INTEGRATING ECOLOGICAL PRINCIPLES AND TRADITIONAL KNOWLEDGE SYSTEMS IN LOCAL RESOURCE MANAGEMENT PLANNING IN UGANDA

BY

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DECLARATION

I declare that this research report is my own work and has not been presented to any other University before for any other degree award.

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APPROVAL

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DEDICATION

This research work is dedicated to my family members; my sweet mother Mrs. Leocardy Masaba Amooti, my late Dad Isaka Masaba Mafabi, my Children; Arnold, Achilles, Abel, Annicent, and Agatha, and above all my beloved husband, Mr. Isaac Kizito.

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I would like to give glory and honor to God the almighty and mother Mary for making it possible for me to complete this level. Further, to all the people who contributed in different ways in making this research project possible. My husband and children for the time and support you gave me. I am honored to thank my supervisors Dr. Jerome Sebadduka Lugumira and Prof. Wambede M. Nabalegwa, for the time and guidance given to me during my study. Your efforts will not be taken for granted.

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LIST OF ACRYNOMS

ANOVA:	Analysis of Variance
CBO:	Community Based Organizations
CDO:	Community Development Officer
CF:	Community Forest
CFM:	Community Forest Management
CFR:	Community Forest Rules
CLA:	Community Land Association
CWMP:	Community Based Wetland Management Plan
DEO:	District Environment Officer
DFO:	District Forest Officer
DWD:	Directorate of Water Development
DWO:	District wetlands Officer
FMC:	Forest Management Committee
FMP:	Forest Management Plan
FMP:	Forest Management Plan
GDP:	Gross Domestic Product
GIS:	Geographical Information Systems
HUC:	Hydrological Unit Code
IWRM:	Integrated Water Resources Management
LC:	Local councils
MoLG:	Ministry of Local Government
MWLE:	Ministry of Water, Lands and Environment
NEAP:	National Environment Action Plan
NEMA:	National Environment Management Authority
NFA:	National Forestry Authority
NGOs:	Non-Governmental Organization
NPHC	National Population and housing census-Uganda
PFO:	Private Forest Owner
UBOS	Uganda bureau of standards
USGS:	United States Geological Service's
UWA:	Uganda Wildlife Authority

WID: Wetland Inspection Division

WWF: World Wide Fund for Nature

ABSTRACT

The extent to which natural resources management planning in Uganda put into consideration ecological principles and traditional knowledge systems is still a matter of debate. This study was undertaken to determine the extent to which current local resources management plans integrate ecological principles and traditional knowledge. Based on a purposive sampling strategy, 44 plans were secured after initial contact with District Natural Resources Officers and Ministry of water and Environment out of which, 27 were used. During this process, un-structured interviews about the planning process were conducted with key informants and these helped to pry into any efforts towards use of traditional knowledge in resource management planning. From the obtained data and review of literature, a plan coding protocol sensitive to traditional resource valuation systems was developed, with 6 traditional knowledge indicators incorporated into the 5 ecological principles/components. The tool was then used to evaluate the land resources' management plans initiated at the local community level. Meta-analysis was used to examine the extent of integration of ecological principles and traditional knowledge whereas one-way ANOVA was used to determine the variations in integration across ecosystem, space and time. Meta-analysis involved standardizing component-wise scores to generate overall measure of ecosystem plan quality and the derivation of plan quality based upon presence, quality and total quality issue scores. Analysis of the data revealed an overall plan quality score of 23.97 out of 50, with a mean ecological component indicator score of 4 on a scale of 1-10 while traditional knowledge indicators contributed 4.7% to overall plan quality score. The one-way ANOVA revealed a p-value of 0.20 for plan scores by regions, 0.02 for plan scores by ecosystem and 0.057 for plan scores by time. The null hypothesis that land resources management plans in Uganda do not integrate ecological principles and traditional knowledge was rejected. It is construed that to a small extent, land resources management plans drawn at the local community level in Uganda integrate ecological principles and traditional knowledge and this varies across ecosystems and time. It is recommended that ecosystem management planners should consider reviewing plans and strengthening ecological principles and traditional knowledge aspects that promote sustainability and protect integrity of land resources. Further research is needed to assess the actual implementation of the plans in the field.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Increasing human populations all over the world largely depend on land resources (e.g. forests, grasslands, water catchments, wetlands and lake basins) for ecosystem goods and services; which exerts pressure on these non-expanding and others; non-renewable resources. To ensure sustainability, such resources need to be carefully managed at all levels amidst both natural disturbances like climate change and human disturbances related to land-use pressures (Ramsar, 2010).

Despite the global importance of different ecosystems, many decisions about their management are made by central authorities with limited attention to local knowledge input and ecological impacts of such decisions (Dale, Brown, Haeuber, & Hobbs, 2000). Decisions made at the national level are mainly economic in nature (aiming at economic transformation of society) which promotes extensive use of natural resources thereby undermining the ecological sustainability of these systems being exploited for economic development consequently which in most cases promotes loss of these ecosystems. (Brody, 2003; Termorshuizen, Opdam, & Brink, Van Den, 2007; Vold & Buffet, 2008).

In Uganda, there are a variety of ecosystems, ranging from Mountain ranges like Elgon, Rwenzori, Virunga; water bodies with associated wetlands like the Nile Victoria, Kyoga, Albert, Edward, Wamala and George; forests like Mabira, Bwindi, Budongo, and Bugoma. For a considerable period of time, management policies and plans for these valuable ecosystems in the country were being made at the national level (Obua, Banana & Turyahabwe, 1998; Nkonya et al., 2002) and mostly for reasons related to faster economic transformation of the country, just as the trend had been elsewhere in the world.

