching baby fish would have a severe impact on the continuity of life inside the lake. As for instance, the lake is known to harbour the highest number of Nile Crocodile, however, with this increased exploitation of fishes these aquatic animals may face shortage of fish which they used to prey on and their number may reduce soon. As a result of this, the tourism potentials of the lake would also face a severe consequence and have its impact on local as well as regional economic development ventures.

As can be seen from the below pictures, they do not also follow the hygienic procedures when handling the produce. For instance, they do not have cooling and transport facilities which could have added value on their product as the case of the cooperatives.

Figure 67: Improper handling of the catch being practiced without hygienic measures

Thus, concerned authorities could challenge this (a) through awareness development of the public on the health-related impact of consuming such unhealthily produced fish (b) finding ways which can help to integrate these illegal fishermen into the existing cooperatives (c) creation of other ecotourism related employment opportunities in the area. In summary, although this issue is emerging as an important development challenge within the protected area, this was outside of the scope of this study and further research would help to find other well researched solutions which can help to maintain the sustainable development of the aquatic resources of the protected area.

Medicinal Plants: In Ethiopia, it is estimated that about 80% of the population are practicing indigenous knowledge based traditional medications which are mainly extracted from plants (Kalayu *et al*., 2013; Bekele, 2007; Dawit, 2001). The traditional medicinal values and benefits of plants will continue to be used by people who do not have the potential and access to modern health facilities (Nwachukwu *et al*., 2010).

In line with this, an elder who participated in the focus group discussions said that:

most of us are dependent on the plants of park to treat ours [humans] and cattle diseases.

He further pointed that:

these plants are used by households who have the traditional knowledge and none of these plant extracts are being traded by any members of the locality for commercial purposes.

Participants of the FGD mentioned that, extracts from *Acacia mellifera* (for treating ringworm) *Aleo vera* (for joint pains and as a deworming), *Balanites aegyptiaca* (constipation and other

intestinal problems), *Croton machrostachys* (for skin infection), *and Solanum incanum* (treat livestock infected with water borne parasites) are among the major plants which are being used as a local remedy to treat health complications by the indigenous community.

In addition to this, the different parts of these plants are also used for processing food items in the household. In the preparation of local drinks such as 'Tela' and 'Tej' adding a small piece from the root of *Tamarindus indica a*long with the main ingredients of these drinks is known to enhance the fermentation process and make the drinks ready in a short period of time. Different trees are also known to provide wild edible fruits in the area, the fruits of *Balanites aegyptiaca* as for instance, are mentioned by respondents for being edible by humans as well as animals (details to be given in the below Table 43 which lists the medicinal plants of the park).

In terms of availability, based on the ecological studies of this thesis, none of the medicinal plants are among the dominant tree species of the park. Though it is subject to further research, it might be associated with the over exploitation of the park's vegetation in meeting the energy demands of the area. To mention some, trees like *Croton machrostachys* which are known to cure skin infections and *Carisa edulis* are not easily available in the park.

Although one could identify serious potential in terms of the medicinal benefits provided by these plants as explained above, the researcher has not identified any organized indigenous medicinal plants producer's association or industry in the area. These indigenous medicinal plants production and use is globally a multi-billion dollars industry as observed in the case of Vietnam, China and India (Rizwana *et al*., 2009; Chandra, 2005; and Thang and Jeff, 2005). Therefore, one can see that proper development of indigenous medicinal industry has tremendous potential for the generation of foreign exchange earnings. Hence, the Nech Sar National Park authority may wish to work with local and indigenous associations as well as national state stakeholders to consider the development of indigenous medicinal industry. The benefits that can be derived from such industry can provide financial and other benefits that have the potential of generating income to contribute to the up-keep of the park as well as enhancing sustainable livelihoods and household income which will help to reduce the impact of poverty on communities and their increased reliance on the park's natural capital. Further research on this issue could also help to

develop the sector as a viable income generation potential for the local communities as well as for the creation of local and regional economic development opportunities.

Table 43: List of Nech Sar National Park Plants Serving as Medicinal and other Benefits (source – FGD discussion with the men group)

S.N.	Scientific Name of the Plant	Amharic Name	Methods of Utilization
1	*Croton machrostachys*	Bisana	The extracts from the youngest leaves can be applied directly to the skin so as to cure wound and other skin infections.
2	*Balanites aegyptiaca*	Bedeno	The fruits of the plant are edible by humans and animals and it helps to treat intestinal problems. The inner part of the bark will also be boiled with water and be taken as a drink so as to treat constipation and other intestinal sicknesses.
3	*Aleo vera*	Eret	The leaves of the plant will be heated by the flame of a fire and will be left for a while to cool down; then the leaves will be squeezed to extract juice from them. The extract will be mixed with Fenugreek and drinking water. It is well known to deworm Ascaris, tapeworm, etc. It is also used to treat joint pains.
4	*Acacia mellifera*	Tikur kontir	Younger stem will be put on fire on one side of the stem only and the watery extract will be collected from the other side of the stem and will help to treat 'Chirt' (Ringworm), 'Quaqucha' (Tinea versicolor) and other skin infections. Some also rub and dress the infected skin with the Latex of the leaves.
5	*Cordia myxa*	Wanza	The leaves of Cordia have a coarse surface and when rubbed on infected skin along with its extracts it will help to treat skin infections like Ringworm and Tinea versicolor. The fruits of the plant are also edible by humans.
6	*Solanum incanum*	Embuay	The roots of the plant are useful to treat human intestinal problems. The bark of the root will be removed and the solid part of the root will be soaked with salty water and then chewed and swallow the juicy extracts from the solid root so as to get relieved from intestinal problems. In addition to this, Solanum also helps to treat cattle affected by water born worms as they usually go to streams and rivers to drink water. Thus, boiling the matured fruits until the color is changed to brown, then letting it to cool for a while and then cover the fruit with clean piece of cloth and squeezed so as to get the juicy extracts. The extracts

S.N.	Scientific Name of the Plant	Amharic Name	Methods of Utilization
			will be sprayed in to the nostrils of the affected animal which forces it to have a deep sneeze and that will force the water born worm to come out of the throat.
7	*Tamarindus indica*	Korie	The roots of the plant are well known to help the preparation of local alcoholic drinks like 'Tela' and 'Tej'. Along with the main ingredients of these drinks adding a piece from the roots of the plant will help to fast-track the fermentation process and make the drinks to be ready in a short period of time.
8	*Quadra angulares*	Bale arat maezen hareg	When water is added on the roots of the plant there will be a thick mucus secretion from it. This extract from the roots of the plant are mainly used to treat livestock from coughing and relieve them from lung related infections.
9	*Salvadora*	Yeharer Mefakiya	The roots of the plant can be used as a tooth brush and the extracts can help fight bad breath as well as bleeding of the gum. It is also known to fight weak sexual performances.
10	*Grewia villosa*	Tey	The inner part of the bark can be used as soap and it also helps to smoothen human skin and hair.
11	*Carissa edulis*	Agam	The extract will be prepared by boiling the fruits with water until the inner seeds are separated from the flesh. Once the seeds are separated from the flesh, the seeds will be removed and the remaining part will be mixed thoroughly with 'Kocho' (false banana) and milk and get boiled again altogether and taken as a drink to treat women's breast pain as well as to relieve from joint pains.
12	*Vernonia amygdalina*	Girawa	The younger leaves will be crushed and mixed with a glass of water for drinking. It is highly remedial for deworming as well as intestinal complications.

Other Benefits: Even though, the protected areas policy and strategy of the country does not allow extractive uses from the park, the indigenous communities are also getting water, forage and grazing pasture for their livestock from the park resources. This could have been done in a sustainable way without affecting the natural ecosystems of the park such as the establishment of buffer zones which could benefit the local communities and reduce the reliance on the strictly protected areas of the park. However, since the park is running without a management plan most of the resources are still being over exploited in unsustainable way. According to official reports

of the park, a total of 193,410 livestock are directly dependent on the park's resources as their source of feed (NSNP, 2016) (Table 44).

Table 44: Livestock Population Data in and around Nech Sar Park (2016)

S.N.	Name of Kebele	Cattle	Goat	Sheep	Horse	Donkey	Mule	Total
1	Ergensa	87,838	18,952	6,823	10	7,224	4	120,851
2	Derbe Menene	5,200	4,067	5,675	388	264	43	15,637
3	Tifetie	4,902	3,236	959	90	209	23	9,419
4	Yero	3,789	2,096	789	23	245	-	6,942
5	Alfacho	6,989	3,451	1,211	-	129	2	11,782
6	Abulo	1,611	753	36	-	112	-	2,512
7	A.M City	13,498	9,028	3,437	-	304	-	26,267
	Total	123,827	41,583	18,930	511	8,487	72	193,410

Source: data collected from Kebeles and Office of Agriculture

Although, there exists a communal grazing land for the community to graze their animals, there are two major factors that prevent pastoralists from using the resources. The primary factor is that, it is completely denude of grass and fodder because it is significantly over-utilized beyond the carrying capacity of the resource. According to the above table (Table 44) about 193, 410 animals are grazing in the land. The second factor is that, pastoralists are more attracted to illegally take the animals to graze in the grasslands due to (a) the availability of the abundance of grass and herbs and (b) availability in the abundance of water for their animals at the lakes. These will provide pastoralists with the opportunity to either engage in fishing in the lake or dealing with exploitation of the forest as a way of acquiring another form of livelihoods.

In the case of these indigenous communities without consideration of the quality aspect, owning higher number of livestock is an indication of wealth where one can get prestige values in the society for being rich. It also seemed as these communities are still leading the traditional pastoralist way of life. They move from one place to the other in search of feed and pasture.

The concerned government authorities such as the office of agriculture has not also challenged this way of life and pave the way for them to practice modern agriculture such as reducing the number of livestock and focus on quality aspect so that they will also earn a better income from their livestock products and by-products (milk, butter, etc.) than counting the number of cattle they own. Formation of cooperatives could have also helped to organize themselves and establish a proper business which would help them generate more income through access to financial services. But, the authorities do not seem responsible in taking such actions since they are considering as this challenge has to be resolved by the park authority itself.

The focus group discussion participants mentioned that, the forest of the park is also serving as a source of wild fruits. The fruits of *Balanites aegyptiaca* and *Cordia myxa* are among the widely used fruits. In line with this, a senior official (P19) said that, the local communities, due to their pastoralist way of life, they do not exercise vegetable crops production inside the park as the vegetable crops production needs an intense and sedentary follow-up, however they practice cereal crops production such as maize, wheat and teff since their production does not require intense management as the case might be for vegetable crops.

During the ecological assessment transect walks of this thesis, the researcher also observed that apicultural activities are being practiced by the local communities. The researcher also noted as communities use traditional beehives to produce honey in the different patches of the forest. But, this activity is not widely practiced in the park. However, apicultural development activities could also help to leverage local economic development activities as the nature of the activity is very friendly to the environment. The supporting ecosystem services of the park will be discussed in the following section.

6.2.2.2. Supporting Services

Nech Sar National Park is cherished with diverse ecosystems and biodiversity resources which have local and global importance. 20% of the country's biodiversity resources are only recorded in the park (Simon, 2016; Shetie *et al*., 2015; NSNP, 2016). Thus, the park is providing a supporting service for the existence of a wide range of wild animals as well as floral species.

From the country's wildlife species, Nech Sar National Park hosts 91 mammal species, 351 bird species, 16 fish species, 33 reptile species and 700 to 1000 plant species in its hotter climate

condition of the Great Rift Valley region (Simon, 2016). This indicates that the site highly contributes for the country's development in wildlife related tourism activities. Burchelle's Zebra, Grant's Gazelle, Greater Kudu, Lesser Kudu, Bush Back, Swayne's Hartebeest, Common Warthog, Common Bushbuck, Columbus Monkey, Anubis Baboon, Guanter's Dikdik, Water Buck, Common Duiker, black backed Jackal, Gervet/Vervet Monkey, Leopard, Lion, Spotted Hyena, and the African civet cat are among the wild animals of the Park (Abraham and Bayisa, 2015).

Hence, it is possible to evaluate as the park hosts diverse ecosystems and landscapes that host an active biological ecology which contributes its part for the wellbeing of humanity of the nearby areas and beyond through biodiversity conservation and provision of ecosystem services.

According to park records, this has also helped a lot in local economic development and employment generations at different levels. Official data from Nech Sar Park records showed that, the number of tourists has grown from 1,047 in 1994 to 37,570 in 2016 (Figure 68). Total income from entrance fee at the main gate of the park has grown from 27,185 Ethiopian Birr in 1994 to 1.6 million Birr (equivalent to $71,428) in 2016. The daily average number of visitors has increased from 57 in 2013 to 108 in 2016 (Annex 11).

From the local communities' perspective, the supporting ecosystem services of the park are yet to be tapped and benefit the communities through income and employment generation opportunities. For instance, presently there are no any ecotourism activities performed by the local communities that could have supported the economic potentials of the localities. Currently, it is only the private sector through the establishment of lodges and hotels are taking advantage of the tourism potentials of the area.

According to the Gamo Gofa Zone Culture, Tourism and Communication Affairs Department 2016 annual report, visitors coming to Nech Sar are only about 30% of total visitors coming to the city of Arba Minch since, the city serves as a transpose to continue down south of the country and visit other parks and touristic sites in South Omo. Therefore, this indicates as the park authorities have to do further promotional works so as to attract the remaining 70% of the tourists to visit the park and generate additional revenue from the tourist flow.

The additional revenue that can be generated by the additional tourists visit could be used to benefit the community through the establishment of public services such as health facilities and schools. Such additional financial resources can also be used to employ more park rangers to enhance the protection of the park's resources.

In addition to that, if the park can tap the tourist flow potential, it will be able to generate more income that could be used to fund community awareness development programmes on the importance of the park and the benefits that can be accrued from conserving such resources. However, the increase in tourist flow to the park can also have its disadvantages if not managed in a responsible way. Increasing in visitors flow to the park would result in increasing garbage and sewerage problems as a result of more people coming to the park. This can lead to the degradation of biodiversity and ecosystem services. Hence, the park needs to have a plan which would help to address pollution and the aforementioned challenges that could emanate from the increasing number of visitors in the park territories. The following section will discuss the regulating services.

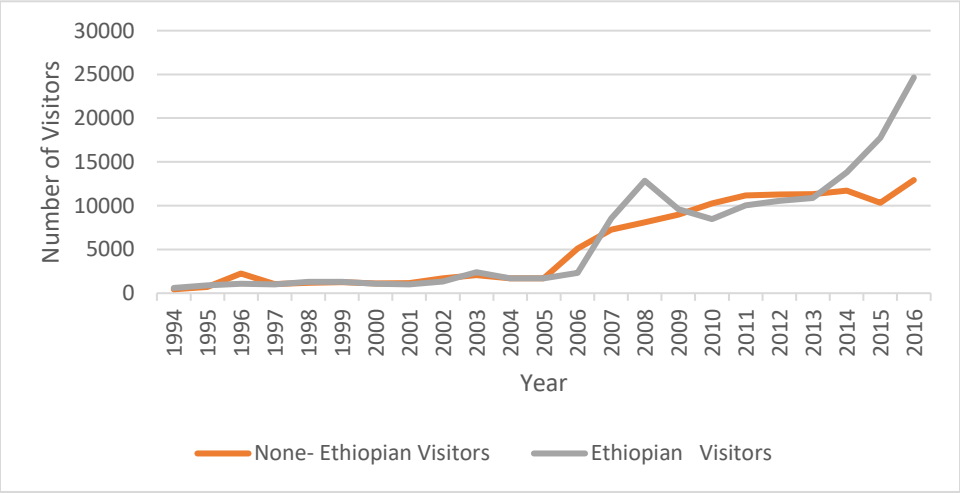


Figure 68: Nech Sar National Park visitors flow (1994 – 2016) (Compiled from park records)

6.2.2.3. Regulating services

Located in the floor of the Rift Valley, the area has a low altitude range that contributes for high temperature ranges. However, the existence of the park's forest and aquatic ecosystems have

helped to moderate the harsh climatic conditions which could have affected the area because of its geographical location in the lower altitudes of the Rift Valley (NSNP, 2016).

In the case of the local and indigenous communities, however, they were not able to relate the role and relations between the existence of the park's natural capital and the creation of the favourable climatic conditions in the area. They seem to be unaware on the importance of the resources of the park (forest, lakes, etc.) towards climate regulation. However, they were able to point out that the trees are helping to serve as shade for their livestock during hot periods. As a result of this, the researcher noted that the importance of the park's ecosystem services towards climate regulation is still unnoticed by the local communities and a lot of awareness development work have to be placed with utmost urgency.

The operational and management staff of the park and the other local and national level stakeholders interview participants, however, clearly mentioned as the Park is playing a significant role in terms of climate regulation, carbon sequestration, ground water recharge, and water purification.

Because of its location in the Rift Valley region, the surroundings of the city are facing land slide and land fracture problems. However, the park warden mentioned that, the existence of the ground water woody vegetation has helped to stabilize the landscape of the city and its surroundings.

An economic valuation carried out by GEF/UNDP/EWCA (2015) estimated the total economic value of ecosystem services provided by the different protected areas of Ethiopia. Accordingly, the contribution of Nech Sar National Park in terms of economic values is estimated to be $63,020,818 on annual basis (details on Table 45).

Table 45: Nech Sar's National Park current annual values associated with the different ecosystem services.

S.N.	Ecosystem Services	Description	Economic Value
1	Current biomass carbon stock	Total carbon stock (tonnes)	1,058,501
2	Current value associated with carbon stocks	Total annual value in $	55,062,905
3	Values associated with harvesting of natural products	Total annual value in $	894,560
4	Medicinal plant harvesting in EWCA protected areas	Total annual value in $	141,976
5	Watershed protection services	Total annual value in $	1,542,311
6	Values associated with grazing	Total annual value in $	807,577
7	Pollination and pest control services	Total annual value in $	76,461
8	Values associated with tourism in EWCA protected areas	Total annual value in $	4,359,461
9	Cultural and existence value	Total annual value in $	135,567

Extracted from GEF/UNDP/EWCA, 2015

6.2.2.4. Cultural Services

Forest resources have a significant role in providing cultural services to local communities and different societies. Recreation and spiritual renewal are some of the values which emanate from the aesthetic beauties of the park (Ahebwa and Van, 2013). In line with this, the local and indigenous communities of the park also believe as the hot springs are holy water that helped them to treat different sicknesses. From academic perspective, the park can help with the promotion of knowledge on nature and sustainable development. The indigenous and traditional life of the indigenous communities is also another untapped ecotourism potential which can help to contribute local economic development efforts.

Recreational benefits such as hiking, physical exercise, etc. which could have helped to create a healthy community are some of the activities that could be promoted by park's authority working in collaboration with local communities. However, due to the management practices of Nech Sar

Park, locals will find it difficult to enter in to the park formally since everybody entering the park is required to pay the entrance fees at the gate and hence only externals and well to do people can only afford this if one has to make a frequent visit to the park to exploit the recreational benefits. This situation has also induced for people to enter into the park territories in an illegal way. All these factors have contributed to the negative perception and lack of ownership of local and indigenous people towards the park.

Since the local and indigenous people cultural life, traditions and way of life is relatively undisturbed by modern way of doing things, that potential can be tapped and used for ecotourism promotions. This includes the development of a cultural village and museum where local dances, cousins, artefacts can be on display for locals and tourists. The culture, tourism and archaeological ministries could have also helped the locals and indigenous people to tap into the services by providing the enabling environment in setting-up the ecotourism initiatives to international standards.

This would involve providing trainings to the locals for them to improve the quality of goods and services to be provided by them. The use of the indigenous medicinal plants is also one potential which can be linked with research institutes and universities and create income and employment generations for the locals. The development of community-based and local accommodation services could also help the development of ecotourism opportunities in the area and enhance the communities' level of ownership towards the park and benefit the efficient management and governance of the park. These community-based lodges can be part of the cultural villages mentioned above and should be designed based on the traditional housing designs and local materials. The preference of the local communities for the different ecosystems is also captured in the following section.

6.2.2. Community Preference for the Ecosystems

Livelihood practices will determine the preference of the local and indigenous communities towards the different ecosystems of a given natural resource. This preference will also have a direct impact on the efficient use and sustainable development of protected areas. This is mainly because, some resources could be subject to overuse in satisfying the needs and necessities of a given community (Ignacio et al., 2013). Hence, knowledge on the preference of the communities

towards the different ecosystems will help to design appropriate intervention measures which will help to use the ecosystems of the protected area in a sustainable way.

The Gamo, Kore and Guji are indigenous communities that reside inside and the nearby areas of the park and have different forms of livelihood. The outcomes of the reconnaissance survey (chapter four section 4.7) done by the researcher in November 2015 and the official communication with the park (NSNP, 2016) indicated that the forest, aquatic ecosystems (lakes, rivers and hot springs) and the grassland are the main ecosystems of the park and hence these ecosytems will be considered for the community preference exercise.

In addition to this, as explained in the data analysis section earlier in this chapter, based on the level of the goods and services importance to the community, the perception of the community for the different ecosystems were also ranked by the participants as high, medium and low. High denoting commonly used by the community as an essential goods and services for their survival and found mainly in the park; medium for goods and services that are still vital for survival but, could be found from other alternative sources and low representing goods and service that are considered to be non-compulsory for the wellbeing of the community.

The focus group discussions were held with 112 (40 female) men, women and youth groups. As part of the community preference exercise each of the group was then requested to rank the forest, grassland and the aquatic ecosytems as high, medium and low. Then the total ranking votes by each FGD group were counted. The ranking among each local community members (men, women and youth) was also compared within the men, women and youth community groups and among the three local communities. Details of the analysis for each local community will be provided in the subsequent sections.

Figure 69: Focus group discussion with the local communities

A total of 52 members of the Guji community participated under the two clusters of the FGDs (15 women, 20 youth and 17 men). The Guji community is mainly pastoralist and their highest valued ecosystem is the grassland followed by the water resources since they depend on the grass field to feed their livestock (Figure 70). The level of wealth of an individual with in this community is valued by the number of livestock possessed by the household, thus the reason for putting such high value to the grassland.

They also rely on hot springs as their "holy water" since they believe in getting cures from some of the diseases by using the "holy water". This is compounded by the lack of modern health services coverage in their locality and shows their reliance on traditional, spiritual and medicinal practices as a way of curing their illnesses.

Within the Guji community, there is a bit of difference in order of importance among the men and women preferences. Hence, for men the grassland (52%) is the highest valued resource followed by the aquatic (30%) but, for women, even though 48% of them preferred as the grassland is the most important resource, about 38% of them agreed as the forest is the second important valued resource in the community. This is largely an attribute of the fact that in the community women are the only societal elements that deal with the household chores like cooking which requires substantial amount of fuelwood energy. So, their significant preference is for the forest as compared to the aquatic resources since most of their activities are attached with the products of the forest in performing their daily routines and their overall survival as a people. When the preference of the Guji women is compared with the Gamo women, the later rated the forest as their highest preferred resource since most of the Gamo women are engaged in fuelwood collection for cooking and other purposes as well as for the generation of income through trading.