Under a decentralized arrangement it was expected that local communities would have authority on how they use their land, only with guidance from the technical officers from the local government and sector ministries (Were et el., 2013). This is based upon the understanding that specific resource-use decisions that promote resource sustainability or degradation are made at

the community level (Brody, 2003), and it is what is pre-supposed by the framework law on environment (the National Environment Act, 1997), the Local Government Act, 1997 and all sectoral laws (e.g. the Land Act 1998, The National Forestry and Tree Planting Act, 2003, the Mining Act 2003, Forestry policy, 2001, among others) guiding the use of land resources. Indeed, several communities have been supported to develop ecosystem management plans. Such plans are expected to embody the ecosystem approach (Musali, 1998) which advocates for integration of all components of the living and non-living environment, and humans as users and drivers of resource degradation (Brody, 2003; Termorshuizen et al., 2007) and is hence based upon the principles underlying ecosystem management.

Ecological principles of ecosystem management are basic assumptions or beliefs about ecosystems and how they function and are informed by the ecological concepts (Vold & Buffet 2008). Ecological principles use ecological concepts taken to be true to draw key conclusions that can then guide human applications. The application of these principles is through components; factual basis, goals and objectives, inter organization coordination and capabilities, policy, tools and strategies, and implementation in land resource management plans constitute plan quality. Brody, 2003; Smith & Lyles, 2012). Plan quality is a conceptualized ability of local plans to manage and protect the integrity of ecological systems (Berke et al., 2012).

Traditional knowledge on the other hand is that knowledge accumulated over generations of living and interaction with a particular environment (Lantz & Turner, 2003). Over the years, communities living close to key resources like forests, wetlands and water catchments have developed particular knowledge to use and manage these resources which has been transferred through various cultural rites like adulthood, marriage, death, twin dancing and bear parties. Traditional knowledge has been vital not only in management of resources but also in responding to environmental challenges like earth quakes, floods, pests, drought and landslides (Lefale, 2009). Local communities therefore have valuable lessons to offer about successful and unsuccessful management of natural resources.

In Uganda, the extent to which ecological principles and traditional knowledge are integrated in these plans is not well documented. This study is the first attempt to examine the appropriateness of land resource management plans developed by local communities in Uganda. It specifically

involved development of land resources management plan cording protocol sensitive to ecological principles and traditional knowledge and applied it to analyze the quality of plans developed by local communities in Uganda. It also attempted to show differences or improvements in plan quality over time and how plan quality differs in ecosystem and space.

1.2 Problem Statement

The Local Government Act of 1997 devolved planning for the management of land resources (e.g. wetlands, forests, and water catchments) in Uganda (Musali, 1998; Pomeroy, Tushabe, Mwima, & Kasoma, 2002; Turyahabwe, 2006). This was aimed at incorporating the local users as co-resource managers and improve service delivery by shifting responsibilities for policy implementation to local beneficiaries (Zaninka, 2001). The question, however, is whether planning at such level integrates ecological principles and traditional knowledge, considering the rampant degradation of the environment in various parts of the country (Pomeroy et al., 2002; Turyahabwe, 2006; State of the Environment Report, 2008; MERECP, 2011; UBOS, 2015; State of Environment Report, 2016). Unfortunately, there has not been any attempt to study the robustness of available land resources plans in Uganda. Moreover, the tools and methods in literature (e.g. Broody, 2003) were developed to evaluate plan quality in the western world. Therefore, they capture those principles as conditioned and understood by regimes and rules at play. A quick review of this suggests that, they are a good starting point but there are certain aspects they do not capture that apply to traditional communities. Planning paradigms here differ from those of the western world, where, for example, land ownership is by government and if by individual, it is on a large scale. Otherwise in Uganda, there are variable land tenure systems, some communities are characterized by small holdings, and in so many areas communities have strong attachment to land (Opio, 2008; Were et al., 2013). This therefore means that their view of land and associated resources impacts its use, and hence planning. In this study, an attempt was made to evaluate the quality of land resources plans in Uganda, using a method adopted from Broody (2003), adjusted to take into account those principles reflective of the relations of land users with the environment, and traditional knowledge.

1.3 Objectives, research questions and hypotheses

1.3.1 General objective

The overall objective of this study was to examine the extent to which land resources management plans initiated at the local community level in Uganda integrate ecological principles and traditional knowledge.

1.3.2 Specific objectives

The specific objectives were;

1. To develop a resources management plan coding protocol sensitive to traditional resource valuation systems.
2. To evaluate the extent to which land resources management plans initiated at the local community level in Uganda integrate ecological principles and traditional knowledge.
3. To identify the variations in the application of ecological principles and traditional knowledge in land resources management plans across space, ecosystem and time in Uganda.

1.3.3 Research questions

1. To what extent do the land resources management plans drawn at local community level in Uganda integrate ecological principles?
2. To what extent do existing plans, integrate traditional knowledge?
3. In which ways do existing land resource management plans in Uganda vary in (i) space (ii) ecosystem and (iii) time?

1.3.4 Hypotheses

1. Land resources management plans initiated at local community level in Uganda do not integrate ecological principles and traditional knowledge.
2. There is no significant variation in the integration of ecological principles and traditional knowledge over space, ecosystem and time in land resources management plans in Uganda.

1.4 Significance of the study

The findings from the study will mainly benefit environmental policy makers, environmental regulators, and researchers in the field of environmental policy and planning.
Policy analysts will gain understanding of the variations in ecosystem management plans under decentralization and account for policy failure or success.

The plan evaluation protocol that was developed in this study will help the district environment regulatory office to assess plans before they are passed for implementation thus cub resource degradation.

Regulators will also be informed of key traditional knowledge systems and practices that are in line with ecological science that need to be strengthened to protect fragile ecosystems.

The study will provide baseline literature for researchers probing environmental policies and management plans. The study will also help to highlight the strength, weaknesses and opportunities in the existing natural resources management plans initiated at the local community level in Uganda so that corrective action is undertaken during development planning at the district level.

1.5 Scope

The study considered land resources management plans initiated at community level. It relied on documentary review of existing local management plans for wetlands, forests, and water catchments in selected areas with in Uganda having plans developed at the local community level. The time period for the plans stretched from 2001 to 2016. This time corresponds to environmental legislation and decentralization campaign period in Uganda. The research study activities up to report writing lasted for a period of nine months, commencing in January 2018.