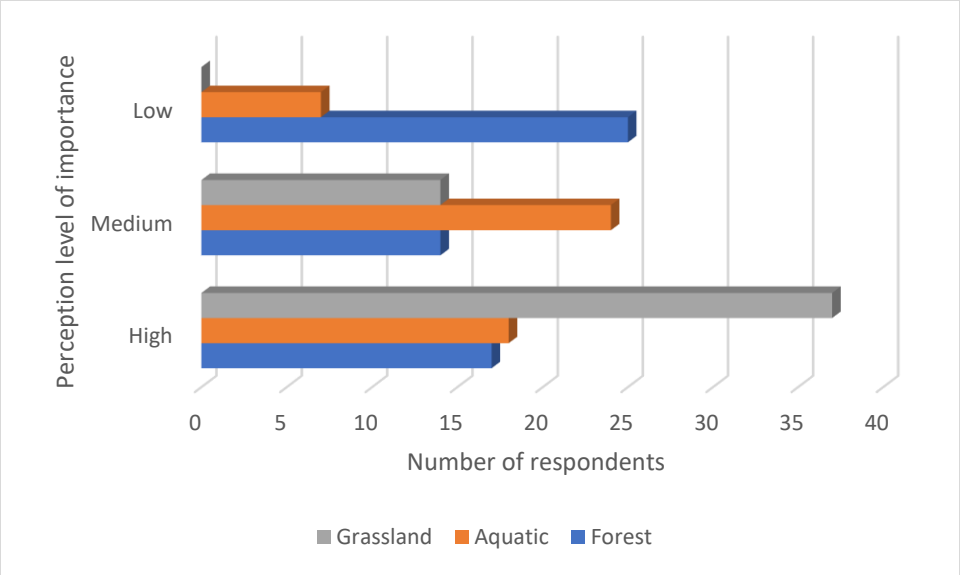


Figure 70: Guji's community perception on the level of ecosystems importance

This fact also indicates that, to avert the impact of the Guji community on the park's natural capital, considering and addressing the gender related roles is a mandatory area as perceptions, roles and responsibilities of men and women could vary from community to community. Apart from that, finding alternative and modern ways of animal rearing such as improved pasture management are vital areas if their dependence on the park's resource has to be minimized in an efficient way. However, such initiative should be handled with care as the local people have some rights to their way of life and also to make indigenous technical knowledge contributions which will aid the sustainable management and development of the protected area's resources.

35 members of the Gamo community have participated in the focus group discussions (13 youth, 11 women and 11 men). In terms of livelihood, the Gamo are usually practicing sedentary agriculture and mostly reside around the lake Chamo area where they are relying on the lake to get drinking water for their cattle and can perform fishing activities as source of income for the household. Hence, their most valued ecosystem as a community is the aquatic resource followed by the forest resources to satisfy their energy demand (Figure 71). Apart from that, they also have a very limited access to feed their cattle inside the park because of their location which is not too far from the park's main office where frequent patrol is being held on regular basis.

Within the Gamo community, however, there exists a preference difference among the men and women. In this community, many women are engaged in fuelwood business and hence for the

Gamo women the forest is the highest valued resource (55%) followed by the aquatic resources (36%). However, for the Gamo men the aquatic ecosystem was rated as the highest valued resource (45 %) followed by the forest (36%) since many men are attached with the lakes on fishing activities as sources of income as well as water for their animals.

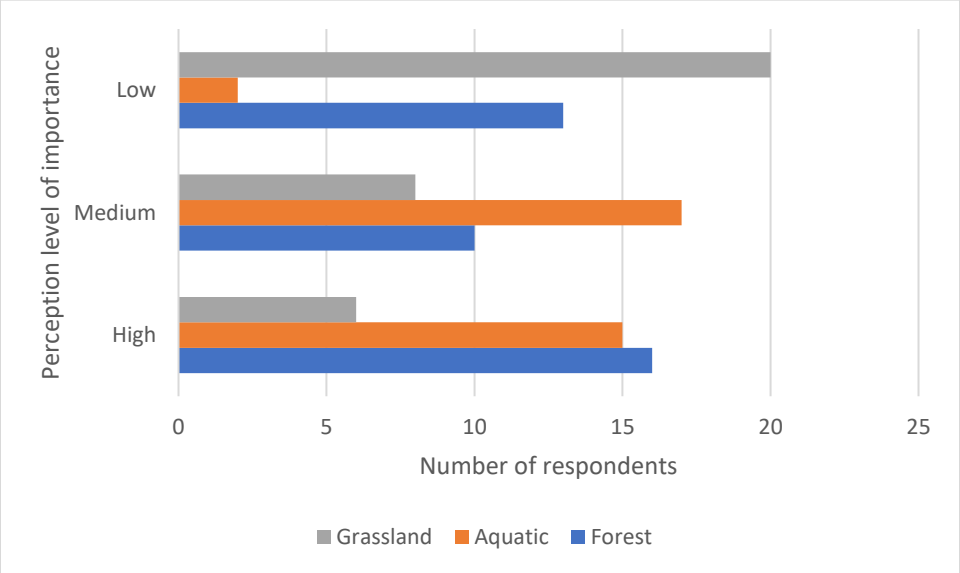


Figure 71: Gamo's community perception on the level of ecosystems importance

From the Kore community, 25 community members have also participated in the focus group discussion (7 youth, 7 women and 11 men). The livelihood of the Kore is more of sedentary agriculture and mainly focuses on livestock rearing and other farming activities such as crops production. Hence, their preferred ecosystem is still the grassland followed by the aquatic ecosystems (River Sermele and Lake Chamo) (Figure 72).

Some of the respondents mentioned as their preference to the forest is low since they assumed as they can get fuelwood from the nearby natural forests of the area. For the Kore people there is no tangible disparity of preference for the ecosystem services among the men, women and youth.

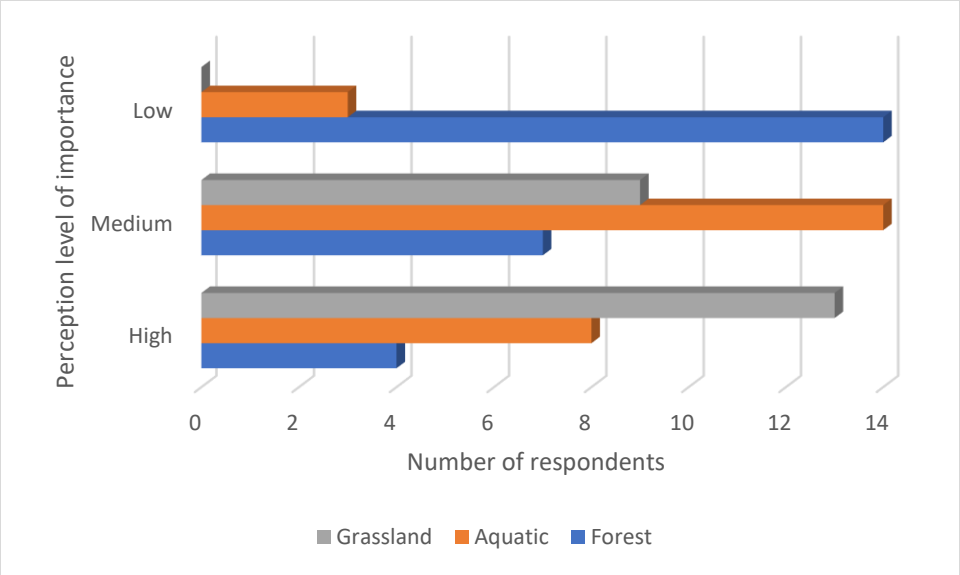


Figure 72: Kore's community perception on the level of ecosystems importance

In terms of policy implication, the preference of the different communities for the different ecosystems helps to understand how the trends of the forest, grassland and the aquatic ecosystems will be affected by the nature of the local communities' livelihoods. This is mainly because a certain community will have its impact on specific ecosystems. For instance, the forest resources of the park are facing multiple threats (fuelwood and charcoal making both for household demand as well as a source of income generating opportunity). Hence, strategic actions which are aimed at reversing such actions should consider the different sets of livelihood trends of the different communities in order to ensure that appropriate interventions are implemented to sustainably manage the natural capitals along with the ecosystem services. The willingness of the community to conserve the natural capitals is another area which needs further study.

6.2.3. Perception of the Communities on the State of Ecosystems

Due to the strict cultural values within this local and indigenous communities where men would not sit with women and youth in the same setting when conducting official meetings / businesses, the researcher conducted three different sets of focus group discussions within each indigenous community. Accordingly, to gauge the perception of this local communities on the current state of the ecosystems, during the above-mentioned focus group discussions individual votes were held in the women, youth and men categories of the three local communities. Accordingly, the

votes on the current state of the ecosystems (forest, grassland and the aquatic) were conducted on the predetermined status of the ecosystems measurement parameters as follows (a) decreasing – showing a deteriorating or degradation trend as compared to their state in the earlier years (b) no change – indicating as the size / density have not showed any change when compared with the earlier times and (c) increasing – if there is an increase in the volume or density of the ecosystems as compared to the earlier times.

To facilitate the voting process, the three parameters were explained to the participants. Then the votes for each ecosystem were counted individually for the youth, women and men group participants of the three communities. This process has enabled to capture the views of the different segments of the local communities on their perception towards the current state of the ecosystems.

Figure 73: Voting exercise during FGDs

Based on the outcomes of the focus group discussions conducted with the local and indigenous people, 88% of the respondents who participated the discussion stated that the forest resources of the park are decreasing to meet the fuelwood demand of Arba Minch city and other neighbouring localities.

Improper land-use practices such as hillside farming are causing for the erosion of land resources and subsequent sedimentation of the silt on the floor of the lakes. Hence, about 71% of the respondents also perceived the decrease in the volume and amount of water in both Chamo and

Abaya lakes (Figure 74). Bush encroachment and expansion of invasive plants in the grassland plains of the park are also causing the decrease in the availability of the palatable grass for the livestock in the grassland ecosystem of the park.

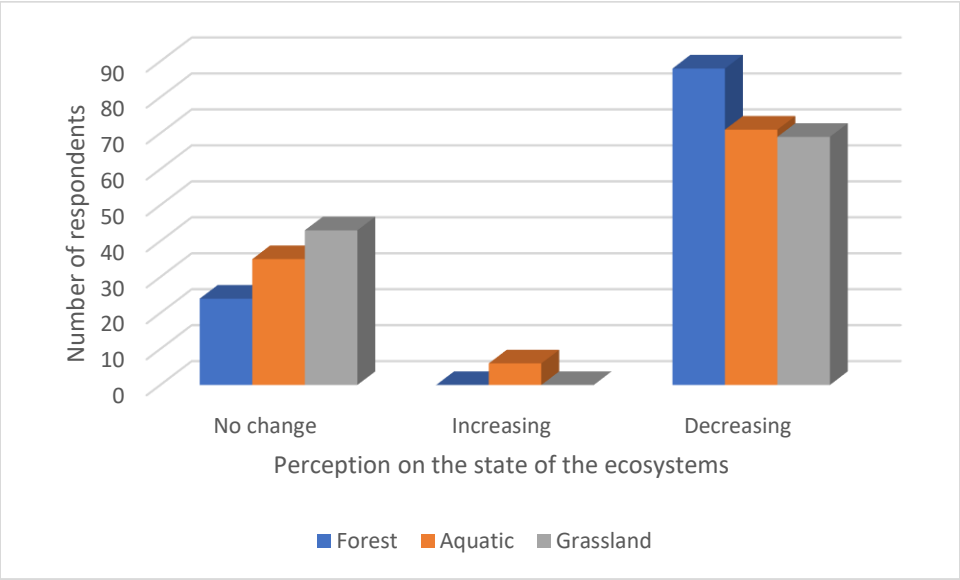


Figure 74: Combined view of the Gamo, Kore and Guji communities' perception on the state of the ecosystems

Based on the information collected from the focus group discussions with the local and indigenous communities (Figure 74), the comparative observation of the responses among the different segments of the community (youth, women and men) on the state of the ecosystems have showed that about 70% of them observed the decreasing trend of the coverage of forests, grassland and the aquatic ecosystems. On average about 30% of the different categories of the communities have not also observed the change since they have responded as there is no change on the state of the ecosystems.

6.2.4. Summary of Section One

Ecosystems provide services that ensure the survival of living things. Knowledge on the ecosystems and the services they provide helps to understand the interrelationships between human needs and the goods and services generated by these natural capitals. This is mainly helpful to devise appropriate policy level actions and governance decisions which will help to sustain the services they provide.

Protected areas are known to harbour different ecosystems. These valued ecosystems in the case of Nech Sar, however, are going through severe degradation from deforestation, overgrazing, improper land-use practices, and lack of community involvement in the management of parks. In general terms, the livelihood activities of the local and indigenous communities are having its impact on the natural capitals of the protected area. These phenomena have created tension between the local communities who are striving to make use of the park resources to sustain their livelihoods on one side and the park authorities on the other hand who are trying to protect the biodiversity and ecosystem services of the park.

In terms of choice of the ecosystem services, one of the findings from this section indicated that there are differences in perception in terms of the value associated to the ecosystem services by different indigenous groups and between males and female members of these indigenous groups.

In the case of the Guji communities for instance, men are putting higher preference for the grassland. This is mainly attributed to (a) they use the grassland of the park to feed their cattle and (b) their wealth and status within the society is directly dependent on the number of animals they own.

Women on the other hand rendered high priority for the forest. This high priority given to the forest is due to their role on extracting fuelwood from the forest for household and other purposes as well as earning additional income through the selling of the fire wood to the local communities. However, the views of the youth did not come out strongly in terms of their preference towards the different resources since their preference is usually related to men.

In terms of addressing the ongoing degradation, harnessing and development of the cultural practices of the various communities of the park as a way of creating eco and heritage tourism development activities is believed to have a paramount role. This can also be viewed as a strategy for enhancing the socio-economic potential of these communities as well as contribute to the reduction of poverty. The following section will provide findings on the governance related challenges of the park.

6.3. Governance Impediments and Human Activities in Nech Sar National Park

"Governance, including customary institutions and management systems ... involving indigenous people and local communities, can be an effective way to safeguard nature and its contributions to people" (UNEP, 2019:1).

Section two of chapter six is hence designed to respond to objective number two and research question number two of the thesis by assessing the governance related factors that impact the management of the park's ecological capital. Thus, the section will present the findings of the research on governance, policy impediments and human activities that aggravate the degradation of the natural capitals of the park.

6.3.1. Governance in the Context of Protected Areas

There exists a distinct difference among governance and management concepts. "Governance is about power, relationships and accountability. It is about who makes decisions, how they make decisions, how they allocate resources and how actors have their say and hold those in power to account. Management is about implementing strategic decisions and objectives, including defining and allocating lower-level objectives, authority and responsibilities" (Franks and Booker, 2018:6).

The management of protected areas has to be answerable to the three environmental governance fundamental elements as follows (a) institutions (laws, policies, rules and norms), (b) structures (decision making bodies, formal organizations and informal networks) and (c) processes (decision making, policy creation, negotiation of values and conflict resolution) which are designed to achieve environmental governance objectives (Bennett and Satterfield, 2018).

In line with this, the prime objective of protected areas governance is to establish systems and mechanisms that will help to ensure the conservation of biodiversity along with the utilization of natural resources in a sustainable way. Hence, as explained by Mirjam *et al*. (2017), policy and strategic activities that ensure the sustainable development of protected areas have to be embedded in to the overall development agenda of a country by adhering to international conventions which frame the global dimension of biodiversity conservation as well as the

International Union for the Conservation of Nature (IUCN) frameworks and guidelines which outline the governance modalities that can be contextualized based on the specific circumstances of protected areas.

Franks and Booker, (2018) outlined that, diversity and quality are the two fundamental features of protected areas governance. Diversity refers to the nature and type of the protected areas governance systems which includes state governance (when governed by government), community governance system (where governance is done by the local and indigenous communities), private (in cases where individuals or non-governmental agencies take the governance roles) and shared governance (a governance arrangement whereby the above two or more parties participate) (Borrini-Feyerabend *et al*., 2013). The quality aspect of governance deals with as to how these governance systems work in line with the good governance principles (to be further discussed in following sections). Hence, the quality aspect of governance is the feature which will be considered by this research since the governance arrangement of Nech Sar is already defined as a governmental governance arrangement.

6.3.2. Governance Systems of Ethiopia's Protected Areas

The governance of protected areas is emerging as a national issue in the conservation and management of protected areas in Ethiopia. In responding to this issue, the government of Ethiopia has issued the Development, Conservation and Utilization of Wildlife Proclamation No. 541/2007 in the year 2007 with the following objectives: (i) to conserve, manage, develop and properly utilize the wildlife resources of Ethiopia (ii) to create conditions necessary for discharging government obligations assumed under treaties regarding the conservation, development, and utilization of wildlife resource and (iii) to promote wildlife-based tourism and to encourage private investment.

As set out by the government of Ethiopia, these objectives adhere to international conservation standards and practices as well as ensuring the benefits accrued by these protected areas are shared among stakeholders. In practical terms, however, in the case of Nech Sar, benefits which are accrued by the park are not being shared with the local and indigenous communities.

According to the aforementioned proclamation there are also four different sets of governance arrangements (Table 46) in managing the protected areas as follows (i) Federal Government Administered Wildlife Conservation Areas (ii) Wildlife Conservation Areas Administered by Regions (iii) Wildlife Conservation Areas Administered by Private Investors and (iv) Wildlife Conservation Areas Administered by Local Communities (Proclamation No. 541/2007, Article 4 - 7).

Table 46: Governance arrangements of protected areas in Ethiopia

Type of Governance	Description
Federal Government Administered Wildlife Conservation Areas (Proclamation No. 541/2007, Article 4)	a) National parks that are nationally and globally significant and known to have representative ecological zones and embrace immense diversity of wildlife; b) National parks and wildlife sanctuaries that are inhabited by the country's endemic and endangered species; c) Any wildlife conservation areas geographically situated within two or more regions; d) Any trans-boundary wildlife conservation areas that may be established in accordance with agreements with neighboring countries.
Wildlife Conservation Areas Administered by Regions (**Proclamation No. 541/2007, Article 5**)	Unless designated and administered by the federal Government pursuant to Article 4 of the Proclamation, national parks, wildlife sanctuaries, wildlife reserves and wildlife-controlled hunting areas shall be designated and administered by regions.
Wildlife Conservation Areas Administered by Private Investors (**Proclamation No. 541/2007, Article 6**)	Private investors may be authorized to administer the wildlife conservation areas referred to in Article 4 and 5 of this Proclamation by concession agreements to be concluded with the Federal Government and the concerned regions.
Wildlife Conservation Areas Administered by Local Communities (Proclamation No. 541/2007, Article 7)	Wildlife habitats other than the conservation areas referred to in Articles, 4, 5, and 6 of this Proclamation may be authorized by the concerned regions to be administered by the local communities.

6.3.3. Governance Arrangements of Nech Sar National Park

Based on the above administration categories, since Nech Sar National Park is situated in two regional states (SNNP and Oromiya), the overall governance of the park falls under the governance category of Federal Government Administered Wildlife Conservation Areas (Proclamation No. 541/2007, Article 4). It is a governance category whereby the Ethiopian Wildlife Conservation Authority (EWCA) which is based in Addis (the capital of the country) at about 510 kilometers away from the park is trying to handle the overall governance issues of the park in a remotely setting.

On the ground, for the day to day management of the park, the authority has a park management office in the park. The office is being led by a Chief Park Warden with the assistance of other technical staff and park rangers.

According to the park warden, however, this governance arrangement is presently creating governance and administrative challenges since the system lacks sufficient human and institutional capacity to effectively manage the park in a remote setting. This is mainly caused by the lack of administrative support system and absence of adequate human and financial resources to effectively manage the park. As for instance, he mentioned during the interviews that "due to budget constraint, currently out of the approved 121 positions only 87 are filled by staff".

It is also faced with inefficient top-down and remotely controlled administration mechanism where the bureaucratic officials from the capital are responsible for dealing with the management and administration of the park. The park on the ground is being administered by low level officials who lack administrative capacity and competence to effectively manage the day to day activities. This type of management arrangement inhibits bottom-up local level community participation and ownership. Since the park is located in two regional states, the federal system aggravates the lack of political will in addressing local level park management challenges. Although, these federal level bodies have better technical human resources capacity, due to their remoteness from Nech Sar park and the lack of experience in the actual field level management of protected areas, their efforts are not effective. This top-down governance mechanism in practice has favored to have lack of ownership by local government authorities and communities as described in the following sections.

6.3.4. Protected Areas Organizational Settings, Policy and Strategy in Ethiopia

The Ethiopian Wildlife Conservation Authority (EWCA) is the autonomous public agency of the Federal Government of Ethiopia which leads the conservation and development of the country's protected areas. With the objectives of ensuring the development, conservation, and sustainable utilization of the country's wildlife resource, the authority was re-established by the Federal Democratic Republic of Ethiopia Proclamation No. 575/2008 - "Ethiopian Wildlife Development and Conservation Authority Establishment". The Authority is answerable to the Ministry of Culture and Tourism. The Authority has its head office in Addis Ababa (the capital) and wildlife conservation area offices elsewhere, as may be necessary.

This governance arrangement, however, is among the prominent factors that caused the degradation of the natural capitals of the country's protected areas including Nech Sar National Park. In this regard, administrative-wise, the lion's share of Nech Sar's landscape falls under the Southern Nations Regional State and only a very small portion of it is known to share borders with the Oromia regional state. The indigenous communities residing in the park also differ in their ethnicity and race (the Guji belong to Oromia and Kore and Gamo to the Southern Region and three of them also speak different languages).

Results of the interview discussions with the administrator of the Gamo zone indicated that, regional states may at times have different focus areas and interest for the different land resources of the park. As for instance, according to the Gamo Zone Administrator "the Southern Nations Regional State is eagerly looking for the park to be devoid of any human intervention". He further added as "this intention of the region has been followed by a practical action of peacefully evicting and resettling the Kore communities outside of the park where they can get land to graze their animals and practice crops production".

On the other hand, a senior park official (P1) explained that the Guji Oromos are still using the grassland landscape due to the lack of political commitment from the side of the Oromia regional state. According to him, "even though, the park authorities are doing their daily activities in protecting the grassland, there exists a weak support from the side of the Oromia region in maintaining the grassland plains as a protected ecosystem part of the park". This mainly happened

since the Oromia region have not evicted the Guji from the park and settle them in the nearby fertile areas where they can get pasture and water resources for their cattle as done by the Southern Regional State.

Furthermore, in the policy there are list of activities which are prohibited in National Parks, Wildlife Sanctuaries and Wildlife Reserves. Some of which, but not limited to are hunting, fishing, undertaking agricultural activities, grazing, picking any natural or man-made object, beekeeping, and other related activities. However, in the Regulation No. 163/2008 under article 5 (3b and 4) there is a sub-provision for people to "cultivate their land plots without expanding, to allow their domestic animals graze and water, and to undertake bee keeping therein" provided that they are the "persons who were inhabitants of a wildlife reserve prior to the date of its establishment". However, though the regulation has this provision which provides for such activities to be allowed in a controlled way, how is this operationalized remains an issue which needs a further strategic action plan which guides the sustainable development of the country's protected areas.

The proclamation on the other hand is silent about human settlement in national parks, which does seem as settlement is not allowed in these areas. The proclamation was supposed to clearly draw the line of granting or withholding settlement related issues so that the issue of settlement would not be a challenge on the governance of the protected areas. When asked about the issue of settlement inside national parks a senior official of the park authority (P13) said that "national parks are expected to be free from any form of human activity including settlement and that is why we deploy rangers as one way of enforcing this principle". In the case of Nech Sar too, based on the interview response of the senior park officials, none of the local communities are allowed to perform agricultural activities since there were no people who lived within the park territory during the establishment of the park.

Apart from these, in the proclamation it is also mentioned if a person carries out unauthorized activities within wildlife conservation areas or causes, in whatever way, damage thereto; shall be punished with fine not less than Birr 5,000 and not exceeding Birr 30,000 or with imprisonment not less than one year and not exceeding five years or with both such fine and imprisonment. However, from observations in the field and results obtained through the previous chapters, illegal activities like grazing, fishing, fuelwood collection are being observed in the park since the

practicality of the laws and regulations is being hampered by financial and human resources related capacity impediments. As an example, in this regard, as explained in the earlier section, the park has a limited number of park rangers and financial capacity as compared to the total area of the park to be protected.

On the other hand, even though the preamble of the proclamation mentions the importance of local communities' participation on the conservation of these resources, the participation methods and the benefits which they can gain from the participation have not been mentioned in the proclamation. For the realization of such policy actions, further action plans were supposed to be formulated and cascaded at the ground level by ensuring the benefits of the local communities so that the natural capitals of the parks can be maintained and conserved in a sustainable way. In line with this, the policy has not identified and indicated any zoning or classification mechanisms which can benefit the local and indigenous communities of country's protected areas. This management arrangement could have helped to develop and enhance local community level of ownership feeling, sustenance of livelihoods, community participation and the subsequent sustainable development of the park.

In general, although the policy emphasizes the importance and relevance of national parks and other protected areas for the sustainable development of the country, factors like weak institutional, human resources, law enforcement and financial capacities have retarded the efficiency and roles of the policy for the conservation and protection of these land resources.

The policy is also yet to be well equipped with strategic tools and frameworks that help to challenge the low level of awareness on ecological importance, increasing population, expansion of agricultural practices, increasing energy demand, low level of livelihood opportunities, poor coordination among stakeholders, and weak law enforcement which are among the challenges that aggravated the degradation of the natural capital of Nech Sar National Park in particular and Ethiopian parks in general. As a result of this, it is possible to say as the protected areas regulations of the country do not clearly ensure the governance and active participation of local communities of the park.

6.3.5. Analysis of Nech Sar National Park Governance Against GAPA Principles

The participation of local and indigenous people in protected areas management is an important element of sustainable development since the United Nation conference report on environment and development held in 1992 (UN 1992). This is also emphasized in the United Nations Framework Convention on Biodiversity and other agencies (IPBES, 2019; UNEP, 2019; SCBD, 2008). With reference to the data analysis section of this chapter, thematic data analysis is deployed by making use of the "Governance Assessment for Protected and Conserved Areas (GAPA)" thematic analytical framework governance principles for assessing the effectiveness of governance arrangements in Nech Sar National Park. The principles are set to address a wide range of protected areas that have varied objectives and natural resources context. Accordingly, the governance challenges of Nech Sar will be assessed based on the following good governance thematic principles of GAPA (1) "Achievement of conservation and other objectives (2) Effective and fair enforcement of laws and regulations (3) Benefits equitably shared among relevant actors based on one or more agreed targeting options (4) Full and effective participation of all relevant actors in decision making and (5) Effective coordination and collaboration between actors, sectors and levels" (Franks and Booker, 2018:9).

Below is therefore, the analysis of response from interviews with senior officials of the park authorities, questionnaire administered with the operational and management staff of the park, focus group discussion with the local and indigenous communities, review of related documents and the outcome of the three-day workshop held with the technical experts from the concerned stakeholders.

6.3.5.1. Achievement of Conservation and other Objectives

Cutting of trees for fuelwood and charcoal making are resulting a serious degradation of natural resources in and around the park. Primarily, this has caused for wildlife habitat fragmentation and the subsequent reduction of the wild animal population of the park as seen in the case of the Swaynes where their population is reduced from 130 in 1974 to two individuals in 2016 (results of the annual wildlife inventory of the park).

The ecological assessment has also showed that deforestation is having an impact on the natural regeneration potential of the woody vegetation of the Park as the seed-bearing matured plants are being cleared from the forest. The ground water vegetation of the park which shares an immediate border of 15 kilometres with the town of Arba Minch is also prone to human interference in meeting the increasing energy needs of the ever-increasing population of the area. Studies have shown that, about 98% of Arba Minch town inhabitants are entirely dependent on fuelwood as a source of their household energy supply which largely comes from the Ground Water Forest and the nearby woody vegetations of the park through debranching, selective cutting and removal of coppice. In recent years there has been an increased degree of deforestation in this area.

In line with this, data on community perception on the state of ecosytems (as discussed in section 6.2.3. of this chapter) showed that 88 % of the focus group discussion participants responded that the forest cover of the park is getting degraded rapidly than it used to be years ago. Interviews held with the different stakeholders' participants have also showed that the forest and wild animals of the park are shrinking from time to time as a result of the human activities. Therefore, the park is not achieving the objective of conserving the biodiversity potentials of the park along with the ecosystem services which are meant to benefit the present and future generations.

6.3.5.2. Benefits Equitably Shared Among Relevant Actors

Proclamation No. 575/2008 which sets the establishment of Ethiopian Wildlife Development and Conservation Authority emphasizes on the utilization of the revenue generated from protected areas to benefit local people and wildlife conservation. In practical terms, however, based on the outcomes of the discussions with the local people and field level observations, the indigenous communities of the park are not getting a direct benefit in relation from the park.

When asked about any direct benefits received from the park, the focus group participants of all local and indigenous communities mentioned that they have not received any form of benefit from the park. This was also echoed by an elder of the Guji community who participated in the focus group discussion:

We never received any benefit from the park authorities except they engaged us to take part in the road construction activities for a couple of times through the cash for work programme.

Youth focus group discussion participants have also showed their concern for not being provided with livelihood development opportunities. One youth of the Kore community FGD participant said:

The park has not provided us any form of training opportunities.

The focus group participants were also asked if the park authority has established public services like schools, clinic, etc. which are aimed at benefiting the local communities of the park. All of the participants, however, said that they have not seen any initiative of such from the side of the park authorities.

According to the warden of the park "the entire revenue which is generated by the park and tax from tourism related activities is channelled directly into the federal finance system than being used to capacitate the local communities through livelihoods development and expansion of basic social services such as health facilities as well as schools". Thus, since the area is enjoying a significant flow of tourists, encouraging the private sector (lodges, hotels, etc.) who operate in the area to deliver their social corporate responsibilities for the community by establishing social services such as health clinics, schools, veterinary centers, etc. could have helped to enhance the level of ownership by the local communities and contributed for the sustainable development and efficient governance of the park's natural capital. Additionally, establishment of buffer zones where the local communities can have a direct economic benefit such as woodlots could be another area which the governance could ensure sharing of benefits with the local communities. Allowing non-extractive uses in the field of apiculture development could also be an opportunity which will help to share the benefits with the communities.

6.3.5.3. Full and Effective Participation of Relevant Actors in Decision Making

The response of the operational and management staff of the park on the level and quality of the indigenous community's participation in the governance of the park indicated that there used to be Park Advisory Committees across the different local administration Kebeles. These

committees were in place a decade ago and were established by the support of the African Parks Foundation. The response of the park staff further indicated that these committees ceased to function soon after the withdrawal of the African parks Foundation support for the park. The committees were established to assist the park management in safeguarding the natural capitals of the park from human induced degradation. However, this view was disputed by a senior civil servant (P8) as follows:

> *"these committees were being managed by the community members who in one way or another depend on the park resources, hence their level of involvement in park protection activities seems superficial".*

The local communities who participated in the FGDs have also said as there is no regular partnership arrangement for the engagement of the community in the governance of the park. in line with this an elder of the Kore community mentioned that:

> *They [park management] have not engaged the community in park development activities except taking part in constructing and maintaining roads of the park.*

On the other hand, all persons who participated in the focus group discussion showed their willingness and interest to be part of park development activities.

Out of the 28 operational and management staff of the park who responded to the questionnaires 25 of them stated as they have engaged the local communities to do the following (a) road construction activities of the Park (b) awareness development on the environmental roles of the park and (c) hiring of some members of the community as park rangers of the Park.

On the other hand, due to financial, technical and human resource constraints the operational and management staff of the park mentioned as they are constantly bombarded by issues related to the encroachment of the pastoralists who illegally graze their animals in the park territories; female households who illegally fetch fire wood from the park's forest for their survival and men who cut forest wood for commercial purposes and who also fish illegally to support their livelihoods.

According to Proclamation No. 541/2007 Article 4, since Nech Sar shares border with two separate regional states, the overall governance is vested up on the federal level office (main office of the Ethiopian Wildlife Conservation Authority) which is based in the capital of the country. The main aim of this arrangement is to avoid any conflict which may arise between the states that the protected areas are located in. In practical terms, however, this form of governance arrangement has its own side effects on protecting the natural capitals of the protected area. Administrative-wise, the local communities who live on either of the regional states are being governed by the respective regional states, hence the federal bodies do not have any direct administration relationship with the local communities. Every administrative order must be conveyed from federal to regional states and then to the grassroots level administration bodies. This in many cases takes a significant amount of time and bureaucracy in addressing governance related challenges.

In explaining the challenge of this governance arrangement, a senior official of the federal authority said that "EWCA is being challenged with human, financial and technical capacities in governing the federal protected areas by being based in Addis". According to him, this is mainly because the authority does not have sufficient capacities to stretch its efforts in governing the protected areas located in various corners of the country. Budget, finance, technical capacity and coordination with stakeholders are among the factors that hampered the efficiency of such governance arrangement. The view of the warden of the park also shares the same concern as he rightly said it, "the volume of work at the grassroots level in the management and governance of the protected areas is beyond the capacities of EWCA". In line with this, community mobilization which would help to ensure the sustainable development of the protected area is among the factors that needs a collaborative effort of different actors and local level institutionalized ownership of governance activities.

When explaining the governance of the park, a long-time servant of the park (ranger) said that:

> *We never used to have a conflicting and tensioned relations in the earlier times until this federal system came into effect in the country which divided administration systems and the people by the language they speak. Until the end of the 1990s, the park was fully under the governance system of the Southern Nations regional state and never had tangible*

challenges in enforcing laws, but now under this federal system there is a tension between the two states as law enforcement efforts of the park will be interpreted on ethnic based sentiments.

An officer from the law enforcing office has also responded as there is a weak coordination between the Oromia and Southern Nations Regional states in governing the park. The Nech Sar park office is located in Arba Minch (Southern Nations Regional State), so according to him "whenever we arrest the Guji who violate the regulations, there will always be a complaint from the side of the Oromia administrators for taking those actions without their consent". This can vividly affect the enforcement of laws in ensuring the sustainable development of the park since the level of ownership by the two regional states is questionable. As mentioned by one of the stakeholder's policy expert (P16) "this situation has created a vacuum for a timely and grassroots level administrative and problem-solving endeavours of park management since many issues must be addressed at Federal level than being administered at local and regional levels".

This type of management/governance mechanism has created tensions between top-down, the bureaucratic officials at the federal level and bottom-up, the regional and local level authorities. This tension resulted in poor implementation of park policies, strategies and programmes within the park. Invasive plants such as Abutilon have also expanded in the park's territory because of the poor governance mechanisms which is not able to control the heavy livestock movement within the territories of the park and other human induced factors.

6.3.5.4. Effective and Fair Enforcement of Laws and Regulations

The country's wildlife policy and strategy in article one (EWCA, 2005) pointed that efforts will be made to gazette national parks and other wildlife protected areas according to international standards and principles. This policy action is aimed at limiting unsustainable practices planned or being carried out in wildlife protected areas and wildlife corridors that affect the survival of the wild animals by issuing rules and regulations which will help to implement and enforce protection measures in the protected areas.

In the case of Nech Sar, the Park was initially established with an official demarcation of the boundaries, however, for the boundary to be legalized it must be gazetted by the country's

proclamation law. The response of a senior park policy official (P13) in this regard has also assured as the decision-making process in officially gazetting the park contributed for the degradation of the natural capitals of the park. In this regard, a senior management staff of the park authority (P1) expressed his anger as:

> *"while the Park is known for its ecological and economic importance, the decision and policy makers are yet to officially gazette it since its establishment. This phenomenon is the major bottleneck for the proper governance of the Park".*

The park authority has also proposed to expand the boundaries of the park beyond its current official boundaries, so that the Park can have a buffer zone. This was expected to help the protection of the natural capitals of the Park by engaging community level development programmes like woodlots and have a controlled access to grazing. However, a park officer (P6) said that, "Decisions on this plan of expansion and other demarcation issues, however, are taking longer time which in turn caused for the governance of the park to be challenged from the ongoing degradation of its resources".

The head for one of the government stakeholder's office view (P8) has also reinforced the concerns of the park officials as follows:

> *"Because of the absence of the specific demarcations which would identify the boundaries of the park, there are grey areas in terms of where the park rangers should reinforce the regulations and where the community should not graze their animals and fetch firewood. This has been an area of tension between the community and the park rangers since long".*

He further added as the regulations and proclamations of protected areas in many cases remained as a shelf paper and not being implemented. This view was also supported by the operational and management staff of the park.

On the other hand, the researcher was unsuccessful in getting the responses of the focus group discussion participants on the issues related to the demarcation of the park, although reading body language of the focus group discussion participants showed that local and indigenous people are not in support of any discussion which relates to the official demarcation of the park. This is

mainly because if the park is officially demarcated they will be evicted from the park and may not get access to any of the resources in the park.

Law enforcement related weaknesses were also observed by the researcher on the ground level wherein according to the Southern Nations and Nationalities Peoples Regional State Fish Resources Management, Development and Control Proclamation No. 78/2004 and Regulation No. 62/99, any form of human interference in the form of farming activities, settlement, etc. are strictly prohibited within 1km radius of a water body (Misikire and Tesfu, 2015). In the case of Lake Chamo, however, based on the ground truthing a lot of local and international investors are cultivating the land with less than 10 meters distance from the Lake offshores. Both local farmers as well as national and international investors are engaged in the production of banana, cotton and other crops production activities in the very immediate borders of Lake Chamo. This has interfered with the wildlife ecology of the area since these lands were used to be the grazing lands for the hippos of the Lake. The researcher has also seen hippos trying to graze on these converted farmlands. Based on the information collected from the respondents and other sources, the local communities have also started to hunt the hippos as source of meat which has never been the case in earlier times (Romulus, 2007).

There also exists a weak coordination among the different central and local level stakeholders in resolving park management related challenges. As many could agree the uncoordinated investment endeavors of the country are also affecting the natural capitals of the country in general and the protected areas in particular. Rahmato (2011) pointed that as for instance, hundreds of thousand hectares of land in the middle of Gambella National Park and Babile Elephants sanctuary were given to investors like the Saudi Star group which caused the clearing of the indigenous ages old vegetation. This allocation was done without even the knowledge of EWCA, the country's highest governmental authority for managing national parks, game reserves and sanctuaries. The deforestation because of these ventures has social, environmental and economic hardships on the lives of the local community. According to Rahmato's (2011) further findings, the used to be plentiful wildlife resources of the area are now vanishing from time to time.

In the case of Nech Sar too, observation by the researcher and discussions with the wardon of the park indicated that, thousands of hectares of land which was proposed by the park authority to serve as a community conservation area or buffer zone are given to India based foreign investors, who are planning to engage in crops production ventures. In this area, the researcher observed as the native trees being cleared out of the land in the name of agricultural investment development.

Thus, based on the information gathered from officials, stakeholders and park staff a range of critical protected areas governance factors are affecting the effective governance of protected areas. Hence, the placement of appropriate policy and strategic actions along with the creation of the conducive and enabling implementation environment are vital tools that can help to govern protected areas in a sustainable way. These include official boundary demarcation; law enforcement; institutional capacity development along with improved coordination among stakeholders and increasing the level of awareness on the role of the protected areas towards the wellbeing of the society.

6.3.5.5. Effective Coordination and Collaboration Between Actors, Sectors and Levels

Under the overall administrative guidance of the Ethiopian Wildlife Conservation Authority, the Nech Sar National Park office is mandated to administer the human, financial and natural resources of the park by being based inside the park which is situated in the very nearby of Arba Minch town (capital of the Gamo zonal administration).

When explaining the responsibilities of the Nech Sar park office, the warden of the park said that:

> *The office is accountable to ensure the wellbeing of the natural resources of the park, increase economic and social benefits by safeguarding the natural environment. It has also a shared responsibility of maximizing ecotourism and alternative livelihood options, enhancing scientific investigations and knowledge for resolving challenges of the park through effective and participatory wildlife management. The park is also mandated to develop commitment of stakeholder's partnership and sense of ownership by the local community members.*

As per the interview discussions with the representative of the Zone Tourism Development Office, "the park management office is not in a proper position to administer the park because of internal and external challenges. Among the internal factors, inadequate staffing, poor salary rates, lack of equipment and poor infrastructural facilities are the prominent causes that affect the proper functioning of the park management office". This view was cross referenced by the park's human resources records which mentions that in 2017 out of the approved 121 positions only 87 are filled by staff. As for instance, out of the approved 72 scout posts the park is only able to have 56 scouts. This variance could mean a lot of challenge on the day to day effective coordination of protection activities of the park as compared to the size of the park and the increasing level of human interference which the park is going through.

As per the deputy warden of the park, the park management office is working with the district police office, justice offices, tourism office, office of agriculture and natural resources, office of security, and other local level administration bodies. According to him, however, in explaining the efficiency of coordination and collaboration with these stakeholders, it does seem that these offices are side-lining the park related issues to the park itself since they feel that the park office should be dealing with all the challenges by its own. According to him, this perception is emanated by the fact that, the park office is reporting directly to the federal bodies. In terms of accountability and achievement of results since the park office is not reporting to the regional offices, the stakeholders will tend to focus on issues that matter most to their offices than the issues of the park office which is answerable to federal bodies.

Interview participant from the justice office, in responding to the factors which affect effective coordination among the park's stakeholders said that "even the political leaders and federal and regional governments commitment is very low or not away from oral hopes and in many cases the management and governance activities are left for the inefficient grass-roots level protected area offices and scouts". From his point and personal observation of the researcher, it is clear that the level of government stakeholders commitment in addressing the challenges of the park by having a coordinated effort is very minimal.

A programme coordinator from an NGO also mentioned that the police, justice and other law enforcing bodies do not coordinate in protecting the natural resources of the park. He further

added that the level of poverty and the high number of local and indigenous people who are dependent on the resources of the park is presenting a huge challenge for coordinating the park protection activities. In addition to this, the interview participants have also mentioned the delays of the legalization of the park boundaries that need federal and regional government's decision is among the prime contributing challenge that affected the placement of effective coordination arrangements among the stakeholders.

This weak coordination and inactive participation of the concerned governmental authorities have presented a challenge on the governance of the National Park since the park authorities are not authorized to perform the works of the stakeholders such as policing and taking the legal actions on the illegal activities by their own.

6.3.6. Summary of Section Two – Chapter Six

Section two of chapter six explored the governance challenges in Nech Sar National Park by assessing the challenges associated with the participation of local communities in the governance of the park as per the GAPA good governance principles. Accordingly, lack of local and indigenous communities' participation in the governance of the park evolved as a major finding of the section. This was followed by the absence of mechanisms which enable local and indigenous people to share in the benefits derived from the national park. For example, lack of buffer zones which could be used by the local communities as source of fuelwood, grazing and construction materials has aggravated the degradation of the natural resources of the park.

The section recognised that, a more coordinated effort should be made on the part of Nech Sar to explore innovative systems and processes which will involve the local communities into the governance of the park. Such initiative would help to reduce the degradation of the park in that, if people are given the opportunity to participate in the governance of the park they will not be engaged in activities that would contribute to the degradation of the park's resources. This initiative supported by education and awareness development programme would enable the local people to see that their livelihoods is linked to the continuous existence and sustenance of the biodiversity and ecosystems of the protected area. Therefore, they would be more inclined to engage in activities that would not destroy the natural resources base of the protected area. Hence, this can be materialized through (a) the establishment of buffer zones where they can get

benefits like grazing, firewood, construction materials and crops production (b) sharing the benefits accrued from the profits of the park to support social services (education, health and community development) (c) the development of alternative livelihoods initiatives which should provide better income generation activities.

To capitalize on the aforementioned strategic directions, efforts should be put at three levels. Firstly, exploring and strengthening institutional arrangement within the community that enhance the possibilities of sharing best practices and lessons learned among cooperatives, community organizations and other institutions that are engaged in community development activities. Secondly, the focus should be on linking local institutions with national institutions by focusing on mobilization and sharing of human and financial resources to build the capacity of the community to develop sustainable practices for example businesses and finally, the necessity to link local and community indigenous institutions with international agencies and institutions by focusing on sharing of human and technical resources as well as technologies which will boost sustainable livelihoods within communities of the Nech Sar Park areas. For example, to develop a system that promotes the indigenous medicinal use of plants as well as facilitate the visit of tourists from a particular area or country. Therefore, emphasis should be placed on the development of the institutional capacity of existing organizations and businesses to ensure that the benefit from the financial resources that may accrue from such initiatives are shared by the local and indigenous people as a result of these linkages.

6.4. Summary of the Chapter

Chapter six consisted two sections. The first section has assessed the ecosystem services and perception of the local communities on the status of the ecosystem of the park and their preference for the different ecosystems. Section two of the chapter has explored the governance impediments that contributed to the degradation of the natural capitals of the park.

The findings of section one revealed as there are differences among the different indigenous communities on the preferences of the ecosystems of the park which largely differed on the nature of their livelihoods. The findings also aloud the consistent degradation of the natural capitals of the park.