1.6 Conceptual framework

The conceptual framework in this study shows connections between land uses and ecosystem sustainability in the assessment of the integration of ecological principles of ecosystem management and traditional knowledge systems; (Figure 1.1).

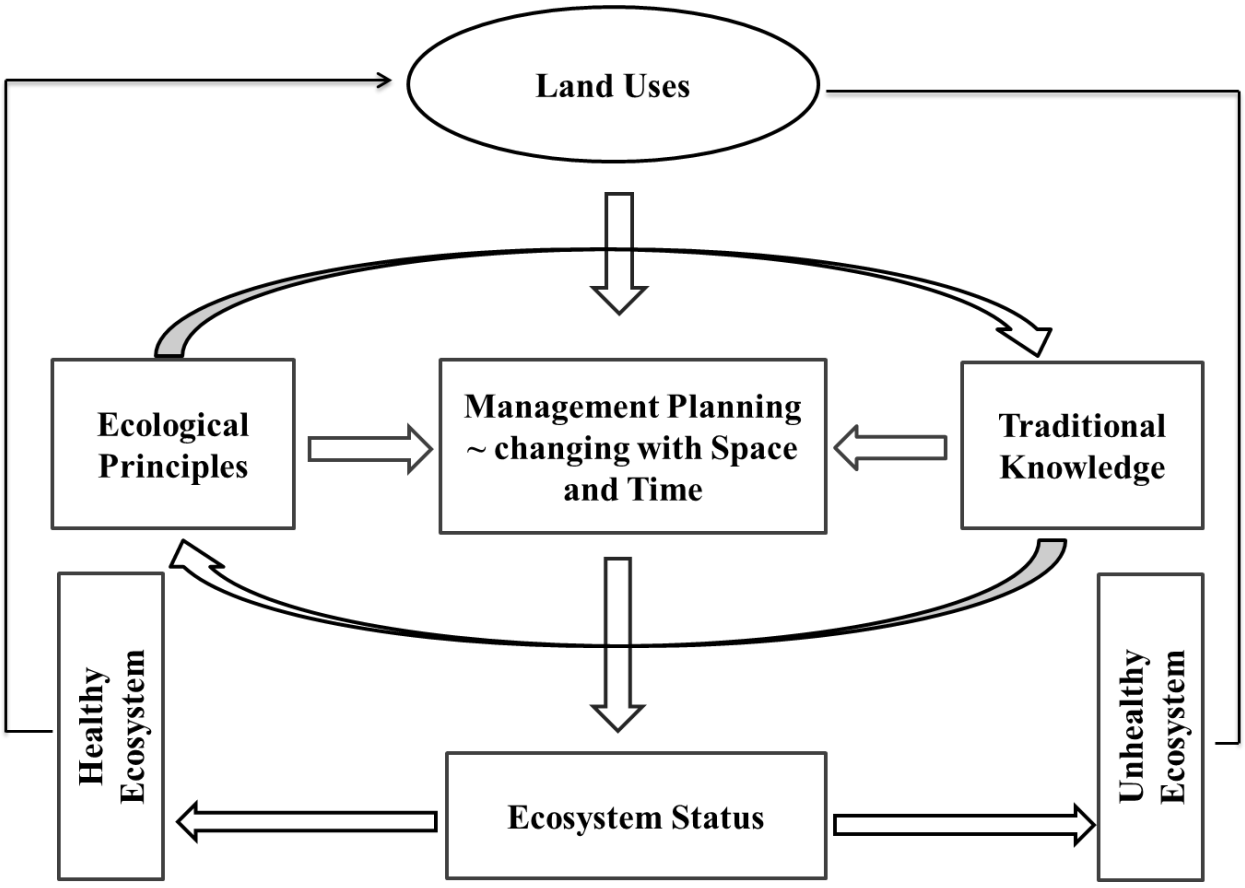

Figure 1.1: Conceptual framework

Sustainable land uses are centered on natural resources management planning. From Figure 1.1, it is hypothesized that management of natural resources should follow ecological principles as envisaged by Brody (2003), Brody et al. (2004), Termorshuizen et al. 2007, Tang et al. (2008), Meyerson (2012) and Berke et al. (2012) and traditional knowledge, given the fact that traditional knowledge can contribute to proper resource management what western science may not (Lantz & Turner, 2003; Mazzocchi, 2006). Traditional knowledge is not considered part of ecology however it reflects some principles of ecological management and, ecological principles reflect some forms of traditional knowledge. If both are considered in resources management planning, they can produce a healthy ecosystem but if either of these is not catered for, the result is an unhealthy ecosystem. It is also important to note that management planning may change in space and time and across the various ecosystems being planned.

1.7 Operational definition of Terms

Ecosystem: components on the natural environment with complex connections and linkages

Land resources: elements of the biophysical environment including forests, wetlands and water catchments that directly or indirectly affect and are affected by human actions.

Local community: the immediate population/locality to the ecosystem and using or influenced by its existence.

Natural resources: naturally occurring substances on the surface of the earth that include forests, wetlands, minerals, weather, water bodies etc. The term natural resources in this study is used interchangeably with the terms; land resources and ecosystems.

Plan assessment: examination of resource management plans to ascertain inclusion or exclusion of specific elements/indicators

Plan coding protocol: a plan evaluation tool having indicators of ecological principles and traditional knowledge for determining consideration or non-consideration of the same in a plan

Traditional knowledge: knowledge that is endemic to the local communities and has been passed on from generation to generation and is not existent in western science.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature related to the research problem. It shows how this research relates to the existing body of knowledge and identifies the gaps existing in the current body of knowledge, with regard to the integration of ecological principles and traditional knowledge in local land resources management.