Section two of the chapter assessed the governance challenges of the park and showed that the lack of local and indigenous communities' participation in the governance of the park is a major factor that contributed to the degradation of the park's resources. Apart from that the lack of the official demarcation of the park is also mentioned as the other governance factor that aggravated the ongoing human incursion on the natural capitals of the park. To counteract the identified challenges, in the following chapter the study will pinpoint the possible strategic options which can enable the local community's participation in the governance of the park along with the enhancement of institutional systems that could aid the sustainable development of the park.

Chapter 7 - Discussion and Concluding Remarks

Chapter seven has two sections. Section one deals with discussion of the results of the study. It is organized by way of responding to the four objectives of the thesis. Section two of the chapter provides the concluding remarks of the study by describing the contributions of the study to knowledge, policy level implications, the integrated development strategic approach and others.

7.1. Section One - Discussion

The general aim of this thesis is to explore the knowledge gap on the impact of human activity on the natural capitals of Nech Sar National Park in Ethiopia and devise strategic approaches through the formulation of a conceptual framework to enhance the management and governance of the national park. This section, hence, recapitulates the research findings of chapter 5 and 6 by relating them to the review of the related literature chapter 3 and the research conceptual framework as stated in chapter 4. This discussion section is also organized in relation to the specific objectives of the thesis as outlined in chapter one as follows:

1. To undertake a systematic analysis of the state of natural capital in the park with a major focus on forest, grassland and aquatic ecosystems.
2. Assess governance related factors that impact the management of the park's ecological capital.
3. Review the perception of relevant stakeholders on the state of the natural capitals and ecosystem services of the park.
4. To propose integrated strategic development framework that will help to improve the sustainable development of Nech Sar National Park and other Ethiopian parks in general.

The research questions of the thesis are addressed in section 7.1. of this chapter. The researcher will also further discuss the research conceptual framework and recommends strategic directions that could help to alleviate the impact of human activities on the natural resources of the park.

7.1.1. Research Question 1: In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems?

The study focuses on assessing the current state of the natural capitals of Nech Sar National Park with a focus on forest, grassland and the aquatic ecosystems of the park. Hence, this section is designed to respond to objective one and element two of the conceptual framework.

7.1.1.1. Forest Ecosystem

Deforestation along with its impacts is one of the major problems of Ethiopia. It has caused the decline of the country's biodiversity potential; degradation of water and land resources; declining of wildlife potentials because of habitat modifications; possible impacts on local, regional and global climate conditions (Emiru, 2003).

Ethiopia's rate of deforestation is estimated to be an average of 141,000 hectares per annum. The environmental protection policy of the country also estimates deforestation rate could reach up to 200,000 hectares per annum (Solomon, 2016; Srinivasan, 2014; FAO, 2010). Population growth, expansion of agricultural activities, recent increase in infrastructural developments, increased energy and construction material demand, forest fire, etc. are among the prominent factors that accelerated the rate of deforestation in the country which in turn is causing for the extinction of indigenous plant and wild animals.

Ethiopia has a total of 120 threatened endemic plant species. Even in those areas which are officially declared to conserve nature and maintain ecosystem services, there exists an override of economic ambition than their ecological functions (Solomon, 2016; Srinivasan, 2014; Kindeya, 2003 and Ensermu *et al.,* 1992). Because of this, many of the valuable land resources such as national parks, which have got regional and global ecological importance are being destroyed as they are not being valued for their role as nature's genetic reservoirs of the world's biological resources (UPA, 2017). At present, the remnant forests of the country are located in National Parks and some of the inaccessible landscapes like mountaintops and hillsides (Solomon, 2016).

The forest ecosystem of Nech Sar National Park is one of the major natural capital of the park which serves as a habitat for the wild animals and other species. The reconnaissance survey of the research carried out by the researcher showed that the natural regeneration, density and

diversity of the park is being challenged by the human and other activities. Survey was then conducted to assess the status of the forest ecosystem of the park by dividing the forest ecosystem in to three management categories, namely protected, less and high human interference areas (reference to chapter four – section two).

The data collected from the experimental plots set up by the researcher (chapter four section two and chapter five section one) in the areas of the park where there is no human activity, the population structure of trees showed an inverted J-shape frequency distribution. This shows that, the natural regeneration of trees in the protected land management category of the park is in a healthy natural regeneration status. This is mainly because that cross section of the park is being protected from human activities such as selective cutting of trees for fuelwood and charcoal making. For the park management, this phenomenon indicates that if proper protection works are in place, the rest of the park's forest and its associated resources can be maintained in a sustainable way while preserving the ecosystem services of the park.

In the less and high human interference areas of the park, however, most of the trees have not exhibited a healthy natural regeneration pattern due to the ongoing selective cutting of trees by the local and indigenous communities of the park. In addition to this, the ecological assessments of this study showed that human interference is having a negative impact on the density and species diversity potentials of the woody vegetation of the park. The highest density of trees and species diversity was found in the protected zones of the park as compared to the areas of the park that are prone to human induced impacts. This indicates a considerable area of the park is being damaged by human activities. If not averted, this phenomenon can cause for the extinction of species and its consequent impact on the degradation of the biodiversity and ecosystem services of the park. This includes impacts such as degrading the role of the park on climate regulation through carbon sequestration. The impact of the ongoing degradation on the density and diversity of the forest will also affect the wildlife habitat and its subsequent impact by causing the migration of wild animals from the park in search of shelter and feed.

7.1.1.2. Ground Cover of Herbs

The presence of a good ground cover of herbs is among the major elements of protected areas (Arega, 2005). The findings of the study, however, showed that the ground cover of herbs in the

Nech Sar grassland (as indicate in chapter five section 5.1.5.) is being degraded by overgrazing that mainly emanated from the impact of the high livestock population pressure of the local communities which are making use of the park's natural resources. This will have a significant impact on the availability of different grass species that are palatable for the wildlife since the available palatable herbs are being ate by the domesticated animals. This may also have a direct impact on the survival of the wild animals who rely on the ground cover of herbs as a source of feed (Girma and Tell, 2012; Abiyot, 2009). The degradation of the ground cover of herbs will also affect the tourism potentials of the park as the reduction in the availability of herbs will result in the decrease of wild animals. Such degradation would make the landscape less attractive than it used to be and will reduce the tourism potentials of the park (Bill, 2003).

7.1.1.3. Expansion of Invasive Plants

In Nech Sar National Park, because of the increased movement of livestock in the park territories and agricultural activities like crop production (among the causative agents for seed dispersal), invasive plants such as Abutilion spp, Parthenium and Prosopis are being disseminated at an alarming rate inside the territories of the park. These species have also the capacity to produce a significant number of seeds and invade an area within a short period of time (Taye *et al*., 2007). Supported by the views of the respondents via focus group and questionnaires (section 5.1.6. of chapter five), the expansion of invasive plants in the area is affecting the availability of palatable grass species in the grassland for the wildlife. This phenomenon will have a direct impact on the survival of wild animals as their wellbeing is directly associated with the availability of feed and water. In addition to that, the landscape of the grassland is getting less attractive than it used to be and this will have a direct impact on the tourism related opportunities of the park. Hence, if remedial measures are not going to be placed with utmost urgency the invasive species are overtaking the natural ecological niches of the park.

7.1.1.4. State of the Aquatic Ecosystems of the Park

The satellite image analysis (as indicate in chapter 5 section 5.1.7.) on the differences in water surface coverage in between the years of 1985 to 2015 showed that, Lake Chamo has lost 2,465.46 hectares of its water coverage. This substantial reduction of water coverage could mean a great loss in terms of the availability of aquatic biodiversity resources such as fishes, crocodiles,

hippopotamus, etc. as well as the other ecological functions of the Lake. Increased sedimentation is potentially caused by improper land-use practices such as hill side farming, poor soil and water conservation activities. In addition to that, as seen from Chapter two Figure 5, the annual rainfall distribution of the area has showed a significant fluctuation and reductions in the last decade and this might also contribute for the reduction of stream flow in to the lake. Other climate change related factors such as rise in temperature in the area (Figure 4 of Chapter 2) could have contributed for the evaporation of the water from the lake. However, further research in the aquatic ecosystems is required to inform policy level actions.

Another outcome of the study indicated the increased activity of illegal fishing and its negative impact on the sustainability of the aquatic resources. Illegal fishing practitioners are using illegal fishing equipment such as reduced net size to catch varying sizes of fish. As a result of the reduction of the volume of water in the lake, increased sedimentation and expansion of illegal fishers, the availability of fish catch is decreasing from time to time. The decrease in the availability of fishes will also have a direct impact by (1) affecting the survival of other aquatic animals such as crocodiles who prey on the fish (2) decreasing the dietary diversification and food supply chain of the locality (3) weakening the income generation potentials of the fishermen.

In addition to this, because of improper land-use practices, as seen in Figure 55 of chapter five, the breeding grounds of the crocodiles are now covered with sediment. This indicates as the entire aquatic ecosystems of the park which used to support the wellbeing of animals like crocodiles are being affected and the future existence of these animals and the continuity of the aquatic biodiversity resources along with the ecosystem services looks gloomy since these ecologically vital resources are being modified by human activities. Hence, further studies on the aquatic ecosystems of the park which would inform policy level actions are deemed necessary. On top of this, concerned institutions must make quick remedial actions which will help to avert the ongoing sedimentation of the lakes and illegal fishing activities.

7.1.1.5. Summary on the state of Natural Capitals of the Park

In summary, the ongoing human activities are degrading the natural capitals of the park (forest, grassland, aquatic ecosystems, and wildlife). In reversing this damage, the park management could consider the following strategic directions (a) provision of alternative renewable household

energy supplies (solar appliances and fuel saving stoves) (b) creation of alternative livelihood opportunities that would reduce the increased dependence of the local communities on the natural resources of the park (tapping ecotourism potentials of the park, expansion of micro and medium enterprises, skills development for youth, etc.) (c) institutional capacity development of the park management office (human, technical and financial) (d) partnership development with the grassroots level stakeholders in the areas of law enforcement, income generating skills development, etc. (e) awareness development on the importance of the park towards the wellbeing of the local communities. Hence, conservation and maintenance of the remaining vegetation cover from deforestation are some of the vital issues that have to be addressed by policy makers if the remaining land resources are to be conserved and used in an integrated and sustainable manner.

7.1.2. Research Question 2: What are the human induced threats that impact the natural capital and governance of the park?

The research is aimed at exploring the human induced threats that are affecting the natural capitals of the park. Accordingly, this section is designed to respond to objective two and three and stage two and three of the conceptual framework.

7.1.2.1. Household Energy Demand and Forest Resources of the Park

More than 90% of the total annual household energy source in Ethiopia comes from biomass (Negussie *et al*., 2013; Kiflu *et al*., 2009). This proportion is projected to continue for the years to come as the major portion of the country's population lives in rural areas that have less access to other alternative sources of energy which makes charcoal and fuelwood the principal energy sources. According to Araya and Yissehak (2012), the production of charcoal has increased from a million tons to more than three million tons per annum and the consumption of fuelwood has also increased from forty million to one hundred million cubic meters per annum. This has led to the degradation of the forest and its associated resources from protected areas and other forest management systems of the country.

Respondents of the focus group discussion (as indicated in chapter five sub-section two) also echoed that, due to cost implication and availability, the rural and peri-urban settlers are not

using renewable energy sources with the exception of minimal use of electricity for lighting purposes. Electricity availability is on average 2-3 hours per day. Due to the scattered nature of the households, majority of the households are outside of the electrical grid so accessing electricity is a major problem. However, it is also important to note that electric cooking is not very common in rural areas in Ethiopia, so even if the households have access to electricity, the firewood use may continue. It is also critical to note that due to the low levels of income, most of the households do not have the amount of money that will be required to pay for the electricity on regular basis.

Results of the ecological survey indicated that, the increased reliance of the growing population on fuelwood is having its direct impact on the natural regeneration, density and diversity of the woody vegetation of the park. As for instance, the highest density of trees was found in the protected zone of the park (1,581/hectare) while 616 trees per hectare were found in the high human activity areas due to the cutting of trees in meeting the household energy demands of the local inhabitants. On the other hand, the clearing of forests for fuelwood will also result for wildlife habitat fragmentation and if not averted, this human activity will have a devastating effect on the biodiversity conservation and ecosystem services role of the park.

As indicated in 5.2, the research found that women are the one (90%) who are responsible for the collection of fuel wood in the park for household use. This situation is compounded by the lack of other forms of alternative livelihood activities for women in these rural communities in Ethiopia. Therefore, any remedial strategy to reduce the impact of fuelwood collection and deforestation in the Nech Sar Park must first and foremost focus on developing skills and employment programme that will help to empowerment women in developing sustainable livelihoods in these rural communities of the Nech Sar Park.

The research also indicated that, the major fuel wood collection activities are held within the 5-8pm time slot since the park rangers will be off-duty after 5:30pm. Although the park authorities are struggling with budget and human resources related challenges, this indicates that the park administration is not addressing the human induced challenges in a strategic way such as establishment buffer zones where locals can get woodlots.

7.1.2.1.1. Triangulation of Findings

Grounded by the ongoing impact of human activity on the resources of the protected area, the conceptual framework of this thesis identified four main conceptual elements that would help to address the knowledge gap that exists on the impact of human activities. It would also enhance the sustainability of protected areas by capacitating and equipping policy makers and protected area authorities with the mechanisms that would help to analyse the state of the biodiversity and ecosystem services and alleviate the vulnerability of protected areas natural capital that emanate from human interference. In this regard, proposing the newly developed conceptual framework is an attempt to bring the impact of human activity down to specific local level contexts along with the suggested remedial integrated approaches that will help to combat the degradation of protected areas resources whilst enhancing the wellbeing of the local and indigenous communities.

In essence, the different elements of the conceptual framework guided the entire research process. In that case the first and second elements (vulnerability of natural capitals and state of natural capitals) were meant to show the need of getting a deeper understanding on the breadth and magnitude of the natural resources degradation and to attest on whether the impact of human activity is real. This is an important element of the conceptual framework which other existing conceptual frameworks have not considered. These elements have also guided the methodological approaches which helped to triangulate the findings as well as the impact of human activity by collecting information from different attributes such as forest, grassland, lakes, etc.

The third element of the framework has also helped to identify the governance related challenges that aggravated degradation of the resources which are defined in the second element. After a careful analysis of the first three elements and identifying the linkages among the different elements of the framework, the last element was meant to propose the approaches that would help to minimize the vulnerability of the protected area's natural capital based on the identified human induced challenges. In this case, the framework also guided to combine knowledge from ecological as well as human systems by encapsulating knowledge sharing, knowledge gaps

identification, documenting knowledge from concerned partners and the formulation of integrated approaches which will help to ensure the sustainable development of protected areas.

In materializing these, triangulation was at the heart of the methodological approach of this thesis. Quantitative date from ecological surveys, qualitative information from communities and stakeholders as well as secondary sources of information were triangulated to ensure the validity of the research and enable a deeper understanding on the state of the park's natural capital in light of human induced impacts. Nickson (2014) also echoed that before handling vulnerability related assessments developing a sound data collection and analysis method helps to ensure the collection of data that will help to address the problem since collecting as much information as possible will help to define the approaches that will alleviate the vulnerability of resources.

In this vein, if we take the case of fuelwood collection, triangulation of the different findings of the study revealed its impact on the state of the park's natural capital as illustrated in the below diagram (Figure 75). For instance, the increased population trend of the locality (chapter two – Table 4) has correspondingly increased the fuelwood demand of the locality. In this regard, the comparisons of results between the parts of the park that get a better protection and human interference zones indicated that human activities are degrading the biodiversity potentials of the park. For instance, due to the absence of human induced threats in protected land management category of the woody vegetation of the park, a total of 27 tree species observed while 17 were found in the human interference areas of the park. Due to the prevalence of rigorous fuelwood collection and livestock pressure, 9 sapling species of the 17 matured tree species are absent in the high human interference areas of the park. In the less human activity area, the population structure of the major trees such as *Maytenus undata* indicated their inability to make it up to the higher diameter classes as their case might be in the protected areas of the park (Figure 35). Had it not been the impact of human activities, the natural regeneration potential of the trees in this category should have showed a similar pattern with the protected zone of the vegetation.

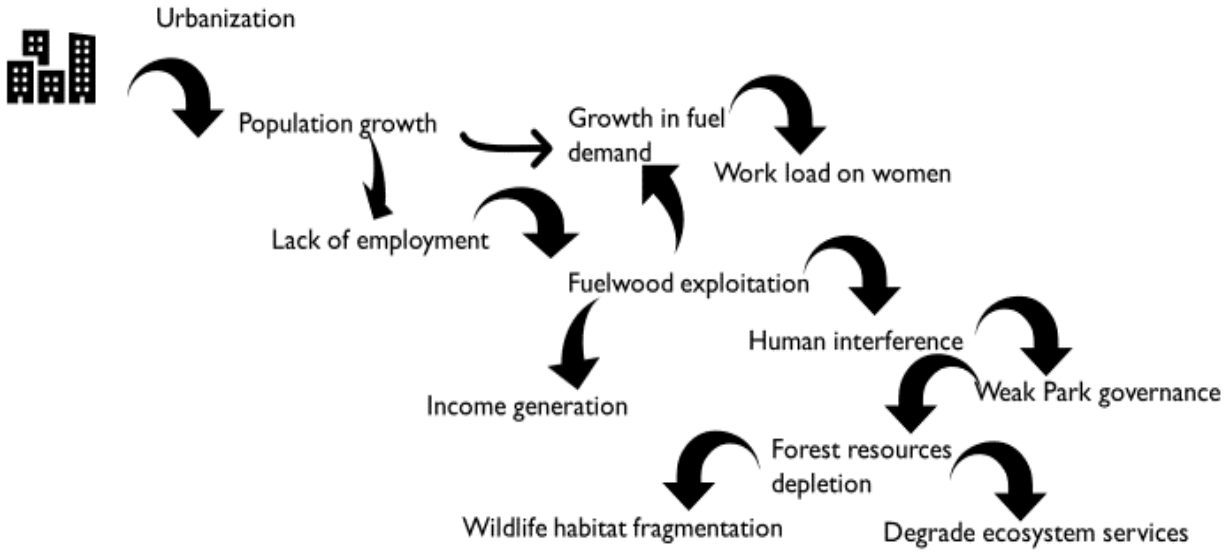


Figure 75: Schema showing the impact of population growth on the forest resources of the park

The ecological assessments on the density of the vegetation also indicated that, on average a total of 824 matured trees are being cut on daily basis from the park to meet the household energy demands of the local inhabitants (Figure 62). The one-way ANOVA also indicated as there is a significant difference in the density of trees across the different land management categories. The local community's perception assessment on the state of the vegetation also indicated that the community are aware of the dwindling trend of the vegetation. This finding is also in line with official reports which estimated as 98% of the household energy demand of Arba Minch city is met from fuelwood that mainly comes from the forest resources of Nech Sar National Park (Abraham, 2015). Due to the lack of employment opportunities, a larger proportion of the young people is also engaged in fuelwood collection.

The Shannon Diversity Index analysis also exhibited that, the highest species diversity of matured trees was obtained in the protected areas of the park (1.76) which is followed by the less and high human activities management categories (1.14 and 1.10 respectively). According to the findings of the fuelwood survey, this is an attribute of the fact that, some tree species are preferred for the amount of energy which can be generated as compared to other trees. Trees like *Lonchocarpus laxiflorus* are known to generate more energy than others and such species are facing the highest rate of deforestation because of the high amount of energy which can be

generated from these species of trees. The outcomes of the focus group discussions held with the local and indigenous people showed that, 88% of the respondents witnessed the decreasing trend of the forest resources caused by increased fuelwood demand of Arba Minch and other neighbouring localities (women being the major fuelwood collectors). The degradation of the forest resources is causing the wildlife habitat fragmentation and subsequent reduction of the wild animals from the park. In addition to this, the impact is being observed on the ecosystem services of park such as reduction on the supply of potable water to the town of Arba Minch (chapter six section one).

On the other hand, the non-participatory nature of the country's protected areas governance system, poor coordination among stakeholders, inefficient law enforcement and weak institutional capacities of park authorities are also among the factors that aggravated the resources degradation. After analyzing the range of information on the challenges which the park is facing, an interwoven of integrated approaches which would help to alleviate the ongoing the degradation are also suggested which include the establishment of buffer zone, provision of environment friendly livelihood opportunities and official demarcation of the park being the main ones.

7.1.2.2. Lack of Community Participation in the Management and Governance of Nech Sar National Park

The participation of local and indigenous people in the sustainable development of protected areas is supported by literature (UNEP, 2019), which states that "Governance, including customary institutions and management systems ... involving indigenous people and local communities, can be an effective way to safeguard nature and its contributions to people's development." (UNEP, 2019). Hence, the placement of proper governance arrangements is a major factor that ensures the sustainable development and management of protected areas. In the case of Nech Sar National Park, however, the GAPA analysis as per the information obtained from focus group discussions with the local and indigenous people showed the park is being governed through a top-down approach which deprived the local communities from taking part in the governance arrangement of the park.

Data from interviews with senior officials and questionnaire from operational staff of the park also indicated that, the park is being governed by officials who are based in Addis. Such top-down governance mechanism would have serious implication in terms of the quality of governing the Nech Sar Park. This include (a) the isolation of local and indigenous people in the governance of the park which lead to the lack of ownership of these people of the park and (b) resulting in increasing the exploitation of the park resources by local and indigenous people to enhance their livelihoods (OECD, 2013; Andrew, 2018).

Based on the outcomes of the GAPA analysis, it was also found that the local communities are not benefiting from the revenue generated by the park. Sharing benefits with the local communities could have helped to raise the local communities' level of ownership in the park's natural capital which would contribute towards the sustainable development of the protected area.

The ecological assessment results have also indicated that the protected area governance system is not contributing to the achievement of the park's objectives in protecting its biodiversity potentials along with the ecosystem services of the park. Due to human and financial constraints, laws and regulations are not being enforced in an effective manner to enhance collaboration and coordination among the different stakeholders of the protected area.

The GAPA approach supports the involvement of local communities as the foremost strategy for addressing protected areas degradation. Therefore, any strategy to be implemented in addressing the above governance challenges at Nech Sar National Park must focus on the creation and enhancement of the enabling environment of the local communities to participate in the governance of the park.

7.1.2.3. Lack of Official Demarcation of the Park's Boundary

According to data collected from park authority and other sources (Abraham, 2015; NSNP, 2016; Abiyot, 2009 and Girma and Till, 2012) the Park was established by law; however, the boundaries of the park are yet to be gazetted by the country's proclamation law. While the Park is known for its ecological and economic importance, the policy makers have not taken the decision to officially gazette the park and give legalized clarity to the demarcation of its boundaries. This is viewed by stakeholders as the major bottleneck for the proper governance of the Park.