2.1.1 Ecological principles and their application in land resources management

Ecological principles are increasingly being promoted as key aspect of effective ecosystem/land resources management planning. Ecological principles are perceived as beliefs about ecosystems and how they function (Vold & Buffett, 2006). Ecological principles are usually informed by concepts. Tang and Brody (2008) define ecological concepts as the general understanding about ecosystems and ecosystem management. Termorshuizen et al. (2007) say that Ecosystem management is an adaptive approach to managing human activities to ensure coexistence of healthy, fully functioning ecosystems and human communities. The main goal is to maintain spatial and temporal characteristics of ecosystems, such that component species and ecological processes can be sustained, and human wellbeing supported and improved (Vold & Buffett, 2008).

Effective land resources management is based on principles (Mitchell et al. 2004; Saklaurs & Krūmiņš, 2015). Principles of Ecosystem management are values that can be applied to support relevant applications of Ecosystem management (Pirot, Meynell & Elder, 2000). These principles involve; setting objectives and targets for biodiversity in plans, managing biodiversity at multiple levels of biological organization and multiple time and spatial scales, incorporating spatial and temporal approaches to land use that are compatible with an area's natural potential (Vedeld et al., 2005; Gu & Rehber, 2006). Other important principles mentioned by Vold & Buffett (2008) include; avoiding land uses that convert natural ecosystems, restoring damaged ecosystem, compensating for the effects of human activities on biodiversity and employing adaptive management of natural resources to maximize learning.

Several studies (Lyles & Stevens, 2014; Berke & Godschalk, 2009), have been carried out to evaluate how incorporation of relevant ecological principles in ecosystem management contributes to sustainable land resource management. Important considerations during implementation are discussed first. Termorshuizen, Opdam and Brink, (2007) advise that for ecosystem management to be successful, ecological principles relevant to a given ecosystem ought to be incorporated. Petursson and Kaboggoza (2006) also state that relevant land resources management plans should consider humans to be an integral part of the ecosystem. This is because most people, especially in developing countries like Uganda depend on natural resources for survival and welfare. In this regard, Kyasiimire (2010) argues that land resources must be planned for and managed for the long-term well-being of humans and other forms of life.

Block and Corn (1994), clearly articulate how ecological principles can be taken into account in ecosystem management planning. They advise that all biotic and abiotic elements in the ecosystem must be allowed to be present with sufficient redundancy at appropriate spatial and temporal scales across the landscape. Berke and Godschalk (2009) also add that, the variability found in natural resources should be present and functioning. Lyles & Stevens (2014) explain that human intervention should not impact ecosystem sustainability by destroying or significantly degrading components that affect ecosystem capabilities. On this issue, Tang and Brody (2008) also advises that the cumulative effects of human influences, including the production of commodities and services, should maintain resilient ecosystems capable of returning to the natural range of variability if left alone and management activities should conserve or restore natural ecosystem disturbance patterns.

Brody (2003) examined the ability of local comprehensive plans in Florida to incorporate the principles of ecosystem management. The study used an issue-based method and component indictors to define and measure the quality of a comprehensive plan. Using a cross sectional design and on a random sample of 30 local comprehensive plans, the study linked general plan quality components to the principles of ecosystem management. Brody (2003) included five plan components and they were; factual basis, goals and objectives, inter-organizational coordination and capabilities, policies, tools and strategies and implementation. Indicators within each plan component were coded using a plan coding protocol listing each. Brody (2003)'s study was however conducted in a country with well-defined community planning framework unlike the

current study area. Besides, traditional knowledge was never included in the plan components for quality analysis; which the current study ventured into. The current study modified and used Brody's plan quality coding protocol to include aspects of indigenous knowledge in ecosystem management planning. In another study, Brody et al. (2004) used watersheds as planning units and served as a unit analysis. In this study, 23 adjacent watersheds were selected for analysis in the southern portion of Florida defined by the United States Geological Service's (USGS). Local jurisdictions were then selected containing land area within one of the 22 watersheds. Thirty adjacent counties intersecting the watershed boundaries, plus the 15 largest cities in the land area were selected for analysis. The study only evaluated plan quality protocol for ecosystem containing indicators to determine their collective ability to manage ecological systems.

Another study by Termorshuizen et al. (2007) done in Holland using a cross sectional design involved of 62 landscape plans. The plans were obtained by asking consulting companies and advisory bodies to send plan reports. The study excluded draft plans but considered multifunctional plans with the requirement of ecological planning indicators. To gather the required data about the plans, different methods were employed. Termorshuizen et al. (2007) state that, one method involved obtaining detailed information by studying every document available and talking to commissioners and those responsible for the planning process. The second method used only information mentioned in the final report. The study proposed a tool to make principles of ecological sustainability in landscape planning measurable and dependable which were tried out in a case study on a sample of the Dutch landscape plans to test the practical value of the tool. The findings were very useful because they highlighted five key specifications for ecological planning indicators. These were; choosing targets, determining qualitative conditions, determining quantitative conditions and including adjacent areas. However, Termorshuizen et al. (2007) preferred the second method because the tool was meant to play a role in communicating ecological quality and landscape plans. They noted however that whatever study tool selected must be able to deal with a variety of ecosystem plans.

Berke et al. (2012) while studying plans for resiliency evaluation of the state hazard mitigation plans, considered six principles of plan quality using content analysis of 30 coastal state plans. The state hazard mitigation plans formed the sampling unit. The plans were selected primarily by downloading them from official state websites. Plans were obtained by submitting email, phone,

and mail request to the state hazard mitigation officer or planning staff. All the 30 mitigation plans were obtained. The coding instrument was developed basing on derivation of coding items to serve as the recording unit for the study data. The study evaluated plans on each of the six quality plan principles. The principles included Goals, fact base, policies implementation and monitoring, inter-organizational coordination and participation. The study used a coding standard procedure by Krippendorff (2004). Each item was measured on one of two scales; 0-1 binary scale or 0 to 2 ordinal scale. This was also adopted and used in plan cording and assessment in terms of quality in the current study.