The park is located between two Regional States of the country; therefore, the issue of regional ownership is a fundamental challenge to address the current governance challenges faced by the park since the Park is currently being governed by the Federal level authorities. This situation has created a vacuum for the participation of local and indigenous community at state level to participate in the governance of Nech Sar National Park.

The above factor is compounded by the ineffectiveness of the park's authority to implement the national parks regulation which prevent people from performing prohibited activities such as hunting, fishing, undertaking agricultural activities and grazing and watering of domestic animals.

It is also critical to note that the forest related policies and regulations of the country are not in a position to provide the required conservation, development and utilization functions that could help the efficient utilization and development of forests and the associated land resources. This is mainly an attribute of the weak / absence of law enforcing mechanisms in the country and compounded by the frequent restructuring of the natural resources management and agriculture sector offices of the country that might have caused to the discontinuation of planned activities.

7.1.2.4. Community's Perception on the State of Ecosystems and their Preference towards the Ecosystems of the Park

Protected areas host a range of ecosystems that contribute services which help to ensure the sustenance of living things (WWF, 2018; SCBD, 2008). These resources in Nech Sar National Park are going through considerable degradation as a result of human induced activities in satisfying basic needs such as firewood and food.

Depending on the nature of livelihoods, the responses of the local communities obtained through focus group discussions showed differences on their preference for the different ecosystems (chapter six, section one). The Guji men who mainly are pastoralists indicated as they prefer the grassland followed by the water resources since they rely on these resources as source of food and water for their livestock. Contrary to this, the Guji women indicated that they value the forest resources more due to their attachment with the forest in fetching firewood for performing their daily household chores. The Gamos on the other hand indicated that the Lake Chamo is their most preferred ecosystem since they mostly rely on fishing activities as sources of their livelihood. Hence, in addressing the ongoing exploitation of the park's natural capital,

policy and strategic activities should consider the livelihood experiences and contexts of the local communities. This would be achieved by devising strategies and programmes based on the specific preferences of each local and indigenous communities to address the specific degradation caused by each community group (refer to chapter seven question three, stage four of the conceptual framework).

Focus group discussion participants indicated that the forests, grassland and the aquatic ecosystems of the park are deteriorating from time to time because of the increased human activities in the park. This includes, impacts of the dependence on fuel wood and charcoal as a source of household energy supply, overgrazing by the increased livestock population, expansion of illegal fishing activities which make use of unrecommended fishing net size which catch the baby fish, impacts of sedimentation on the aquatic ecosystems of the park caused by improper land-use practices, poor governance, weak coordination among stakeholders, etc. (Figure 76). These factors are causing a tangible impact on the biodiversity potentials of the protected area. Thus, this magnifies that the efficiency of park management and governance systems of the country are far from ensuring the sustainable development of the protected areas and hence the urgency of putting strategic actions that could help to avert the ongoing degradation of the park's natural capital.

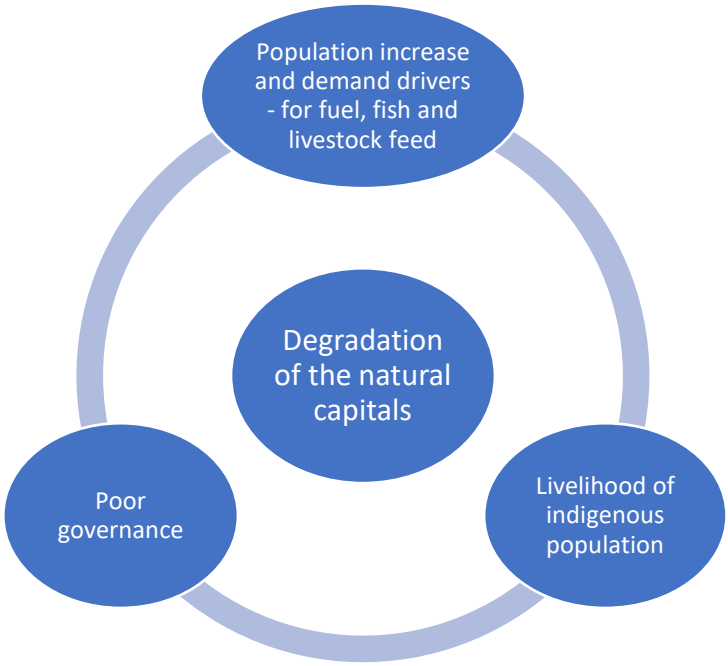


Figure 76: human induced causative agents for natural capitals degradation

7.1.3. Research Question 3: How can the natural capital of the park be protected and managed in a sustainable way?

This section is responding to objective number four and stage four of the conceptual framework of the research. This is aimed at the formulation of the conceptual framework entitled an integrated development approach to ensure the sustainable development of the natural capital of Nech Sar National Park. Before embarking on the strategic approaches which will allow the sustainable development and management of the park's natural capital, the researcher would explain the conceptual framework which will help to achieve the intended approaches.

7.1.3.1. Operationalisation of the Conceptual Framework for the Formulation of the Integrated Development Approach

The conceptual framework of this research titled as "Conceptual framework for analyzing the impact of human activity on the natural capital of Nech Sar National Park" was designed to assess the current state of the natural capitals of the park, identify human induced and governance factors that affect the natural capitals of the park. It was also aimed at designing an integrated development strategic approach which respond to the development challenges faced by the protected area. The following sections will discuss the different elements of the framework along with the ways of how the framework could be used to deliver the integrated strategic development approaches. The possible adjustments that would enhance the operationalization of the framework will also be highlighted.

The conceptual framework of the research is composed of four distinct elements: (1) identifying the vulnerable natural capitals of the protected area, (2) state of the natural capitals in line with human activities (3) governance and processes and (4) the integrated strategic development approach to improve the sustainable development of Nech Sar National Park.

The framework is designed to capture the natural capitals of the park (forest, grassland, lakes) and examine their current state in light of the ongoing human induced impacts. This element helped to explore current state of the natural regeneration potential of trees along with the species diversity and density. In operationalizing this element of the framework, the fuelwood collection was found out to be the major threat. Since managing the household chores is considered by this community as a women's job, fuelwood collection is also among the driving

factors that increased the vulnerability of women to workloads as they have to travel 5-10 kilometers to fetch firewood. This element of the conceptual framework is also directly related with the governance and processes element of the framework since the non-participatory governance approach of the park authorities aggravated the depletion of the park's resource. This is mainly because the current governance approach has denied the local and indigenous communities from being part of the management activities of the park and share the benefits which could in turn have helped the sustainable development and management of the protected area. The combined and interwoven outcome of the results from focus group discussions, ecological assessments, etc. have also helped to tighten the complementarity of the different elements of the framework. After deploying the quantitative and qualitative analysis procedures, the formulation of the integrated development approaches has also showed the integrated nature of the framework which is designed to ensure the sustainable development the natural capitals, placement of effective governance system and enhance the institutional capacities of the park authorities. In line with this, the conceptual framework of the thesis was also operationalized by the following methodological stages.

Stage one of the conceptual framework helped to identify the natural capitals of the park which are prone to human induced impacts. Hence, the forest, grassland, aquatic ecosystems are the preliminary resources of the park that are being affected by human activities.

Stage two of the conceptual framework was mainly focussing on assessing the state of the natural capitals of the park with a major focus on forest, grassland and aquatic ecosystems. To do this the researcher (a) collected primary and secondary data that helped to assess the current state of the woody vegetation, grassland, lake Chamo, etc. (b) analysed the impact of human activities on these natural capitals by dividing the protected area in to three different management categories (no human interference, less and high human interference). This process enabled the researcher to have a closer look at the intensity and impact of human activities on the natural regeneration potential, density and diversity of the forest vegetation (chapter five – section one).

The breadth of human induced impact on the grassland and Lake Chamo was explored by making use of experimental plots, observations, FGDs with the local and indigenous communities, questionnaire with operational and management staff of the park and satellite images.

Stage two of the conceptual framework also focused on identifying the human induced threats. The researcher conducted focus group discussions with the representatives of the three local communities who live in and around the protected area. The views of the operational and management staff of the park were also captured through the questionnaire (chapter four section two). Senior park officials and decision makers were interviewed to get their views on the different threats which are affecting the natural capitals of the park. Secondary data from official reports of the park and other stakeholders and from related literature were used as a source of information. Accordingly, the human induced threats which are having a negative impact on the park are identified. In line with that, the natural regeneration potential of the vegetation which ensures the continuity of the biodiversity potential of the protected area is in danger since the seed producing adult trees are being cut by the locals in satisfying the household energy demands of the local inhabitants. Similar negative impacts were observed on the density and diversity of the woody vegetation.

Stage three of the conceptual framework mainly focussed on exploring the governance factors that affect the daily operations of the park. This stage assessed the impact of the lack of community participation on the governance of the park. Since Nech Sar National Park is being governed remotely by Federal arrangements, this stage also examined the impact of a top-down governance arrangement on the natural resources of the park through interview with policy makers and senior officials and questionnaires with operational and management staff of the park. The views of the local and indigenous communities on the management and governance and benefits sharing were explored at this stage by making use of focus group discussions with the youth, women and men categories.

The final stage focused on designing strategic approaches which would help to overcome the ongoing impact of human activities on the natural resources of the park. Hence, a set of strategic approaches were formulated by closely examining the nature of the human activities that are presently impacting the governance and sustainable development of the park. In formulating the strategic approaches, information was collected from review of literature, interviews with policy makers and officials and questionnaires conducted with the operational and management staff of the park and focus group discussions with the local and indigenous community representatives. So as to provide feedback on how the research project is performing and to document and share

lessons learned, monitoring and evaluation will be implemented as part of the integrated strategic development approaches.

After carrying out the research, the researcher revised the conceptual framework in such a way that the formulation of the strategic approaches has to go through from initial to the final operationalization stages of the conceptual framework as been depicted in the below Figure 77.

The review of related literature indicated that, there is a knowledge gap on conceptual frameworks which will help to assess the quantified impact of human activities on the natural capital of protected areas. This phenomenon will deny policy and strategic actions to have a knowledge based informed decision which would help the sustainable development of natural capitals in the context of protected areas.

The design and implementation of a new conceptual framework hence will provide evidence and knowledge-based approaches that will help to develop the institutional capacity of protected areas authorities for them to avert the impacts of human activities on the natural capital of protected areas such as fuelwood collection and its impact on the natural regeneration potential of trees. The conceptual framework will also provide decision and policy makers with the approaches that will help to explore and tap the environment-friendly livelihood potentials of protected areas which will have local and regional economic development opportunities while ensuring the sustainable development of protected areas.

The framework also makes an academic contribution on biodiversity, ecosystems services and sustainable development protected areas in the context of developing countries because of its applicability to assess the impact of human activities on the natural capital of protected areas.

In line with this, the revised conceptual framework consists of four distinct elements (Figure 77) – (i) Vulnerability of natural capitals (ii) State of the natural capitals (iii) governance and processes and (iv) Integrated development approaches. Vulnerability in the context of this research framework refers to identifying natural capitals that are prone to human interference and are facing sever degradation. This includes forest, grassland, wildlife, aquatic ecosystems (lakes, rivers, hot springs) and soils. This element is again linked to the state of natural capitals where their current state needs to be analyzed by deploying ecological as well as qualitative assessment tools

so that empirical based strategic approaches can be deployed by decision making bodies of the government in ensuring the sustainable development of the protected areas natural capital. In achieving this, the governance and processes element of the framework is also the main attribute of the conceptual framework since it will have a direct impact on the state of the natural capitals. Hence, in order to achieve the sustainable development of protected areas that are being affected by human activities, the framework suggests the continuous formulation of the integrated strategic development approaches in the entire research process which is aimed at addressing the vulnerability of the protected area's natural capitals caused by human activities. Apart from that, the wellbeing of the local and indigenous communities through the development of alternative livelihood and household energy sources should be central to the integrated development approaches whilst enhancing the biodiversity potentials along with the ecosystem services of the protected area.

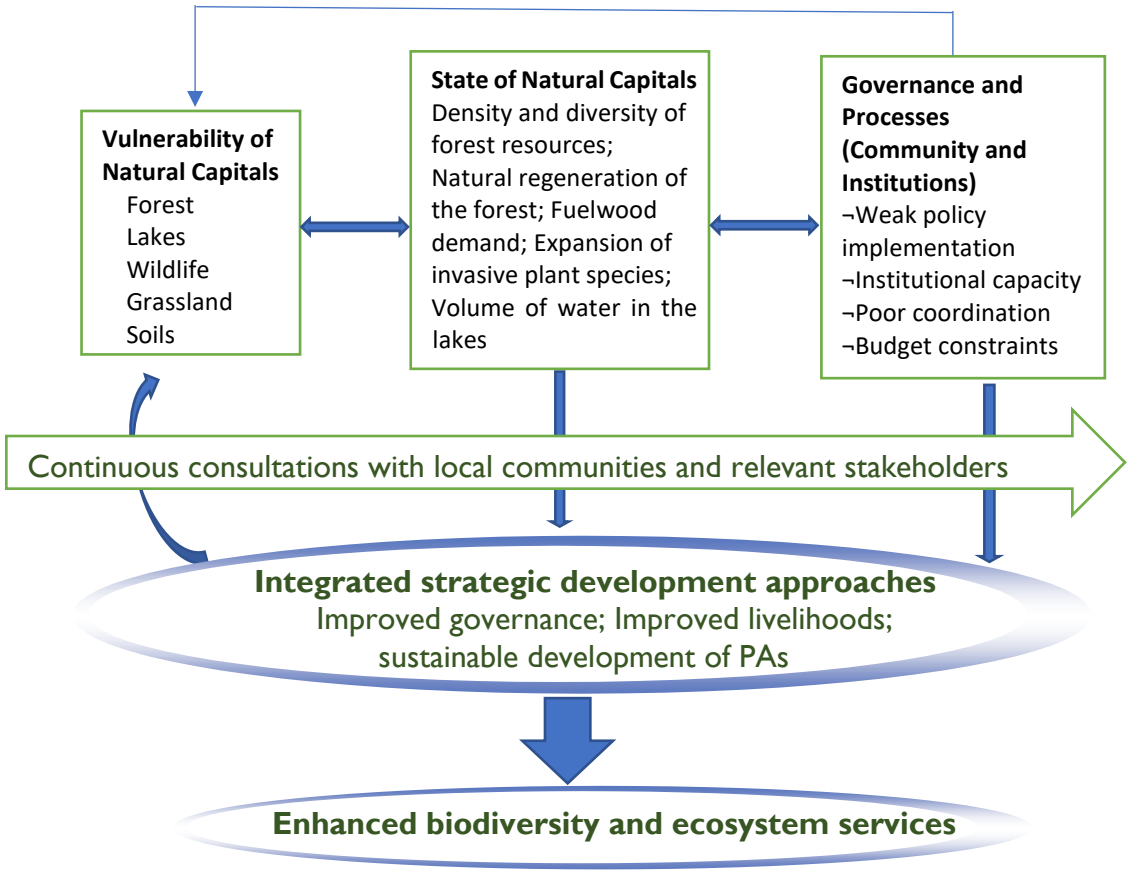


Figure 77: Revised conceptual framework for analyzing the impact of human activity on the natural capital of Nech Sar National Park.

As part of the knowledge contribution of this study, the researcher also believes on the transferability of the conceptual framework of this research as the framework can be applied in the following areas.

- ✓ Academicians and researchers can deploy the framework to assess forest, grassland, etc. biodiversity components such as species diversity, density and natural regeneration potentials in protected areas context as well as other conservation related strategies.
- ✓ Academicians and researchers can make use of this framework in order to identify the breadth and intensity of invasive plant species impact on protected areas and other conservation areas.
- ✓ Development practitioners and policy makers can also use the framework to gauge the status of natural capitals in protected areas and other related resources in the light of human activity and devise appropriate strategies that could help to halt the degradation of resources and ensure their sustainable development.
- ✓ The framework can also be used by development practitioners to tap ecotourism potentials and provide local economic development opportunities (livelihoods) for local and indigenous communities.
- ✓ Gender related issues such as the vulnerability of women in fuelwood collection can also be assessed and inform policy and strategic action plans for devising ways which will help to reduce the workload and vulnerabilities on women.

Therefore, the conceptual framework of the theis along with the methodological approaches have a wider role of application than it was originally indicated in the earlier chapters of the thesis.

7.1.3.2. Integrated Strategic Development Approaches

The sustainable development of protected areas is dependent on the creation of the enabling environment whereby the local communities are considered in the management and governance of the resources. This includes, the creation of opportunities where local communities would benefit economically, establishment of coordination mechanisms among stakeholders and other protected areas good governance principles. The findings of the GAPA analysis explained in 6.2 showed that, the local communities are lacking the opportunity of sharing the economic benefits which could be generated from the park. This is mainly because the income generation potentials

which could have helped the local communities are not tapped by the park authorities. The existence of weak enforcement of laws and regulations is also contributing for the loss of biodiversity in the park.

Based on these findings of the research, the researcher explored a mix of strategic approaches that will help to address the impact of the ongoing human induced activities on the natural capitals of the park as follows.

7.1.3.2.1. Development of Alternative Livelihoods

The lack of alternative livelihood opportunities and the pastoral life-style of the local and indigenous communities are among the primary factors that forced the communities to rely on the natural capital of the park for maintaining their livelihoods (Dena 2006; Aramde *et al*., 2012). For instance, as per the ecological assessments of this research it was found that a considerable number of trees are being cleared everyday from the park in meeting the household energy demands as well as to generate income for those who rely on firewood collection as their means of survival. Pastoralists in Ethiopia also rely on animals as their sources of livelihood. The pastoralists will move from one place to the other in search of feed for their livestock. They will graze their cattle in one place and when the grass cover gets low they will again move to other potential areas where they can get a better ground cover of herbs. Nech Sar grassland plains are also affected as a result of this trend and the heavy livestock pressure will consume the available ground cover of herbs which is meant to support the wildlife of the park. However, the development of eco-friendly alternative livelihood opportunities would help to increase the income generation potentials of the local and indigenous communities who live in and around the protected area in an environment friendly way. This includes the following.

1. **Ecotourism**

The rich cultural values and heritages of the local and indigenous communities of the protected area are among the ecotourism potentials which could be tapped in various ways. This could include exploring opportunities such as the establishment of cultural museums, community lodge and village and cultural accommodation that could help to attract tourists and generate income

in a sustainable way. This can include promotion of local dances, cultural food, couisines, and establishment of shops to showcase and trade cultural art and utensils.

In this regard, the strategic approach will consider organizational arrangements and partnership developments with the concerned partners including local authority, community groups and NGOs. This would include the formulation of legally binding letter of agreements (Memorandum of Understanding) with the different parties which outlines the roles and responsibilities of the concerned actors. With this regard, the local institutions would be invited to participate in the ecotourism initiatives by providing trainings and technical inputs to bring the services to be delivered by the local communities up to national and international standards. The park management authority's management committees will be broadened to involve a range of key stakeholders on these committees to participate in the formulation of policies as well as the development of the park's operational plans. In order to establish such viable businesses, efforts will be made on the part of the organizers of the initiative to link these businesses to microfinance institutions who will provide credit as start-up capital to new and existing businesses. Business management skills such as records keeping, savings and preparation of additional innovative business plans are some of the areas which can be done with support from the park management and appropriate national development institutions. The strategy will put emphasis on the promotion of tour operating businesses as part of the eco and heritage tourism sector.

Tourism could have impacts on the park in terms of firewood demand, road and infrastructure development pressure, demand for water, shelter, food and other basic amenities. These adverse effects will be minimised by conducting regular assessments on the carrying capacity of the ecosystems of the park along with the development of measures to ensure that the ecotourism and related livelihoods activities to be introduced will not affect the natural resources base of the park. To minimize the dependence of the tourism activities on fuelwood, clean energy sources such as solar appliances will be in place for cooking and other necesscities. Solid and liquid garbage disposal systems will also be in place. The parks authority will also ensure that a monitoring and evaluation framework is developed in collaboration with key stakeholders to enable them to work with stakeholders to ensure that the number of visitors in the park do not go over the carrying capacity of the park. Public awareness programmes will be developed and implemented within the participating and adjacent communities to raise the community's awareness on the

impact and implications of such programmes on the park. The local park officials will be involved in the monitoring of the activities in collaboration with the National Park Authority. The National Park Authority will be responsible for the analysis of the data provided by the local park management officials and develop and implement strategies in collaboration with the local park officials and concerned stakeholders.

2. Modern Agricultural Development

Modernizing the agricultural livelihood activities of the local and indigenous communities is also another area that should be captured as part of the livelihood development strategy. As most of the local communities are pastoralists, the livelihood development strategy should engage modernizing the animal production in an environment friendly way. In the context of Ethiopia as highlighted above, pastoralist usually will not reside in one place on permanent basis. They will move from one place to the other searching for areas where they can access a better ground cover of herbs to feed their cattle. Without consideration of the quality aspect, holding a huge number of cattle is also one way getting social prestige in these communities. Environmentally this could mean a great impact on land resources since the natural capitals like grasslands will be overwhelmed by a huge number of cattle without considering their carrying capacity. Hence, this trend of livelihood is hostile to the sustainability of the park's natural capital. Thus, modernizing the agricultural livelihood practices of the local communities who lead a pastoralist way of life will thus start by awareness development works of the local communities on the negative impacts of not having a sedentary way of life which denies their right from having access to proper public services such as health and education facilities since they move from one place to the other in search of feed for their livestock. These communities also have a rich indigenous knowledge of livestock production and hence, the technical training programmes that will help to maximize agricultural production in a given area of land which will also form part of the strategy should build on their indigenous technical knowledge of production. This could include destocking the high number of livestock per household which consumes a lot of space, labour and resource along with its limited benefit to the household and focus the production on a manageable size of cattle. However, since having a high number of cattle is a symbol of wealth in these communities, this initiative may not be easily welcomed by the pastoralist communities. Hence, awareness development works and experience sharing visits will be deployed to overcome this challenge. In

this regard, if they agree to this strategy, the communities will be able to engage in agricultural extension systems where they can access technical support from extension agents and improved inputs and technologies that will help to boost the productivity and production systems. This will help also to maximize agricultural production since the household will be focused on maximizing the quality of production from a limited number of livestock by maximizing the profit margins than it used to be in the traditional pastoralist way of animal production systems which consumes a significant energy and time of the household members. In this regard, experience sharing visits with other best performing protected areas will also form part of this approach.

Thus, land will be designated to produce communal fodder for distribution to livestock owners. The reduction in free grazing would assist the community to produce food crops as well as for commercial purposes. This would enhance food security and reduce poverty. Farmers would use the irrigation water from the rivers and lakes to boost other agricultural productions such as producing field crops, vegetables and fruit crops. Introduction of climate smart agricultural practices such as development of pest and drought resistance crops will be also an important part of this component.