From the above literature, it is noted that management plan quality evaluation studies applied different evaluation methods to assess the incorporation of different plan components. What is common for most studies however is the binary and ordinal scale coding system was adopted. In the current study, the main plan components included, factual basis, goals and objectives; policy tools and strategies; inter-organizational coordination; and implementation. Indicators were measured using ordinal scale. Ordinal coding was preferred because most of the indicators of ecological principles and traditional knowledge can be found in the plans and measured accordingly.

2.1.2 Land resources/ ecosystem management plan quality assessment

There are a number of developed indicators currently being used to determine whether ecosystem management planning adheres to ecological principles. These indicators are usually predefined under themes and sub-themes that best capture the major aspects of ecosystem management. Some scholars have called these plan components, indicators of ecological principles (Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; & Berke et al., 2012). It is important however to note that the component indicators used in plan quality assessment evolve over time as plan quality studies advance and gain support (Meyerson, 2012). Brody (2003)'s system is among the commonly applied ecosystem management plan assessment protocol (Berke et al., 2012). This protocol includes five major components that are; factual basis, goals and objectives, inter-organizational coordination and capabilities, policies, tools and strategies and implementation. Each of these components has got specific indicators

for which plan quality assessment is based (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012 & Berke et al., 2012).

2.1.2.1 Factual basis component

According to Brody (2003), factual basis is the first plan component. This component refers to the general assessment of existing and projected condition of an ecosystem from which goals and policies are developed (Meyerson, 2012). The component is an inventory of existing resource issues, environmental policies and stakeholder's interests within the ecosystem captured from which policy decisions of the plans are made. Several researchers have elaborated on the actual implementation of this component. Tang et al. (2008) states that factual basis of an ecosystem identifies the existing local conditions and needs for community to foster development. Berke et al. (2009) say that factual basis is the analysis of the state of natural environmental resources and constraints. Factual basis supports and often drives other components of ecosystems plan quality and it entails 3 sub-categories, namely; resource inventory, human ownership and human impacts (Brody, 2003).

2.1.2.2 Goals and objectives component

The Goals and objectives component describe the future conditions to which land resource planners seek which stimulate plans for implementation (Brody, 2003). Goals are general statements of either long-term or short-term goals with measurable objectives that aim at providing bench marks of a successful plan. They reflect the values of the planners and, aspire to sustainably protect the local ecosystems. Goals and objectives prioritize issues and problems facing communities where the resource ecosystems are found. Therefore, guiding the implementation of ecosystem management and providing effective planning that shows more detail than intangible commitment of ecosystem protection (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; and Berke et al., 2012).

2.1.2.3 Inter-organizational coordination and capabilities component

This component identifies the need for coordination with other authorities, landowners, and organization so as to generate an effective land-use plan (Brody 2003). It recognizes that

planning problems often extend beyond designated areas or the domain of a single organization and that collaboration is necessity to achieve commonly held resources management goals (Brody, 2003; Brody et al., 2004; Tang et al., 2008; & Meyerson, (2012).

2.1.2.4 Policies, Tools, and Strategies plan component

Policies, Tools, and Strategies plan component is very important in the sense that it actualizes the goals and objectives by defining actions to protect ecosystems (Brody et al., 2004). They are the means for realizing the plan goals and objectives (Tang et al., 2008). Policies are the actions intended to guide decisions in the implementation of a plan (Meyerson, 2012). Polices, tools and strategies need to be clear and more detailed to minimize confusion during plan implementation. They should be flexible and adaptable to allow any eventuality of ecosystem degradation. Strong policies identify tools that effectively protect critical habitats and related natural systems. Brody (2003) categorized this plan component into four major branches that; regulatory tools, incentive-based tools, land acquisition programs and other policies.

2.1.2.5 Implementation

The last component according to Brody (2003) is implementation which Berke et al. (2012) describe as commitment to carry out policy-driven action. It shows how a plan can after adoption become an enduring instrument. It conceptualizes a commitment to implementing a final plan in future and not how well the plan is implemented after adoption. Tang et al. (2008) described plan implementation as a component that translates plans policies, tools and strategies into tasks and assign them to each party involved. Implementation as a component should establish ways of meeting the goals and objectives of a plan and how well to improve the performance of policy, tools and strategies (Brody, 2003; Brody et al., 2004; Tang et al., 2008; and Berke et al., 2012). In this study, a plan coding protocol for assessment of ecosystem management plans in relation to incorporation of ecological principles and traditional knowledge systems for Uganda was developed by modifying Brody (2003) plan component indicators in relation to other plan quality assessment studies and following consultations with district ecosystems management planners and implementers.

2.1.3 Integration of traditional knowledge in natural resources management planning

The communities within an ecosystem are crucial resource management planners. Sustainable plans ought to integrate traditional knowledge systems. This is because people living in areas endowed with natural resources have over time utilized them for continued life and have subsequently accumulated substantial knowledge relevant to sustainable conservation. This knowledge has to be utilized if we are to have successful natural resources conservation (Byarugaba, 2009). This knowledge is rooted in traditional systems and beliefs, which indigenous people use to understand and interpret their biophysical environment. The word traditional refers to the belonging naturally to a place. Traditional knowledge is synonymous with; focal ecology, ethnology, indigenous knowledge, customary laws and knowledge of the land. Indigenous environmental, ecological knowledge or practices are probably the mental common terms of the concept (Kyasiimire, 2010).

Traditional knowledge generally is referred to as a board of knowledge built up by a group of people through generations of complex interactions with nature (Lafele, 2009; Kyasiimire, 2010). It includes a system of classification, a set of empirical observations about the local environment and the system of self-management that governs resource utilization (Kothari, 2007). Indigenous knowledge boosts of a wealth of wisdom and experience of nature gained over generations; which western science can benefit from (Iaccarino, 2003; Mazzocchi, 2006). This knowledge is acquired through direct observations and transmitted most often orally over generations. The importance of this traditional knowledge for the protection of biodiversity and the achievement of sustainable development has attracted international attention since the last two decades (United Nations, 1992; Gómez-Baggethun, Corbera & Reyes-García; 2002).

Mazzocchi (2006) summarizes the role of traditional knowledge systems in ecosystems management by starting that;

"Generally, traditional knowledge systems adopt a more holistic approach, and do not separate observations into different disciplines as does western science. Moreover, traditional knowledge systems do not interpret reality on the basis of a linear conception of cause and effect, but rather

as a world made up of constantly forming multidimensional cycles in which all elements are part of an entangled and complex web of interactions, pp. 23".

Kyasiimire (2010) studied the role of indigenous knowledge practices in conservation of national parks in Uganda using Interview, observation, questionnaires and photography. The main purpose of the study was to establish whether indigenous knowledge practices had contributed to the conservation or degradation of these National Parks. Cultural laws and regulations; totems and beliefs/taboos; gender in hunting wildlife and management; traditional hunting, grazing and fishing; medicinal plants collection and indigenous knowledge are some of the practices that were discovered to be contributing to conservation, while those contributing to degradation included; poaching, witchcraft, bush burning, mining, fishing, farming/ cultivation, grazing, tree cutting for timber, fire wood, charcoal burning, and building materials. This study did not however link traditional knowledge practices to ecological principles; which the current proposed study attempted to address.

Zaninka (2001) studied the impact of nature conservation on indigenous peoples, using group discussions and interviews. From the study, it was discovered that forest conservation program for Mgahinga and Bwindi Impenetrable Forests ignored the participation of the native inhabitants (Batwa) which in turn affected implementation of the conservation program. Although in the study, forest management planners had ignored the local people, their contribution in Ecosystem management planning and implementation cannot be underestimated. This current study assessed windows available in land resource management plans for native peoples' input and participation.

Iyango et al. (2005) in their study of the traditional wetland practices in rural communities in Busia and Rakai in Uganda, reported that traditional practices mainly emphasize sustainable utilization of wetlands, such as aesthetic value that revolve around various controls to ensure sustainability and existence of various resources which are based on acceptable, though not documented regulations and rules. They also pointed out that one of the major ways to develop policies and guidelines for sustainable use of wetlands is through a better understanding of their traditional uses because traditional management systems are based on indigenous knowledge and practices which have evolved over generations. These ideas are the ones that need to be

promoted and applied during wetland management planning, as there is consequently a need to test a variety of potential use options for wetlands (Franc & Laroussinie, 2001; Kothari, 2007). The study further noted that indigenous knowledge provides the best management options to the continued use of wetlands especially those that provide at least one known essential good, service, or attribute where alternatives are not practically or economically viable. In this study, the traditional knowledge indicators ascertained in the plans are shown in Appendix I, under different components. These have been decided up on after interviews and consultations with environment management planners from NEMA and District Environment Officers from the districts of Masindi, Hoima and Buliisa, in line with the plan quality analysis recommendations by Termorshuizen et al. 2007.

2.1.4 Variations in integration of ecological principles and traditional knowledge in resource management planning over space, ecosystem and time

With differences between ecosystems, space/regions and time of planning, it is envisaged that integration of ecological principles and traditional knowledge in ecosystem management planning too varies. Berke et al. (2012) while conducting a critical analysis and review of ecosystems 'management plans dating back to as early as 1995 in their study reported that plan quality improves with time. In so doing, they attempted to ascertain, if any, improvements in planning had been registered. In addition, quantifying the ecological indicators in the plans enabled precise communication of results from the study. However, literature on plan variations in terms of ecosystems and places/regions is generally scanty even in the western world where planning for land resources is hopped to have been under taken for long period of time. For this reason, the current study also assessed whether there were significant differences in planning with respect to specific ecosystems planned for, time, and place/region.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents, describes, and justifies the appropriateness of the procedures and processes that were followed in conducting this research. The research design, study area, sampling techniques, data collection instruments and procedures are described and justified. The chapter further explains data management and analysis techniques as well as study limitations.

3.2 Study area

The study was intended to look for land resources management plans across the whole country. The plans that were interrogated were from 23 districts that is 3 in Central, 3 in the East, 4 in the North, 5 in Mid-west and 8 in south western Uganda (Figure 3.1). It is important to note that these areas don't have same geology, soil type, physiography, hydrology, vegetation and climate. In addition, they don't have the same social characteristics in terms of language, population and dominant socio-economic activity. In this section, an effort was made to give a representative description of geology, soil, relief, hydrology, climate, population and land use.

3.2.1 Location

Uganda is a landlocked country in the Eastern part of Africa lying between latitude 1°30' South and 4° North and Longitude 29° 30' East and 35° East. It is within the Great Lakes region of Africa and it shares borders with Kenya to the east, South Sudan to the north, Tanzania and Rwanda to the south and the Democratic Republic of Congo to the west (NEMA 1996, & UBOS 2015). The country covers an area of 241,551 km^2 of which land area (excluding open water & swamps) constitutes 197,097 km2 and open water and swamps constitute 43,941 km^2.

3.2.2 Geology and soil

Uganda's geology is made up of very old rocks formed during the Precambrian era (3000 – 6 000 million years ago) [Kyasiimire, 2010]. The youngest rocks date back to the cretaceous era (135 million years ago) and these are mainly of sedimentary or volcanic origin (Geological Survey of Finland, 2014; NEMA, 2010). A number of parameters are used to define the soils of

Uganda, such as, parent rock, age of soil and climate. However, the most dominant soils are ferralitic soils; covering more than two thirds of the country (Soil Atlas of Africa 2013). Basing on productivity, the country's soils have been classified into five categories; i) very high to high productivity; ii) moderate productivity; iii) fair productivity; iv) low productivity; v) negligible; and nil productivity.