7.1.3.2.2. Promotion and Development of Medicinal Plants

The local communities of the study area have a rich heritage of using the different parts of plants to cure human and animal diseases. They also possess a rich body of knowledge on how these plants are to be used to cure infectious diseases. However, if the ongoing deforestation is not curbed, the potential of these medicinal plants development could not survive for long.

The strategy would focus on attracting local universities and research intuitions to develop further research on the medicinal properties contained in these plants and shrubs and develop facilities within the communities to package these indigenous medicinal plants for shipping and distribution to market nationally and internationally. This component would focus on working with the communities to create businesses and enterprises to enable them to market these products locally and internationally and to use the benefit to enhance the livelihoods and wellbeing of the community.

More specifically for the realization of this approach, the following steps will be put in place (a) the indigenous medicinal plants knowledge will be explored and documented (b) assess the local and international market potentials (c) concerned governmental authorities must provide indigenous knowledge property rights and recognitions for the community (d) to harvest sustainably, the establishment of household and community-based nurseries and the cultivation of the medicinal plants in home gardens and farmlands will be promoted.

To ensure the efficiency of benefits sharing among the local communities and to sustaine the impacts of this action, medicinal plants producers' associations will be established by the district level enterprises development office who will be able to provide the necessary administrative help in getting market linkages and establishment of offices. Bylaws will also be developed to enforce the benefits generated are shared among the association members based on the agreed modalities of production. These bylaws will also govern the functioning of the businesses such as records-keeping. On health-related technical issues, the concerned health offices will be engaged as part of ensuring the quality of products processing, handling and packaging. In order to warrant that the benefits remain with the indigenous population of the park who holds the knowledge, the concerned governmental authorities will register the indigenous knowledge of the local communities and certify them legally.

7.1.3.2.3. Strengthening of Institutional Capacity

This new strategic approach would create a partnership to focus on identifying the institutional strengths, weaknesses as well as devising strategic approaches to strengthen the capacity of existing institutions within the communities including the park management. The strategy would involve exploring the possibilities of developing a hybrid approach where local and indigenous people and their communities (bottom-up) can work together with policy makers and senior officials of EWCA along with operational and management staff of the park (top-down) (OECD, 2013 and Simmons, 2018). This partnership with the community would work with national and international organizations such as UNDP, UNEP and UNFAO as well as other NGOs to assess and provide resources to enhance the human and technical capacity of the institutions. This would also help the park authorities to engage these agencies in programmes that will enhance the

capacity of the community to develop alternative livelihood strategies as well strengthening the overall governance and management of Nech Sar National Park.

The structure of this arrangement would have three different strata (policy makers, operational and management staff of the park and the local communities). The policy makers and senior officials can focus on the development of appropriate policies and regulations as well as mobilizing resources (technical and financial) to facilitate the effective functioning of the park, while the operational and management staff of the park will focus on the implementation and enforcement of the programme within the park level. The local and indigenous communities can work with the park management to create appropriate management and operational committees which contribute to the development of appropriate sustainable livelihood development programmes.

This suggested approach is also in line with the existing wildlife policy and strategy of the country. For instance, the policy and strategy emphasize the community participation in the overall administration of protected areas (article 1). However, the strategic approaches are not pointed out by any action plan that reinforces the implementation of the policy. Thus, as an effort of bridging that gap this strategic approach will focus on (a) creation of buffer zone to allow for the grazing, crops production and fuelwood cultivation (b) in accordance with article 2.4 of the wildlife policy of Ethiopia (EWCA, 2005) ensuring that a percentage of the resources generated by the park are reinvested in the community to ensure the implementation of social and educational programmes in the community as well as (c) development of alternative livelihoods which benefit the community itself. Building the capacity of local and indigenous people to participate in the governance of the park will thus be a critical component of this approach.

In order to establish a lasting relationship between the different entities under this scheme and to address the tensions between different communities, regional states and federal level park authorities, the strategic approach will work on establishing a management committee. This committee will comprise of representatives from local communities, federal departments, regional states, private tourism facilitators (lodges, hotels, tour operators, etc.), concerned stakeholders, etc. This management committee will be able to devise mechanisms and frameworks on roles, responsibilities and benefits sharing and management mechanisms of the park. The materialization of this arrangement will require to place awareness development works

and law enforcement. On top of this, community mobilization works will also help enhance their participation in the sustainable development of the park whilst ensuring benefits are shared with them in an equitable way.

7.1.3.2.4. Training and Education Development

Training and education development would constitute an important component of the integrated strategic development approach. This would comprise the development of new curriculum for secondary and tertiary levels as well as training of teachers and instructors to use innovative and friendly teaching methods to deliver training on (a) climate friendly agriculture, (b) ecotourism and (c) green construction.

(a) Climate friendly agriculture would involve training and demonstration of drought and disease resistant crops as well as the use of soil conservation techniques such as mulching, terracing, contouring and furrowing. The efficient use of water example irrigation can be used to enhance crops production as well as to address the impact and consequences of climate change on the resource and devising strategies to reduce its impact.

(b) Ecotourism would consist of training in protected areas as well as wildlife conservation by taking and developing livelihood opportunities from the national park. Other training areas of this sector could involve tour operation, hospitality and entrepreneurship development.

(c) Green construction would involve training persons specifically at TVET centres in building accommodations which could help to use energy efficiently and help to regulate excess heat and cold that would be generated from increased temperature. This training could also include using alternative building materials that move people away from the use of forest wood and other materials from the park for building the houses.

7.1.3.2.5. Official Demarcation and Establishment of Buffer Zone

The integrated development strategic approach would focus on engaging EWCA and other policy and decision makers to work with local and indigenous communities and regional state officials to get the Nech Sar Park boundaries surveyed and gazetted so that the boundaries of the park

will be legally recognized by all stakeholders. In this process community consultations and getting the buy-in of the local and indigenous communities is of vital importance.

Part of the surveying of the boundaries of the Nech Sar Park should focus on putting in buffer zones and dividing these zones into land for agriculture (communal food production and growing of grass and fodder plants), land for grazing of animals, and land for planting of fast-growing fuelwood trees. The appropriate governmental ministries and NGOs should be contacted to work with local communities to develop these developmental zones.

7.1.3.2.6. Gender Mainstreaming

The findings of this research showed that women are the vulnerable segment of the society. In the household for instance, they are the one who fetch fuelwood by risking their lives in the forests of the area. They are also exposed to health-related hazards since the are is still making use of traditional stoves which exerts a lot of smoke. Hence, in any development cooperation, gender analysis guarantees that both women and men have equal opportunities to participate in development, to influence and to benefit, this is mainly because of the fact that men and women are affected differently by any form of project intervention. In this regard in the integrated development strategy approach gender roles should be key criteria when assessing the goals and results of the intended development activities. More specifically the following should form the gender equality assurance modalities of the strategy (1) development of gender-inclusive management plan with key government ministries and departments (2) the appointment of gender focal points in the government line offices and the programme (3) implementation of a quota system where all programmes to be implemented must involve 50% of women and (4) implement a monitoring and evaluation systems which ensure that 50% of resources implemented will benefit women.

7.2. Section Two: Concluding Remarks

This section provides the conclusion and recommendations of the study by highlighting contributions of the study to knowledge, policy implication of the research on protected areas governance, limitations of the conceptual framework and the integrated development strategic approach, and recommendations for further research.

Nech Sar National Park is cherished with diverse ecosystems (forest, wetlands, lakes, etc.) and biodiversity resources is believed to host about 20% of the country's biodiversity resources. However, because of the ever-increasing population of the country (the second populous country in Africa) and other human induced and natural factors, Nech Sar National Park and other ecologically vital resources of the country are experiencing serious environmental and biodiversity resources degradation (Srinivasan, 2014).

So far though there have been researches done on Nech Sar National Park such as on the floristic composition of the vegetation (Samson *et al*., 2010), introduction to the natural history of Nech Sar (Clark, 2010), population status and human impact on the endangered Swayne's (Datiko and Bekele, 2011), human impact on the Plains Zebra (Doku *et al*., 2006), impact of human activity on groundwater forest (Fetene *et al*., 2012), vegetation dynamics (Shetie *et al*., 2015), contesting the national park theorem (Girma and Till, 2012), resettlement (Abiyot, 2009; Denna, 2006), ecotourism (Aramde *et al*., 2012), tourist satisfaction (Bililign, 2015), and small mammals (Simon, 2016), analysis on the impact of human activities on the natural capitals of the park and its implication for governance of the park have not been supported by research. This indicates as there has been no substantial research carried out to serve as a basis for the development of appropriate strategies that could halt the ecological problems of the park.

The overall aim of the thesis is to explore the impact of human activity on the natural capital of Nech Sar National Park in Ethiopia and devise strategic framework and approaches to enhance the management and governance of the national park.
The researcher achieved the above objective by responding to the below research questions:

a. In relation to human activity, what is the current state of the park's forest, grassland and aquatic ecosystems?
b. What are the human induced threats that impact the natural capital and governance of the park?
c. How can the natural capital of the park be protected and managed in a sustainable way?

Nech Sar National Park operates under a complex mix of conflicting land-use patterns whereby people, wildlife, livelihood activities and livestock exist. This situation has presented a complex

system which challenged the efficient governance of the National Park as there exist a strong tension between preserving the natural capitals of the park which are meant to be protected on one hand and the equally important indigenous communities that reside in and around the ecology by exploiting the resources of the park for their own survival (Girma and Till, 2012). Thus, understanding the degree and severity of the ongoing degradation along with the driving factors warranted the attention of the researcher.

In responding to the research questions, the researcher deployed a range of ecological assessment methods which enabled the study to have a closer look at how the human induced threats are aggravating the degradation of the natural capitals of the park. Focus group discussions, interview and questionnaires were also utilized in capturing the views of the local and indigenous communities; operational and management staff of the park; and the senior park officials and other related stakeholders of the sector.

7.2.1 Contributions of the Study to Knowledge

The findings of the research contribute to knowledge by (a) exploring the current state of the natural capital of the park (b) challenges associated with the governance arrangements of the protected area (c) human induced threats (d) integrated development approach (e) research methodological contribution and (f) policy implication of the research on protected areas governance.

7.2.1.1. State of the Natural Capitals of the Park

As part of the knowledge contributions of the study, the ecological assessments of this research (chapter five section one and two) indicated that the natural regeneration of trees is being affected by human activities. The research found that many of the major trees of the park are not exhibiting a healthy trend of regeneration from seedlings to saplings and then to matured trees. The density and diversity of the woody vegetation of the park is also encountering a severe degradation due to the ongoing selective cutting of trees by the local and indigenous communities of the park as a means of generating income and for meeting the household energy demands of the area. If not averted this would cause for the extinction of species and its consequent impact on the degradation of the biodiversity and ecosystem services of the park.

The satellite images analysis revealed that increased sedimentation in lake Chamo and Abaya which is caused by improper land-use practices such as hill side farming, poor soil and water conservation activities in the nearby watersheds of the area are the prime factors that caused for the shrinkage of the volume of water in the lakes.

Invasive plant species such as Abutilon species which has been introduced by human activity are overtaking the grassland ecosystems of the park. This is mainly caused by the ongoing frequent in and out movement of livestock in the park territories and expansion of agricultural activities in the nearby areas. As a result of this the scenic beauty of the grassland along with the availability of palatable cover of herbs for the wildlife will disappear in the near future since the findings of the study showed about 70-80% of the grassland is currently overtaken by the invasive plant species. Apart from the ecological disruptions caused by the expansion of invasive plants, the decline of the tourist attraction potentials of the landscape will have a direct impact on local and regional economic development and livelihood opportunities.

The findings of the research on the proportion of the ground cover of herbs in the grassland plains of the park indicated that the grassland areas which are prone to frequent livestock pressure are having a degraded grass cover as compared to the protected cross-sections of the grassland. This shows that the availability of feed for the wildlife has dwindled in the landscape due to human interference. This degradation of the grass cover will have a direct impact on the wellbeing and survival of the wildlife of the park which will again negatively impact the touristic values and local economic development/livelihoods potential of the park.

The results on the local and indigenous communities' perception survey on the state of the ecosystems of the park showed that, the local communities have also perceived the deterioration of the forests, grassland and the aquatic ecosystems of the park caused by the increased human activities. Therefore, the above ecological assessment findings have added to the body of knowledge as to how human activities are affecting the natural capitals of the protected area. The breadth and intensity of the impact is a knowledge output which can be translated in to a practical strategic and policy actions which will help to ensure the sustainable development of the protected area.

7.2.1.2. Governance and Policy Implications

According to Proclamation No. 541/2007 Article 4 (c), any wildlife conservation area geographically situated within two or more regions will be administered by federal park authorities. According to this provision, since Nech Sar shares border with two regional states, the park is being governed by officials who are based in Addis and such type of top-down governance arrangement is posing a serious challenge on the effective governance of Nech Sar park. This is mainly because such governance approach has denied the participation of the local communities in the management and governance of the park. Apart from this, the approach denies the park from being directly managed by the regional states since procedurally order has to flow in a top-down manner from the federal authorities to regional states and then from regional states to zonal and district offices where the park is located. This lengthy cumbersome process is rife with bureaucratic procedures and took a considerable amount of time before any action is taken to address any park management related issues. This factor also contributed to the lack of ownership of the park by the regional states and has favoured the increased exploitation of the park's resources. This phenomenon hence is explained in chapter six section two, magnifies the importance of participation of the local community in the governance of the park by deploying a hybrid governance approach.

The wildlife policy and strategy of the country as magnified in Article 1, states that efforts will be made to gazette national parks and other wildlife protected areas according to international standards and principles and administer them by the federal government, regions, private investors and through community participation. As a strategic direction the policy states that it will identify national parks and other wildlife protected areas and give them legal basis or foundations; limiting unsustainable practices planned or being carried out in wildlife protected areas and wildlife corridors that affect the survival of the wild animals. However, in the case of Nech Sar even though the park was established by Regulations No. 163/2008, the boundaries of the park are yet to get a legal recognition by being gazetted under the country's proclamation law. This has denied the park management to have rules and regulations to implement and enforce the administration of the park in an efficient way. Therefore, in line with this, policy makers should consider the importance of involving all critical stakeholders specifically the local and indigenous

people in the design, development and implementation of the demarcation and gazzeting of the protected area.

Article 2.4 of the policy has a provision of utilizing revenue generated from wildlife resources to be used to benefit local people, wildlife conservation endeavors, etc. In practical terms, however, the revenue generated by the park is being directly channeled to the federal financial system by leaving the above provision of the policy behind the policy papers. None of the resources generated in the park are channeled into the development of project in the communities in and adjacent to the park. This revenue was supposed to be utilized in creating employment opportunities for communities residing around the protected area, helped to enhance the ownership of the local communities and ensure the sustainable development of the park.

In addition to that, the policy promotes the development of ecotourism activities in protected areas without causing damage to the environment by **c**reating a conducive and enabling environment to promote sustainable eco-tourism activities in line with internationally accepted standards. The strategic approaches include the development of infrastructure to enhance the promotion and establishment of ecotourism in collaboration with other appropriate government bodies by issuing and enforcing laws, rules and regulations which prevent the adverse effects of eco-tourism on wildlife and their habitats. However, there has not been any tangible efforts on the ground which encourages the development of ecotourism activities in the park. The roads are not all-weather roads and there were no facilities in the park which could enhance the ecotourism potentials of the protected area and the culture of the indigenous communities of the park as explained in the strategic approaches of this chapter.

In terms of building human and financial resource capacity of park management offices to guide and administer the conservation of wildlife, though the policy mentioned as it will enable the park officials to create adequate capacity in terms of trained manpower in the field of wildlife conservation, the findings of the research also identified the ineffectiveness of the park's authority to prevent the local communities from performing prohibited activities in the park. Hence, policy makers should work with concerned stakeholders to mobilize technical and financial resources to create alternative livelihoods which will help to reduce the increasing reliance on the natural capital of the park. As a way forward (part of the knowledge contribution of the study), the

creation of buffer zone around the park boundaries which can be used for planting of fodder for animals, grazing of animals by pastoralist, trees for fireword for household use and putting aside lands for growing food and cash crops is pointed out as a viable solution. Apart from that, in order to avert the governance related challenges of the park, the research as part of its contribution to knowledge suggested to deploy a hybride governance arrangement which combines top-down and bottom-up governance approaches whereby community level associations will be formed to ensure the sharing of benefits whilst the park authorities will enhance the coordination among stakeholders as well as law enforcement related activities.

7.2.1.3. Human Induced Threats

Deforestation, lack alternative livelihood activities, lack of alternative renewable energy supply, expansion of agricultural activities, overgrazing, expansion of invasive plants, sedimentation of lakes are among the primary human induced threats that affect the natural capitals of the park. It was also found out that, women are the major segments of the community that are engaged in the fuelwood collection and hence any effort that aims to address the impact has to consider the gender dimension which would set out the roles and responsibilities of men and women.

7.2.1.4. Integrated Development Approach

The research has highlighted the limited livelihood opportunities in the study area as a critical factor that aggravated the depletion of the natural resources of the park. An analysis conducted identified the critical development challenges that confronted the effective management and governance of the park. In addressing these development challenges the research recommended an integrated development approach which consists of the development of alternative livelihoods (ecotourism, modern agricultural development, sustainable fishing and green construction), promotion and development of medicinal plants, strengthening of institutional capacity of the park authority, training and education development, and the establishment of buffer zone that would reduce the increased reliance of the local communities on the natural capitals of the park.

7.2.1.5. Research Methodological Contribution

The development of the new conceptual framework which includes the four distinct elements: (1) identifying the vulnerable natural capitals of the protected area, (2) defining the state of the

natural capital in line with the impact of human activities (3) assessing governance related factors that impact the management of the natural capitals of the park and (4) formulation of integrated strategic development approach to improve the sustainable development of Nech Sar National Park will contribute to build the capacity of park authorities to adapt the formulation of an integrated development approach which will help to address the impacts of human activities on the natural resources of protected areas.

As explored in the review of literature chapter of this thesis, existing protected areas related conceptual frameworks appear to be very general and focused on single elements such as governance, social aspects, etc. None of the reviewed conceptual frameworks were in a position to guide the assessment of the degree of ongoing human induced impacts on the natural capital of protected areas. However, the conceptual framework of this research contributes to the academic world and protected areas focussed researchers by providing methodological approaches of how the negative impact of human activities on the natural capitals of protected areas can be assessed. It is also applicable to assess the governance and management impediments which affect the sustainable development of protected areas.

This new conceptual framework can also be applied by decision and policy makers in designing policies, regulations and strategic programmes that will help to create sustainable livelihoods, alternative household energy supplies, institutional capacity development strategies, economic development, tourism, and forest development in the context of protected areas.

7.2.2. Limitations of the Conceptual Framework for Analyzing the Impact of Human Activity on the Natural Capitals of Nech Sar National Park

Even though the conceptual framework of the research is applicable to analyze the impact of human activities on the natural capital of other protected areas of Ethiopia and other developing countries, there may be difficulties in implementing the outcomes of the research in other protected areas of other developing countries due to the difference in the overall development context of the geographic areas, climatic contexts, anthropogenic and cultural contexts in which the protected areas are situated in.

Despite this limitation, the researcher encourages other researcher to make use of the framework since it will help them to identify its applicability to similar and other development contexts of protected areas. The researcher hopes that such disparities in the settings of protected areas would offer opportunities for other researchers to improve the various stages of the conceptual framework.

7.2.3 Further Research Recommendations

Successful implementation of research on assessing the impact of human interference on the natural capitals of protected areas can offer tremendous benefits to policy makers, operational staff of the park as well as local and indigenous communities residing in and adjacent to protected areas.

Implementation of such researches can be time constraining as well as can produce serious financial constraints on the part of the researcher. The entire research programme was self-sponsored, and this has deprived the researcher from exploring all the issues that pertain in the research process. Hence, the researcher suggests the following thematic areas which should be supported by further research findings.

Based on the findings of the research, Lake Chamo have showed a significant reduction in volume of water mainly due to poor land-use practices such as the lack of soil and water conservation measures. Due to the increase in sediment load on the floors of the lake, as pointed out by literature, the depth of Lake Chamo is reducing from 13 meters to an average 8 meters (Fenta and Kidanemariam, 2016 and Misikire and Tesfu, 2015) hence, further research should be implemented to analyze the impact of sediment load on the aquatic biodiversity and ecosystem services of the Lake and the impact of human activities on the watershed so as to inform policy makers in devising appropriate strategic actions which can save the ongoing loss of the Lake's biodiversity and its related ecosystem services.

The researcher has also noticed the increasing expansion of water Hyacinth in Lake Chamo and if remedial research-based actions are not placed, the water ecosystem would be taken over by the water loving invasive plants. The researcher, therefore, suggests further research to identify the main causes of the expansion of the water loving Hyacinths on the Lake and devise

appropriate strategies that could help to halt the growth and expansion of the invasive plants in the lake.

Further research is also essential on ways of controlling the invasive plant species such as Abutilion which have taken about 80% of the grassland ecosystem of the park.

A study on economic valuation of the ecosystem services of the park could also help to inform decision makers and planners to have an informed investment in the protection ventures of the park.

The ongoing human activities have severely impacted the natural regeneration, density and diversity of the ground water woody vegetation of the park. The researcher observed as the high and less human interference categories are experiencing a significant reduction on the species diversity potential of the park. Hence, so as to inform further strategic actions which could help to regenerate the indigenous forest biodiversity resources in that part of the park, soil seed bank analysis studies will help to examine whether there still exists viable seeds of the indigenous tree species of the ecosystem that would help to rehabilitate the park's woody vegetation in a natural way of regeneration.

The carbon sequestration potentials of the protected area is also another research area which could help to inform regional and global conservation agencies in finding strategic ways which could safeguard the ecosystem services of the park that has local, regional and global roles.

The country's protected areas policy and regulations are not modern enough to create the enabling environment to enhance the governance of protected areas. This indicates that policy related researches are recommended to enhance the sustainable development and governance of the country's protected areas.

There is also significant scope of research work to investigate the governance arrangement and develop alternative options that ensure the sustainable development of the country's protected areas.

Indigenous conservation experiences and knowledge also plays a significant role in conserving natural capitals of protected areas and with this regard research undertakings on indigenous wildlife conservation experiences and knowledge could help to inform policy actions.

Researchers could also explore the best practices in other African countries and elsewhere and assess they applicability in the context of Ethiopia.

Financial viability of park operations and creating win-win situations for the local stakeholders such as the private investors remains something to work on.

The creation of governance arrangements with the private sector and other stakeholders which can support the conservation and sustainable development of local areas also remains an interesting work to do.