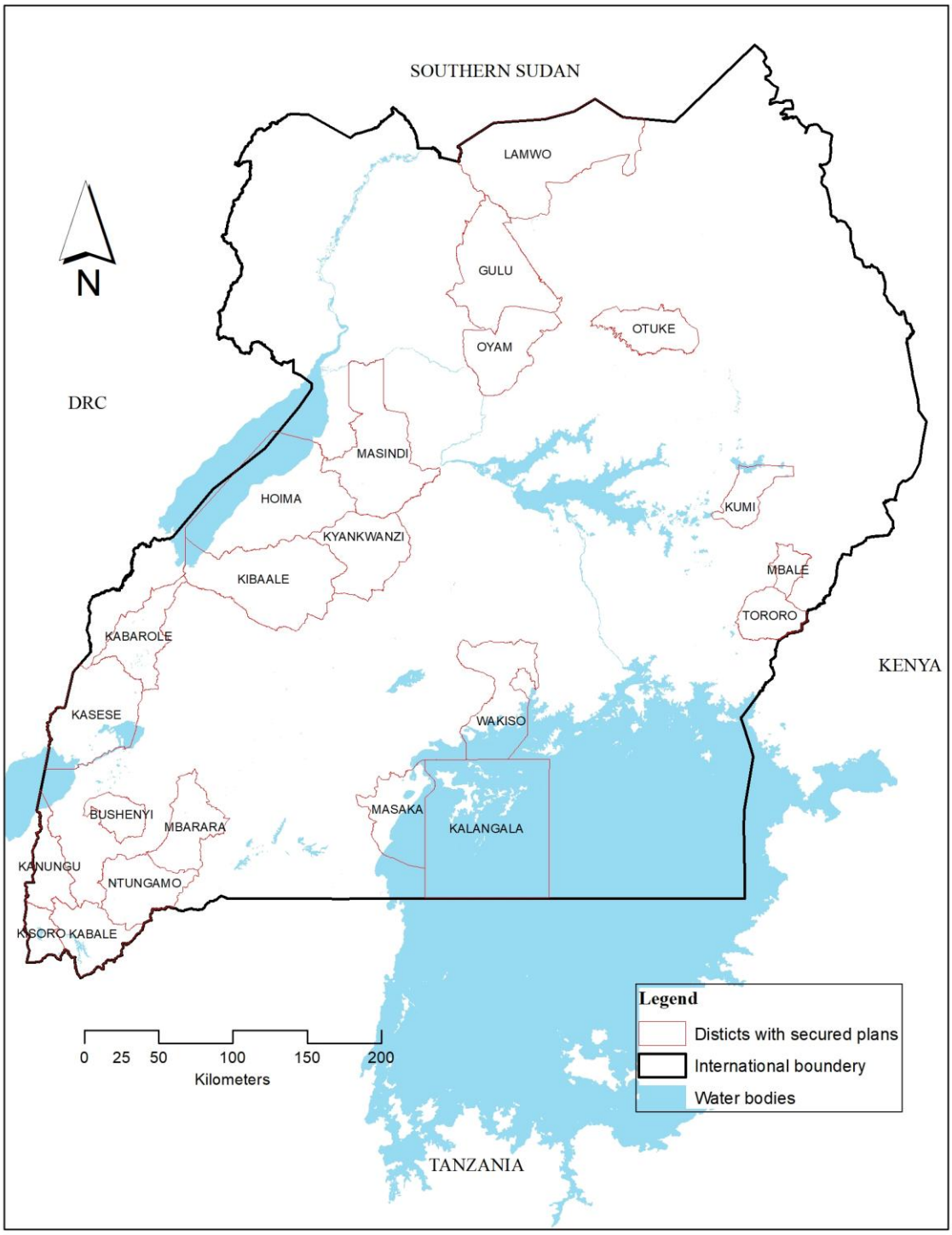

Figure 3.1: Location of study area

3.2.3 Relief

Uganda's relief is part of the interior plateau of Africa, which is characterized by flat-topped hills in the central, western and eastern parts of the country. The rise of the plateau in the eastern and western parts of the country is represented by spectacular mountainous topography found along the borders (Bland et al., 2016). These include the Block Mountains of the Rwenzori and the Mufumbira volcanoes in the West; and Mt. Elgon, Mt. Moroto, Mt. Morungole, Mt. Timu and Mt. Kadam in the East (NEMA, 2008).

3.2.4 Climate

Uganda's climate is influenced by two main factors that is, the Inter-Tropical Convergence Zone (ITCZ) and air masses including the southeast and northeast monsoons. The country experiences two main seasons: the rainy and dry seasons (Di Gregorio & Jansen, 2005). The country receives fairy reliable precipitation, ranging from 750 mm in Karamoja in the Northeast to 1500 mm in the high rainfall areas on the shores of Lake Victoria, in the highlands around Mt. Elgon in the east, the Rwenzori Mountains in the south-west and some parts of Masindi and Gulu and its temperatures range between 15^0C- 30^0C. Temperatures on lakeshores are modified by the maritime conditions (NEMA atlas, 2009).

3.2.5 Drainage

Uganda is watered by a number of water bodies with Lake Victoria shared with Kenya and Tanzania being the largest in the country and the second largest freshwater body in the world (Figure 3.1). The lake forms the major water deposit point for most of the rivers in the southern part of the country. Lake Victoria waters drain through the Owen Falls dam through the Victoria Nile and Lake Kyoga into Lake Albert, the Albert Nile and White Nile in Sudan down to the Mediterranean Sea through Egypt. The western part of the country is characterized by rift valley lakes and several crater lakes associated with the Western Rift Valley (NEMA, 2008 & 2010).

3.2.6 Vegetation

The vegetation classification and descriptions used in Uganda today are based on 1967 Langdale-Brown and Osmanson classification. According to this system, there are 11 main

vegetation classes, including high montane moorland and heath; medium altitude forests; forest/savannah mosaic; moist thicket; woodland; wooded savannah; grass savannah; steppe; bush land and dry thicket; swamp (wetlands) and cultivation communities (UWA, 2003).