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Appendices

Annex 1: Memorandum of understanding between the researcher and EWCA

የኢትዮጵያ የፌዴራል ዲሞክራሲያዊ ሪፐብሊክ
The Federal Democratic Republic of Ethiopia
Ethiopian Wildlife Conservation Authority
ኢዱልፕባ EWCA

ቁጥር Ref. No. ዓ131/24/08
ቀን Date 09 ሀዳር 2008

ለነጭ ሣር ብሔራዊ ፓርክ
አርባ ምንጭ

ጉዳዩ :- ትብብርን ይመለከታል ::

በዲሞንትፎርት ዩኒቨርስቲ የዘላቂ ልማት ትምህርት ክፍል የፒኤችዲ ተማሪ የሆኑት አቶ ሞላ መኮንን በነጭ ሣር ብሔራዊ ፓርክ "Protected areas and their sustained development by unlocking livelihood capabilities, the case of Nech Sar National Park, Ethiopia". በሚል ርዕስ ጥናትና ምርምር ሥራን ለማከናወን በጠየቁት መሠረት አስፈላጊውን ፎርማሊቲ በማሟላታቸው ምርምራቸውን ለማከናወን የተፈቀደላቸው ስለሆነ ብሔራዊ ፓርኩ አስፈላጊው ትብብር እንዲደረግላቸው እየጠየቅን፣ የጥናቱን ፕሮፖዛል 1 ጥራዝ ኮፒ እንዲላክላቸው የተደረገ መሆኑን እንገልጻለን ::

ከሠላምታ ጋር

ግልባጭ ፣
- ለዶር እንስሳት መኖሪያ አካባቢያቸው ጥናትና ምርምር ዳይሬክቶሬት/ቀሪ/
- ለአቶ ሞላ መኮንን
  አዲስ አበባ ፣

መልስ ሲፅፉልን የደብዳቤያችንን ቁጥር ይጥቀሱ
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Memorandum of understanding (MOU)

The agreement is made between Ato Molla Mekonnen Student of De Montfort University, Leicester, U.K.(here in after referd as the "researcher") and Ethiopian Wildlife conservation Authority (here in after refered as "EWCA") to undertake research thesis entitled "Protected areas and their sustained development by unlocking livelihood capabilities, the case of Nech sar National Park, Ethiopia".

Article 1 :- undertakings of the researcher

1.1 The researcher agrees to conduct the study in accordance with the Ethiopian Wildlife law and research guideline.

1.2 The researcher agrees to submit copies of his research finding for the respected protected areas, region and EWCA.

1.3 The researcher agrees to cover related to the counter parts involved in research work.

1.4 The researcher agrees not to trap and kill any wild animals.

Article 2 :- Undertakings of EWCA

1. EWCA grants permission to the Researcher to conduct a research on the above mentioned topic in Nech Sar National Park.

2. EWCA agrees to provide the necessary support for the researcher.

Article 3:- General

This agreement was signed in Addiss Ababa on the 17th November, 2015 and shall enter into force beginning from the date of signature by EWCA and the researcher.

For EWCA

Sig----------

Kahsay Gebresilase
Wildlife Research & Monitoring
Directorate Director

The Federal Democratic Republic of Ethiopia
Ethiopian Wildlife Conservation Authority

For Researcher

sig----------

Molla Mekonnen

Annex 2: GPS Coordinate points for natural regeneration of trees experimental plots

Code	POINT_X	POINT_Y
1	37.564717	6.021065
2	37.568315	6.018815
3	37.571097	6.017067
4	37.573910	6.015317
5	37.576670	6.013591
6	37.578990	6.012140
7	37.581312	6.010688
8	37.560431	6.013939
9	37.562894	6.012280
10	37.565192	6.010732
11	37.567643	6.009081
12	37.569382	6.007910
13	37.571873	6.006233
14	37.573896	6.004870
15	37.556986	6.004594
16	37.559910	6.002805
17	37.562848	6.001008
18	37.564983	5.999701
19	37.566988	5.998475
20	37.569954	5.996660
21	37.570153	6.028528
22	37.569831	6.025131
23	37.569592	6.022613
24	37.569354	6.020103
25	37.569054	6.016929
26	37.568655	6.012713
27	37.568249	6.008434
28	37.567885	6.004593
29	37.564017	5.999026
30	37.561030	5.997456
31	37.556353	5.994996
32	37.552078	5.992748
33	37.547604	5.990396
34	37.542076	5.987489
35	37.568600	6.024200
36	37.569620	6.023150

Annex 3: GPS Coordinate points for vegetation density experimental plots

Code	POINT_X	POINT_Y
1	37.570153	6.028528
2	37.569831	6.025131
3	37.569592	6.022613
4	37.569354	6.020103
5	37.569054	6.016929
6	37.568655	6.012713
7	37.568249	6.008434
8	37.567885	6.004593
9	37.578522	6.022396
10	37.577759	6.019653
11	37.576866	6.016440
12	37.576054	6.013521
13	37.575273	6.010714
14	37.574650	6.008474
15	37.556986	6.004594
16	37.559910	6.002805
17	37.562848	6.001008
18	37.564983	5.999701
19	37.566988	5.998475
20	37.569954	5.996660
21	37.572306	5.995242
22	37.564017	5.999026
23	37.561030	5.997456
24	37.556353	5.994996
25	37.552078	5.992748
26	37.547604	5.990396
27	37.542076	5.987489
28	37.568600	6.024200
29	37.569620	6.023150
30	37.570250	6.022460

Annex 4: Data collection participants information sheet

Dear Participant,

We would like to ask you to participate in the data collection for a study on Impact of Human Activity on Protected Areas: A case study of Nech Sar National Park in Ethiopia.
The study will mainly focus on the following issues:

1. Identify the threats (human interference) on the ecological capital of the park;
2. Assess policy and strategy impediments on the management of the park's ecological capital;
3. Identify livelihood strategies/initiatives which can contribute to the improvement and conservation of the park's natural/ecological capital.

Participation in this study is entirely voluntary. It will involve an interview of approximately 30 - 60 minutes in length to take place by arrangement. We will initially contact you by email or telephone.

You may decide not to answer any of the interview questions if you wish. You may also decide to withdraw from this study at any time by advising the researcher interviewing you or by emailing P1403019X@myemail.dmu.ac.uk or using the contact detail at the end of this document. If you notify us of your withdrawal, all identifiable data will be destroyed. Once data has been anonymised it will be impossible to identify the origin and cannot be destroyed.

We may ask for clarification of issues raised in the interview sometime after it has taken place, but you will not be obliged in any way to clarify or participate further.

The information you provide is confidential, except that with your permission anonymised quotes may be used. If you request confidentiality, beyond anonymised quotes, information you provide will be treated only as a source of background information, alongside literature-based research and interviews with others.

Your name or any other personal identifying information will not appear in any publications resulting from this study; neither will there be anything to identify your place of work.

The information gained from this interview will only be used for the above objectives, will not be used for any other purpose and will not be recorded in excess of what is required for the research.

Even though the study findings will be published in international conferences and journals, only the research team will have access to the interview data itself. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study or would like additional information please ask the researcher before, during, or after the interview.

Yours Sincerely,

Molla Mekonnen Alemu

De Montfort University

The Institute of Energy and Sustainable Development, The Gateway, Leicester LE1 9BH, UK

Annex 5: Consent form for respondents

Issue	**Respondent's initial**
I have read the information presented in the information letter about the study "Impact of Human Activity on Protected Areas: A case study of Nech Sar National Park in Ethiopia".	
I have had the opportunity to ask any questions related to this study, and received satisfactory answers to my questions, and any additional details I wanted.	
I am also aware that excerpts from the [interview/study/survey/questionnaire/etc.] may be included in publications to come from this research. Quotations will be kept anonymous.	
I give permission for [the method of data collection, e.g. recording an interview/videoing/etc.]	
I understand that relevant sections of the data collected during the study may be looked at by the researchers and/or supervisors. I give permission for these individuals to have access to my responses.	
I understand that I can withdraw from this study at any time, with no penalty, and all data that has been collected from me will be destroyed.	

With full knowledge of all foregoing, I agree to participate in this study.

I agree to being contacted again by the researchers if my responses give rise to interesting findings or cross references.

☐ no

☐ yes

if yes, my preferred method of being contacted is:

☐ Organization ……..

☐ Designation …….

☐ telephone ……..

☐ email …….

☐ other ……..

Participant Name:		Consent taken by	
Participant Signature:		Signature	
Date		Date	

Annex 6: Interview guide questions

Code: _____

Date: _____

Place: _____

Interview questions to collect information from Ethiopian Wild Life Conservation Authority (HQ), Park Management, and different stakeholders

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

Probes: land degradation, deforestation, wild life loss, biodiversity loss, etc.

2. What livelihood activities are being practiced in the park?

Probes: the livelihood activities practiced in the park; the extent of these livelihood activities contributing to the general well-being of the society; the livelihood activities which contribute towards conserving the park; to what extent these are being encouraged and state how these activities can be protected and expanded for the future.

3. What possible livelihood opportunities will help the sustained management of the park?

Probes: Opportunities for ecotourism, fishing, skills development

4. What policies and strategies do you have in place to support the conservation and sustainable development of parks?

Probes: When was it formulated? Who is the governing body of the park? How effective are they for the sustained development of the park? What are the barriers to the implementation of these policies? Law enforcement? Human resources capacity? Institutional partnerships / coordination for the implementation of the strategies and law enforcement?

5. In what way does the park authority involve the indigenous people and other stakeholders in making decisions and implementation of strategies for the sustained development of the park?

Probes: are the local communities engaged in management and governance of the park? are the benefits generated by the park being shared with the communities? local employment opportunities

for the local; engagement in conservation and protection activities; skills development training opportunities; engaging the youth in protection activities?

6. What is the policy of the park authorities (EWCA) on the use of resources from the park?

Probes: Fuel wood and charcoal collected from the park; the use of fodder in the park and to feed cattle in the park; the use of specific trees in the park that has indigenous medicinal value for humans and livestock?

7. Cognizant of the current institutional arrangements and structures in park management, what do you think can be done more to improve institutional arrangements which can promote the sustained development of the park?

Probes: Institutional arrangements; coordination; partnerships; resource allocation; impacts and implications of the different governance categories of the protected areas; etc.

8. Please explain and list invasive plant species which you have seen in the park?

Probes: name of the invasive plants; since when you have seen the plants; what caused their occurrence; impact of this plants on the ecology; etc.

Estimate of invasive plants coverage on the Nech Sar grass land plain (Please tick one)

30-40☐ 40-50☐ 50-6☐ 60-7☐ 70-8☐ 80-10☐

9. Please explain the factors that affect aquatic ecosystems of the park?

Probes: over fishing; erosion; land use; weather; etc.

10. What sources of energy are being used for household consumption (light, cooking)?

Probes: fuel wood, charcoal, electricity, solar

Annex 7: Focus group discussion guide questions - Indigenous people

Code: _____

Date: _____

Name of locality: _____

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

Probes: land degradation, deforestation, wild life loss, biodiversity loss, etc.

2. Do you partner and participate with the park authorities in making decisions on different programmes to enhance the sustained development of the park?

Probes: Plan preparations? Training? Employment? Protection of natural resources?; do you participate in the management of the park? are there any community level committees which you take part in protecting the park? what forms of direct benefit did you get from the park authorities?

3. Please explain and list invasive plant species which you have seen in the park?

Probes: name of the invasive plants; since when you have seen the plants; what caused their occurrence; impact of this plants on the ecology; etc.

Estimate of invasive plants coverage on the Nech Sar grass land plain (Please tick one)

30-40☐ 40-50☐ 50-60☐ 60-70☐ 70-80☐ 80-100 ☐

4. What sources of energy are being used for household consumption (light, cooking)?

Probes: fuel wood, charcoal, electricity, solar

5. What is the major source of fuelwood supply in Arba Minch city?

(1) Nech Sar Park (2) others

6. Do you make use of improved or fuel saving stoves?

(1) Yes (2) No

7. Please list the specific trees in the park that have indigenous medicinal value for humans and livestock?

8. What are the major ecosystem services provided by the forest, grassland and the aquatic ecosystems of the park?

Probes: (1) provisioning services (which provide direct inputs to livelihoods and the economy), (2) regulating services (which provide flood and disease control), (3) supporting services (which sustain and fulfil human life), and (4) cultural services (which support recreation and spiritual or historical sites).

Please rank the forest, grassland and the aquatic ecosystems in order of importance to your wellbeing as high, medium and low?

High: commonly used by the community as an essential subsistence;

Medium: for services that are still vital for survival, but could be found from alternative sources;

Low: representing service that are considered to be non-compulsory, but still helpful for the community.

Is there any change in these ecosystems in terms of their area coverage/volume during the past 10 years? Please respond as No change; Increasing; and Decreasing.

Annex 8: Questionnaire for park operational staff

Code: _____

Date: _____

Name of the locality: _____

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

Probes: land degradation, deforestation, wild life loss, biodiversity loss, etc.

2. Please list the specific trees that are preferred for fuel wood, charcoal making and other use?

3. Please list the specific trees in the park that have indigenous medicinal value for humans and livestock?

4. What livelihood activities are being practiced in the park?

Probes: the livelihood activities practiced in the park; the extent of these livelihood activities contributing to the general well-being of the society; the livelihood activities which contribute towards conserving the park; to what extent these are being encouraged by Government bodies.

5. What possible livelihood opportunities will help the sustained management of the park?

Probes: Ecotourism potentials, local practices that can be scaled up, etc.

6. In what ways have you engaged the local community to take part for the sustained development of the park?

Probes: in the formulation and implementation of development plans, strategies, trainings, etc. Creating enabling environment for them to participate in management and governance activities that would help to preserve the park?

7. What is the policy and action of the park authorities on the use of resources from the park?

Probes: Fuel wood and charcoal collected from the park; the use of use of fodder in the park and to feed cattle in the park; the use of specific trees in the park that has indigenous medicinal value for humans and livestock?

8. Cognizant of the current institutional arrangements and structures in park management, what do you think can be done more to improve institutional arrangements which can promote the sustained development of the park?

Probes: Institutional arrangements; coordination among the different stakeholders; law enforcement challenges; etc.

9. Please explain and list invasive plant species which you have seen in the park?

Probes: name of the invasive plants; since when you have seen the plants; what caused their occurrence; impact of this plants on the ecology; etc.

Estimate of invasive plants coverage on the Nech Sar grass land plain (Please tick one)

30-40☐ 40-50☐ 50-60☐ 60-7☐ 70-8☐ 80-10☐

10. Please explain the factors that affect aquatic ecosystems of the park?

Probes: over fishing; erosion; land use; weather; etc.

11. What sources of energy are being used for household consumption (light, cooking)?

Probes: fuel wood, charcoal, electricity, solar

12. What is the major source of fuelwood supply in Arba Minch city?

(1) Nech Sar Park (2) others

13. What are the major ecosystem services provided by the forest, grassland and the aquatic ecosystems of the park?

Probes: (1) provisioning services (which provide direct inputs to livelihoods and the economy), (2) regulating services (which provide flood and disease control), (3) supporting services (which sustain and fulfil human life), and (4) cultural services (which support recreation and spiritual or historical sites).

Annex 9: Basic information of the interview, questionnaire and FGD respondent

Section 1: Basic information of the respondent:

A. Gender

Male: _____ Female: _____

B. Age category

18 - 20_____

21 - 24 _____

25 - 30 _____

30 – 35 _____

35 – 40 _____

40 – 45 _____

45 – 50 _____

>50_____

C. Level of education

No education: _____

Primary School: _____

Junior High School: _____

Secondary School: _____

University: _____

Others: _____

D. Nature of employment

Government: _____

NGO: _____

UN/Donors: _____

Self-employed: _____

Volunteer: _____

Other: _____

Annex 10: Top 20 Invasive plant species in Ethiopia

S.N.	Species	Ecosystems Highly Affected*[1]	Distribution Status
1	*Parthenium hysterophorus*	1,2,3,4,5,6,7,8	High
2	*Prosopis juliflora*	1,2,3,4,5,6,7,8	Moderate
3	*Opuntia ficus-indica*	3,4,5,6	Moderate
4	*O. stricta*	3,4,5,6	Moderate
5	*Mimosa diplotricha*	1,2,3,4,5,6,8	Moderate
6	*M. pigra*	3,4,7	Low
7	*Cryptostegia grandiflora*	2,3,4,7,8	Low
8	*Lantana camara*	1,2,3,4,5,6,8	High
9	*Acacia drepanolobium*	1,3,4	Moderate
10	*A. saligna*	2,3,4,5	Low
11	*Parkinsonia aculeate*	2,4,5,6	Low
12	*Nicotiana glauca*	1,2,3,4,5,6	Moderate
13	*Argemone ochroleuca*	1,2,3,4,5,6	High
14	*Xanthium strumarium*	1,2,3,4,5,6	High
15	*Xanthium spinosum*	1,2,3,4,5,6	Moderate
16	*Psidium guajava*	8	Low
17	*Senna didymobtrya,*	1.2.3.4.5.6.8	High
18	*S. occidentalis*	2,4,5	Moderate
19	*Calotropis procera*	1,2,3,4,5,6,7,8	Moderate
20	*Ricinus communis*	2,4,5,6	Moderate

(Fessehaie and Taye, 2014)

*[1]1 = Cultivated land, 2 = Roadside, 3 = Grazing areas, 4 = Non-cultivated land, 5 = Rural villages, 6 = urban areas, 7 = Riverside, 8 = Forest areas

Annex 11: Nech Sar National Park visitors flow, and revenue generated (from entrance fee only) (1994 – 2016)

Year	None-Ethiopian Visitors	Ethiopian Visitors	Total	Revenue from Park Entrance Fee (in Birr)
1994	447	600	1,047	27,185
1995	713	885	1,598	42,181
1996	2,241	1,081	3,322	60,036
1997	1,035	999	2,034	54,029
1998	1,201	1,286	2,487	66,712
1999	1,275	1,281	2,556	68,811
2000	1,113	1,066	2,179	58,362
2001	1,163	1,017	2,180	153,255
2002	1700	1,329	3,029	222,610
2003	2,049	2,396	4,445	234,813
2004	1,703	1,716	3,419	265,477
2005	1,703	1,716	3,419	265,477
2006	5,113	2,328	7,441	639,714
2007	7,267	8,528	15,795	695,419
2008	8,112	12,854	20,966	838,098
2009	8,992	9,607	18,599	996,593
2010	10,261	8,469	18,730	1,033,459
2011	11,160	10,049	21,209	1,113,472
2012	11,277	10,540	20,417	1,169,345
2013	11,321	10,867	23,588	1,179,625
2014	11,731	13,819	24,917	1,332,170
2015	10,342	17,769	28,111	1,242,130
2016	12,926	24,644	37,570	1,610,365

Source (Park record, 2016)

Annex 12: Codes for Senior Officials and Policymakers who participated in the interview

Code	Interviewee Description
P1	Senior park official for more than 20 years in park management, policy formulation, teaching in forestry and conservation. A plant scientist by training.
P2	Senior Director in an NGO that focuses on natural resources, agriculture and livelihoods. About 30 years' experience in development. Development specialist by training.
P3	Senior Officer in World Bank. More than 25 years of experience in forestry, natural resources management and development.
P4	Senior Administrator in one of the districts.
P5	University Lecturer in Arba Minch University. Forester by training.
P6	Senior park official. About 15 years of experience in community mobilization and development.
P7	Manager of fish producer's association for more than 15 years. Trained in management.
P8	Senior official in environmental protection office. More than 25 years of experience in conservation, forestry, agriculture.
P9	Senior Coordinator in water, mines and energy office. More than 10 years of experience in the field.
P10	Senior official in tourism and culture development for more than 20 years.
P11	Programme Manger in NGO that operates in the area in the field of environmental conservation, livelihoods development and education.
P12	Senior GIS officer in the Ethiopian Agricultural Research Institute for more than 15 years.
P13	Senior director of directorate in EWCA. More than 20 years in park policy formulation, research, monitoring and management.
P14	Senior official in women and development for more than 15 years.

P15	Senior officer in the office of zonal administration. Responsible for leading policy, strategic and action plan development for more than 15 years.
P16	Senior policy and strategy official in the field of biodiversity protection for more than 15 years.
P16	Senior researcher and director marine biodiversity resources for the last 25 years.
P17	Senior researcher in wildlife development and protection.
P18	Senior strategy and action plan development officer in an international agency.
P19	Senior officer in livelihoods development. More than 20 years of experience in development and environment.
P20	Policy and strategy specialist in the ministry of environment and climate change. More than 20 years of experience in research, teaching and development.
P21	Environmentalist in a development partners agency.

Annex 13: Transcripts of interview, FGD and questionnaire

Interview Questions Response (Code 1)

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

a. Loss of biodiversity - wildlife loss, local extinction of higher mammals, deforestation, wildlife habitats fragmentation, diseases and parasite transmission from livestock to wild animals, fire wood, construction material and charcoal production, expansion of invasive species

b. Overfishing and siltation of lakes

c. Weak institutional capacity and strategic approaches

d. Low level of livelihood opportunities

e. Poor waste disposal - pollution of water bodies and flooding

f. Destructive extractive uses causing land degradation and loss of soil and gully formation

2. What livelihood activities are being practiced in the park?

Pastoralism is being practiced on the eastern part of the park with strong dependence on overgrazing. On the other hand, in the western part, in and around Arba Minch city many people are directly dependent on Park resources for their livelihood in the form of fuelwood, charcoal making, grass collection and fishing. This all are affecting the forest as well as the aquatic resources since being exploited in unsustainable way.

3. What possible livelihood opportunities will help the sustained management of the park?

None consumptive utilization of resources such as ecotourism, construction of community lodges, utilizations permitted by the national park, beekeeping, pond fishing, recreational facilities, transport, tour guiding, hotel, lodges, supermarket, and souvenir shopping. All these require scientific knowledge and skills development. Creating employment opportunities and establishment of businesses in town and constructions of rental houses which will bring income to support their livelihood may be vital and help for generating alternative income sources.

4. What policies and strategies do you have in place to support the conservation and sustainable development of parks?

Ethiopia has a good policy, institution and regulations arrangements for sustainable conservation, development and utilization of wildlife resource such as **Ethiopian wildlife policy formulated in 1997 (2005)**, and **Proclamation No. 575/2000 (2008) (**Ethiopian Wildlife Development

and Conservation Authority Establishment Proclamation are still working. **Proclamation No. 541/1999 (2007)** Ethiopian wildlife Conservation Regulation Proclamation and **Regulation No 163/2000 (2008)** Ethiopian wildlife Conservation and Utilization Regulation are under review.

The formulation of these national level policies, proclamations and regulations shows how Ethiopian government provided due attention to conservation of wildlife and their natural habitats along with sustainable conservation and utilization. These wildlife proclamations and regulations include institutional frameworks, prices of wild animals, different protected areas establishment and management systems both at national and regional levels. Prohibited and permitted activities and their ecological, economic and social benefits are also listed in detail.

However, these regulations and proclamations in many cases remained as a shelf paper for not being effectively implemented particularly law enforcement, capacity building and infrastructure development in many of wildlife protected areas are extremely far below expected. Particularly field activities and legalization of the park boundaries that need federal and regional government's decision are not considered. Even the political leaders and federal and regional governments commitment is very low or not away from oral hopes and in many cases all legalization, management and facilitation of protected areas is left for protected area offices, and scouts. Even in some areas such as Nech Sar National Park the demands of the community are not being addressed by regional and federal governments. Moreover, annual budget and facilities required for the implementation of wildlife regulations in the field and offices are not at a sufficient level.

The effectiveness of law enforcement and continuous application is not executed at the required level. Monitoring activities on the work of stakeholders is largely at minimal due budget constraint, infrastructure and facilities and overlap of other urgent activities. However, this has to be improved for the sustained conservation and development of the park and partnership development has to be encouraged as it can benefit the communities and sustain the natural resources of the park.

5. In what way does the park authority involve the indigenous people and other stakeholders in making decisions and implementation of strategies for the sustained development of the park?

We engaged them in road construction activities through the cash for work programmes. We also gave them several trainings on the benefits of natural resources conservation. But for communal resource conservation only awareness creation does not create a sustainable solution, it requires law enforcement on prohibited activities and exploited the resources in an illegal way.

6. What is the policy of the park authorities (EWCA) on the use of resources from the park?

The EWCA polices and regulation 163/2008 indicates extractive or consumptive uses are prohibited in National Parks such as collecting fuelwood and charcoal making. Similarly, the use of fodder in the park and feeding cattle in the park is also prohibited. Extractive and destructive use of specific trees in the park that has indigenous medicinal value for humans and livestock is not allowed. These things can only be allowed based on an assessment and less negative impact on wildlife and their natural habitats. These things can also be allowed after the formulation of park management plan. The management plan of the park helps to guide all activities to be planned and implemented. However, Nech Sar National Park currently has no management plan.

7. Cognizant of the current institutional arrangements and structures in park management, what do you think can be done more to improve institutional arrangements which can promote the sustained development of the park?

Institutional arrangements and structures in park management basically need to bring better conservation and utilization of resources by reconciling the management options of the park which can further enhance the sustained benefit sharing and ownership development at the side of the local communities. For this to happen, sufficient infrastructure, technical and logistics capacity are critical elements of development. Based on the existing institutional arrangements, NSNP is currently being administered by EWCA. But the mitigation of anthropogenic challenges and the development of livelihood opportunities are left for local and regional governments. The infrastructure development and decision-making process at national level has been taking long time. While EWCA is technically dealing with natural resources (wildlife, forests, Lakes, etc.) it is currently reporting to the Ministry of Culture and Tourism which may not have the technical comparative advantages as compared to other Ministries like the Ministry of Forestry and Climate Change and also the Ethiopian Biodiversity Institute which are directly working on natural resources which EWCA is also mandated to act on.

8. Please explain and list invasive plant species which you have seen in the park?

Abutilion, Parthenium and other encroaching plants.

9. Please explain the factors that affect aquatic ecosystems of the park?

Improper land-use practice in the nearby and surrounding watersheds is causing the siltation of these ecologically important resources. This includes farming activities on hilly landscapes which are implemented without having a proper soil and water conservation activities. Improper road construction has also opened up gullies in many areas. It is also not uncommon to see economic activities being implemented within the 1000 meter radius of these aquatic resources. Illegal

fishing by making use of illegal net size is also diminishing the reproduction and sustainable development of the fish resources as the smaller and baby fishes are being caught by the illegal fishing gears.

10. What sources of energy are being used for household consumption (light, cooking)?

Fuelwood is the primary source of household energy in the Arba Minch city and the nearby communities. Charcoal is also another major source for the household energy. Electricity is being used in cities for lighting.

Focus Group Discussion - Indigenous people (Code 1)

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

- ✓ Nech Sar National Park used to be Nech (white) like its name but now covered by the invasive Abutilon
- ✓ Deforestation
- ✓ Dwindling wildlife population

2. Do you partner and participate with the park authorities in making decisions on different programmes to enhance the sustained development of the park?

- ✓ There is no regular partnership arrangement for engaging us in park management.
- ✓ We have not been engaged in park development activities with the exception of taking part in road construction through the cash for work kind of programme.
- ✓ They showed interest to be part of park development activities.

3. Please explain and list invasive plant species which you have seen in the park?

- ✓ Abutilon spp., Parthenium, Solanum, etc. are invading the grassland area of the park. These plants are fastly changing the landscape from grass dominated ecology to a thorny landscape which is affecting the availability of green pasture. These plants are fastly invading the area since they produce a huge number of seeds per plant and also as they are non-palatable for the animals.

Proportion of Coverage	Number of Responses
40 – 50	0
50 – 60	0
60 – 70	1
70 – 80	8
80 – 100	2

4. What sources of energy are being used for household consumption (light, cooking)?

Type	Number of Responses
Fuelwood	11
Charcoal	1
Electricity	0
Solar	0
Kerosene	0

5. What is the major source of fuelwood supply in Arba Minch city?

1. Nech Sar (11)
2. Others (1)

6. Do you make use of improved or fuel saving stoves?

(1) Yes (2) No

Yes: 8

No: 4

7. Please list the specific trees in the park that have indigenous medicinal value for humans and livestock?

Refer to the Table.

8. What are the major ecosystem services provided by the forest, grassland and the aquatic ecosystems of the park?

Grass, fuelwood, water, charcoal, fish, holy water, recreation, rain, temperature control..

Please rank the forest, grassland and the aquatic ecosystems in order of importance to your wellbeing as high, medium and low?

High: Lake

Medium: forest

Low: grassland

Is there any change in these ecosystems in terms of their area coverage/volume during the past 10 years? Please respond as No change; Increasing; and Decreasing.

Decreasing: 12

Responses from Questionnaire (Code 1)

Guiding Questions

1. What are the main threats/risks for the natural capital of the park?

1. Loss of biodiversity
2. Overfishing and siltation of lakes
3. Weak institutional capacity and strategic approaches
4. Poor waste disposal

2. Please list the specific trees that are preferred for fuel wood, charcoal making and other use?

Type of trees preferred for fuel wood

S.N.	Scientific Name	Local Name
1	*Lonchocarpus laxiflorus*	Hasso
2	*Prunus africanus*	Tikur Enchet
3	*Acacia polycanta*	Deleme

Type of trees used for charcoal making

S.N.	Scientific Name	Local Name
1	*Lonchocarpus laxiflorus*	Hasso
2	*Prunus africanus*	Tikur Enchet
3	*Balanites aegyptiaca*	Bedeno

3. Please list the specific trees in the park that have indigenous medicinal value for humans and livestock?

Refer to Table

4. What livelihood activities are being practiced in the park?

Agriculture, livestock rearing, fishing, apiculture, fuelwood collection, charcoal making, grass mowing and selling it in Arba Minch

5. What possible livelihood opportunities will help the sustained management of the park?

Ecotourism, Establishment of cooperatives and associations, Development of SMEs, Establishment of community lodge and Development of the hot springs in the Park

6. In what ways have you engaged the local community to take part for the sustained development of the park?

Awareness development training on protected areas

Road construction activities inside the Park

Awareness development on the environmental roles of the Park

7. What is the policy and action of the park authorities on the use of resources from the park?

Extractive uses are not allowed inside the park.

8. Cognizant of the current institutional arrangements and structures in park management, what do you think can be done more to improve institutional arrangements which can promote the sustained development of the park?

EWCA should report to Ministry of Forestry and Environmental Protection than letting it to be answerable to the Ministry of Tourism and Culture.
Budget constraint must be alleviated.
Staff capacity building.
Coordination among partners.

9. Please explain and list invasive plant species which you have seen in the park?

Abutilon, Parthenium

Estimate of invasive plants coverage on the Nech Sar grass land plain (Please tick one)

30-40☐ 40-50☐ 50-60☐ 60-70■ 70-80☐ 80-100☐

10. Please explain the factors that affect aquatic ecosystems of the park?

Over-fishing, Illegal net size and Sedimentation of Lakes

11. What sources of energy are being used for household consumption (light, cooking)?

Fuelwood – first rank
Charcoal – second
Electricity – light in the city
Kerosene – in few households

12. What is the major source of fuelwood supply in Arba Minch city?

1. Nech Sar
2. Others (mountain forest)

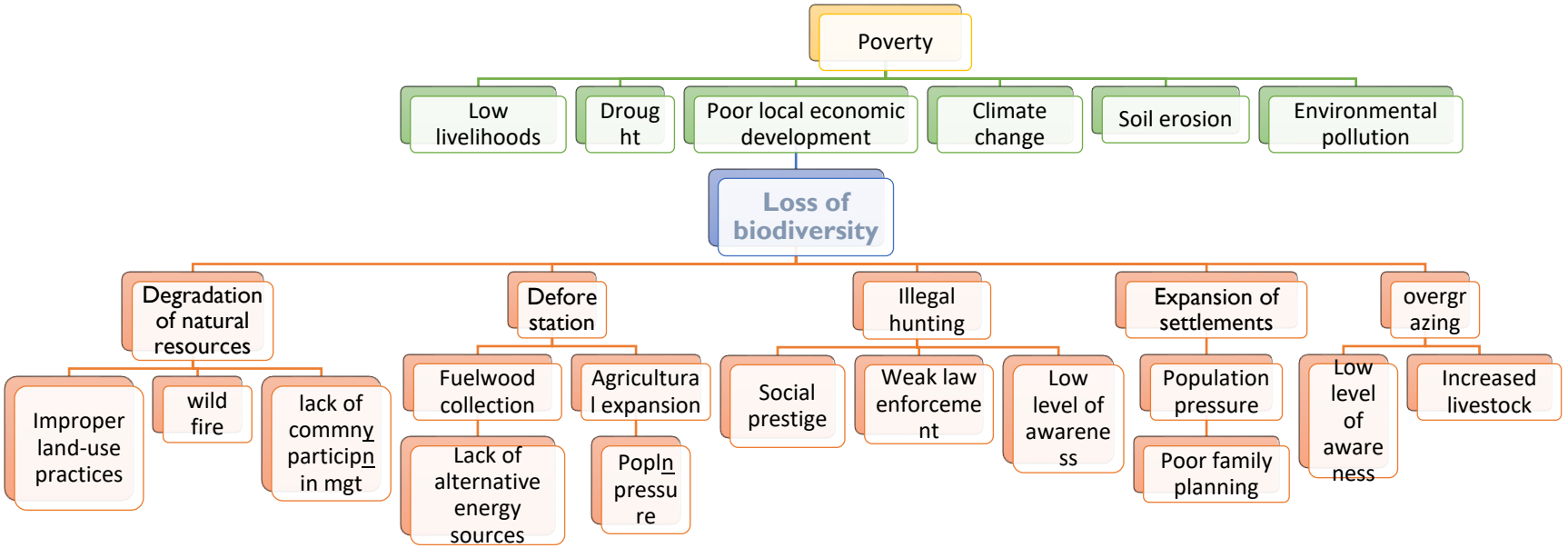
Annex 14: Summarised data of fuelwood collection from the three outlets

Time	kg	Highland		Jinka		Kulfo		Total	
		M	F	M	F	M	F	M	F
7-9	20-30				3	0	0	0	3
7-9	31-40			1	6	14	78	15	84
7-9	41-50							0	0
7-9	20-30							0	0
7-9	31-40							0	0
7-9	41-50					53	99	53	99
7-9	20-30							0	0
7-9	31-40					9	34	9	34
7-9	41-50							0	0
9-11	20-30			1	2			1	2
9-11	31-40	1	1	3		30	93	34	94
9-11	41-50	1	1	12	18			13	19
9-11	20-30							0	0
9-11	31-40							0	0
9-11	41-50				76	108		108	76
9-11	20-30							0	0
9-11	31-40				27	39		39	27
9-11	41-50							0	0
11-1	20-30		2			16		16	2
11-1	31-40	2	1			18	40	20	41
11-1	41-50	1		3	4		25	4	29
11-1	20-30							0	0
11-1	31-40					21	47	21	47
11-1	41-50					7	40	7	40
11-1	20-30					15	26	15	26
11-1	31-40					7	12	7	12
11-1	41-50							0	0
1-3	20-30	1	2			8	38	9	40
1-3	31-40	2		3	5	22	42	27	47
1-3	41-50		3	9	20			9	23
1-3	20-30							0	0
1-3	31-40					18	31	18	31
1-3	41-50					21	29	21	29
1-3	20-30					15	23	15	23
1-3	31-40						26	0	26
1-3	41-50					15		15	0

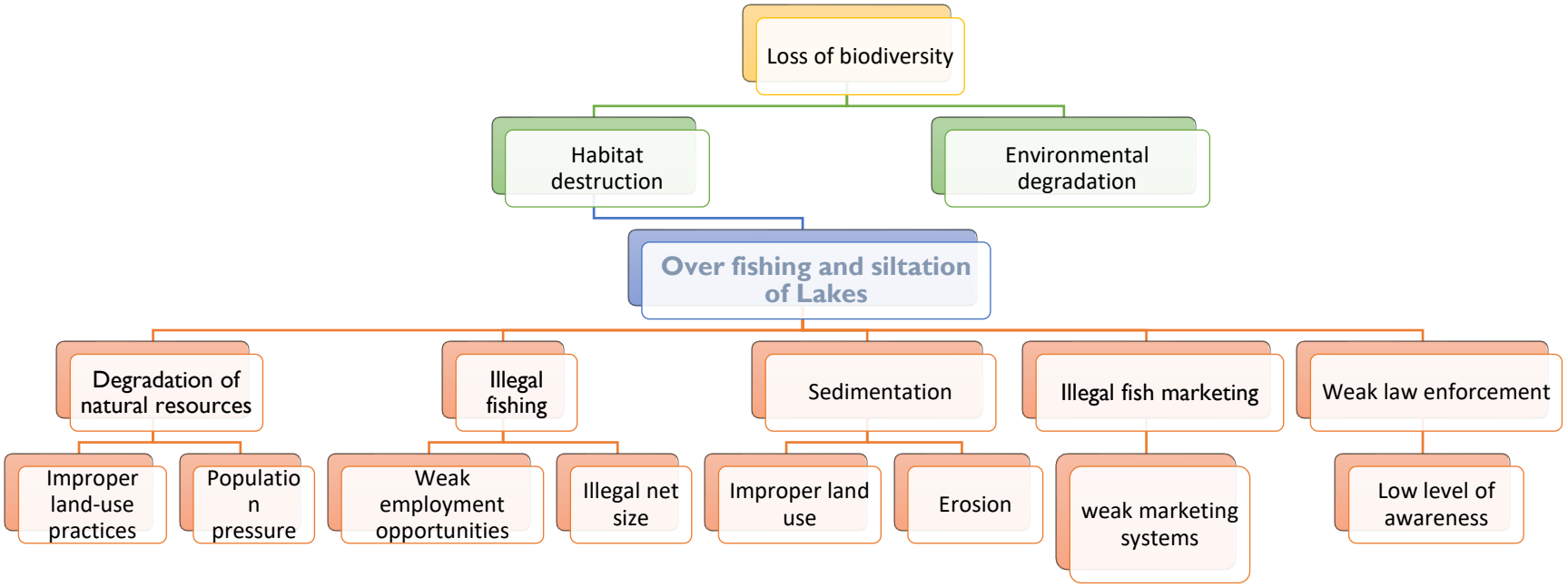
Time	kg	Highland		Jinka		Kulfo		Total	
		M	F	M	F	M	F	M	F
3-5	20-30	12	15			24		36	15
3-5	31-40					46	35	46	35
3-5	41-50	3	12	7	7		82	10	101
3-5	20-30							0	0
3-5	31-40					10	49	10	49
3-5	41-50	1	1			37	93	38	94
3-5	20-30						15	0	15
3-5	31-40					15	36	15	36
3-5	41-50							0	0
5-8	20-30	2	8	2	4	20	57	24	69
5-8	31-40			17	2	74	194	91	196
5-8	41-50		11					0	11
5-8	20-30							0	0
5-8	31-40					8	73	8	73
5-8	41-50	11	11			146	296	157	307
5-8	20-30							0	0
5-8	31-40					32	29	32	29
5-8	41-50						82	0	82

Annex 15: Problem trees

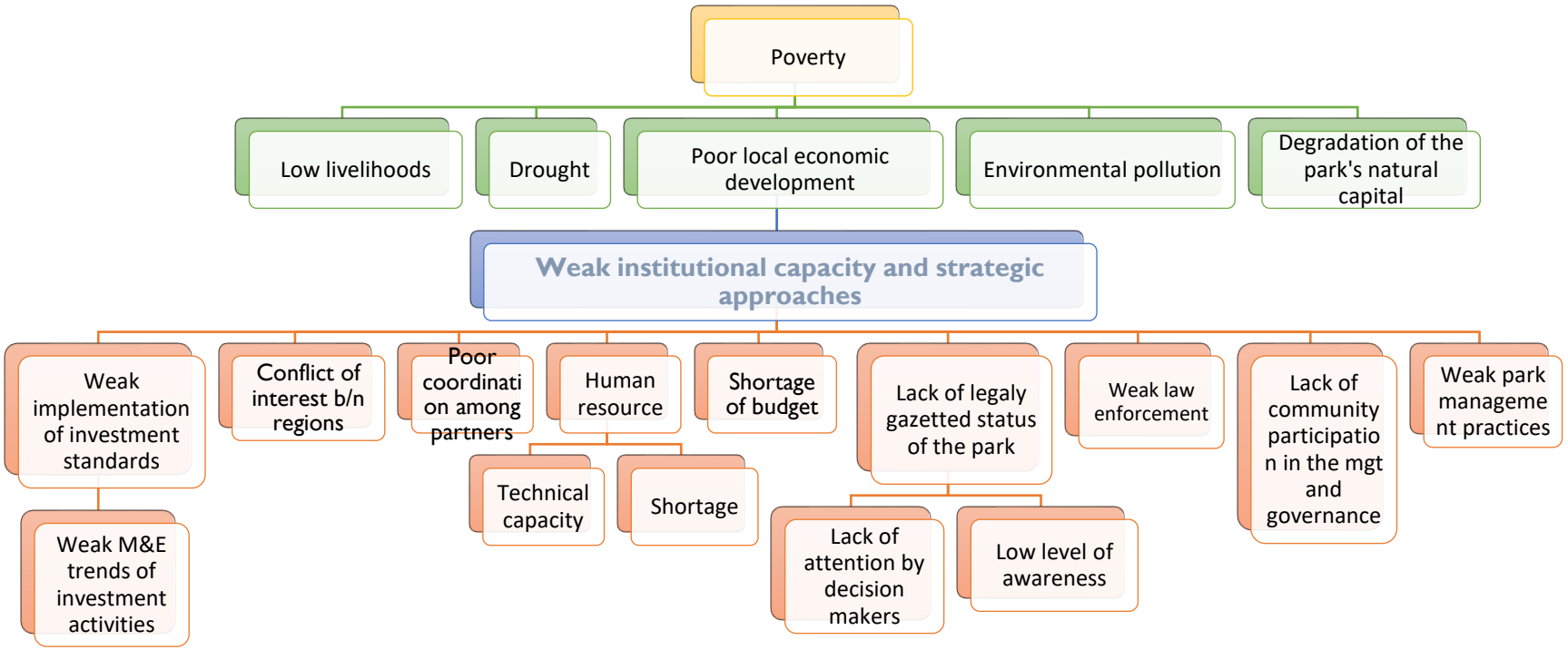
(a) Problem Tree for loss of biodiversity



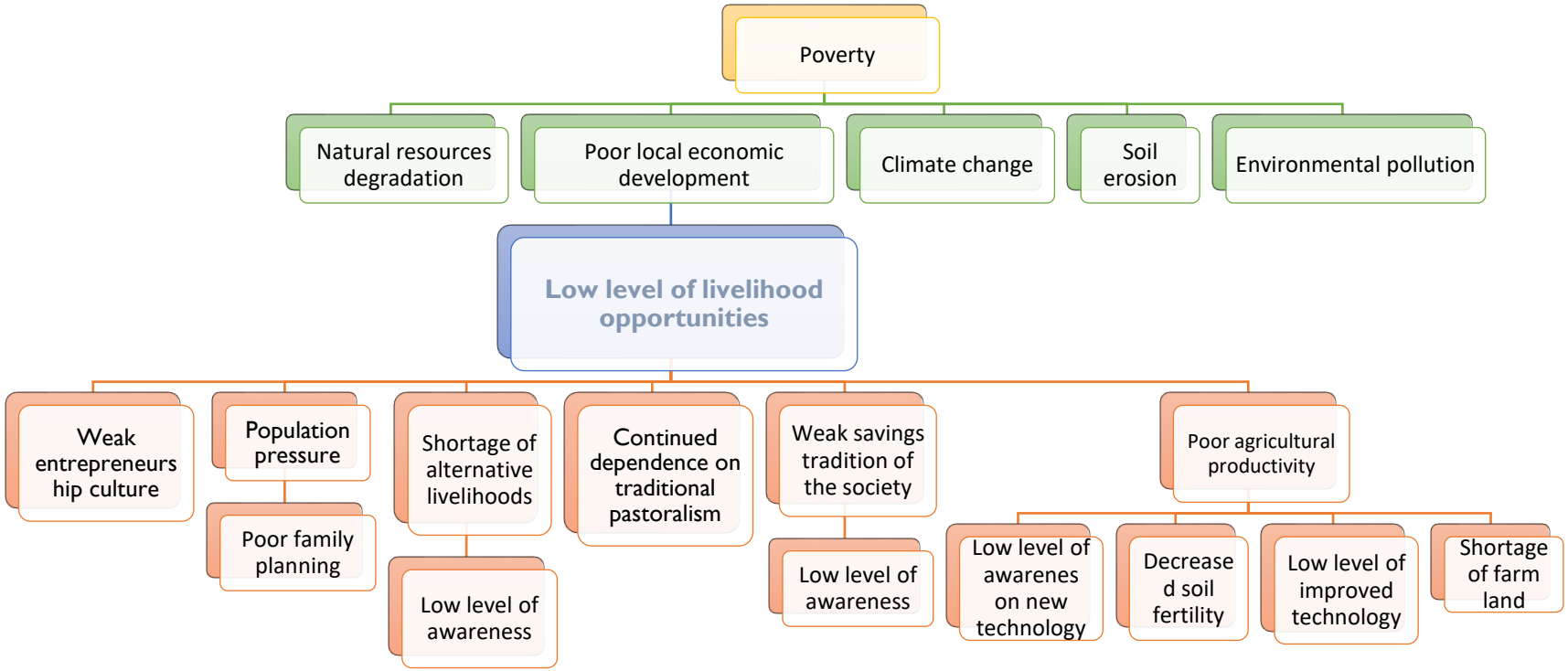
(b) Problem tree for over fishing and siltation of lakes



(c) Weak institutional capacity and strategic approaches



(d) Weak livelihood opportunities



(e) Poor waste disposal