3.2.7 Population

By 2014, Uganda's population was 34.6 million people (National Population and housing census report, 2016), representing an increase of 10.4 million persons from 24.5 million people in 2002. With an average population growth rate of 3.0 % per year, demographic pressures are likely to adversely affect resources ecosystems and compound the impacts of climate change especially in the arid parts of the country (MFPED, 2010).

3.2.8 Land-use

Uganda is a predominantly an agrarian economy employing over 80% of the country's population. The sector contributes about 50% to the country's Gross Domestic Product (GDP) (UBOS, 2013). Forestry, fishing, and mining represent a small fraction of the land use activities in the country.

3.3 Research design

In this study, a systematic review design which involves analysis of plans basing on historical documentation and semi quantitative approach involving transformation of categorical data into numerical or continuous data was adopted (Laws, Harper & Marcus, 2003). Systematic review is where historic documents are scrutinized with an aim of establishing out patterns of interest. The study design and approach were used on grounds that ecosystems management planning in Uganda started in the mid-1990s and until now the country is still staggering with plan development which is currently affecting implementation (NEMA report, 2010; Lavrakas, 2008). Berke et al. (2012) in their study reported that plan quality improves with time therefore the study design attempted to ascertain, if any, improvements in planning have been registered over time. In addition, quantifying the ecological indicators in the plans enabled precise communication of results from the study. The study involved critical analysis and review of ecosystems 'management plans stretching back to as early as 1995.

3.4 Sample design

Ecosystem management planning in Uganda has not yet been properly streamlined, and so, information on the existence of plans for all ecosystems in the various parts of the country was unknown to warrant a random sampling technique. The sample population for this study comprised of all land resources' management plans for different ecosystems developed by local communities in the whole country. The objective was to have as many plans as possible to enable statistical permutations however, a sum of 44 plans were secured out of which only 27 met the criterion that they had been initiated at local community level and thus selected purposively. The original thinking was that all plans would be sourced from NEMA as the law (National Environment Act 153, section 6) gives mandate to the Authority to archive such information. Unfortunately, no plans were archived in the Authority's library. Plans were, therefore, sourced from local governments and relevant government ministries, departments and agencies such as the National Forestry Authority (NFA), Worldwide Fund for nature (WWF) and the Wetlands Management Department, in the Ministry of Water and Environment.

3.5 Data collection

3.5.1 Data sources

The study involved collection of both primary and secondary data. Primary data was in form of management plans for natural resources sourced from district local governments, National Forest Authority (NFA), Worldwide Fund for nature (WWF) and Wetlands Management Departments in the Ministry of Water and Environment. The ecological indicators for components in this study were selected basing on their frequency of use in previous management plan quality assessment studies elsewhere, whereas traditional knowledge indicators were decided up on after interviews and consultations with environment management planners from NEMA and District Environment officers from the districts of Masindi, Hoima, Buliisa, Mbale, Sironko, Manafa, and Bulambuli, and in line with the recommendations by Termorshuizen et al. (2007). The plans secured during the study are listed in the table in Appendix I.

Out of the 44 plans collected, 17 plans falling under the category of general and national plans were removed and only 27 plans developed at local/community level were considered for this

study. Out of the 27, 14 plans were wetland management plans, 3 were catchment plans and 10 were forest management plans. Out of the 10 forest management plans, 3 plans were for forests on private land, making them private forest management plans.

Within each of the plans (Appendix I), it was assumed that there were sections corresponding to plan components following principles of ecological management (Brody et al., 2004; Berke & Godschalk, 2009; Berke et al., 2012) and as modified by the study from Brody (2003) to cater for unique landscape in Uganda, that is; factual basis, goals, policies, inter-organizational coordination and implementation (Brody 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; Berke et al., 2012). Under each of these components, presence or absence of indicators of ecological principles and indigenous knowledge were assessed.

Secondary data on the other hand involved documentary and literature review on the subject under investigations that is, ecosystem management planning which helped in the development of a plan coding protocol.

3.5.2 Interviews

Un-structured interviews were conducted with key informants (i.e. DEOs) in the districts of Masindi, Hoima, Kiryandongo, Buliisa, Mbale, Sironko, Manafwa and Bulambuli. The districts were purposively selected because they host vast ecosystems whereas the environmental officers were selected on the basis of being directly involved in planning for natural resources development within these districts.

They were meant to provide information on the land resource management plans, and indigenous knowledge used in the sustainable utilization of these resources. This information was used in the development of a plan coding protocol.

3.6 Data analysis

3.6.1 Plan coding protocol

To develop a resource management plan coding protocol sensitive to traditional resource valuation systems, contextual analysis was used where specific indicators for each principle/ component were developed through an interactive process involving synthesizing literature and evaluating existing plans and collecting opinions of DEOs during interviews (Meyerson, 2012). The process of identifying plan component indicators preceded as follows. First the plan components and indicators presented by Brody (2003) were compared with those presented by others. Secondly, indicators presented by other scholars and not found in Brody (2003) but considered applicable to Uganda's setting were also selected and included in the present study. This considered indicators reflective of traditional knowledge of ecosystem management, which was mostly derived from interaction during the interviews (Appendix II).

3.6.2 Extent to which local plans integrate ecological principles and traditional knowledge

The present study involved use of Meta-analysis method as used by Godschalk (2009) and Brody (2003). The process involved transformation of codes used into statistics of interest (computation of sums and standardization of the scores). Three trained coders working independent of each other evaluated and scored the selected plans according to the developed coding protocol. An "inter-coder reliability score" was computed equal to the number of coder agreements for indicators, divided by the total number of indicators. Each indicator was measured on a 0-2 ordinal scale where 0 represented indicators not identified or not mentioned in the plan, and 1 represented indicator suggested or identified but not detailed and 2 represented indicators whose full details had been stated in the plan (Brody, 2003a). In order to enable further analysis of the findings, the plan scores were standardized. Standardized scores are better comparable across plan quality characteristics (Brody, 2003; Godschalk 2009; Jiren, 2013). The plan coding and analysis procedure involved two steps as shown in the flow chart below.

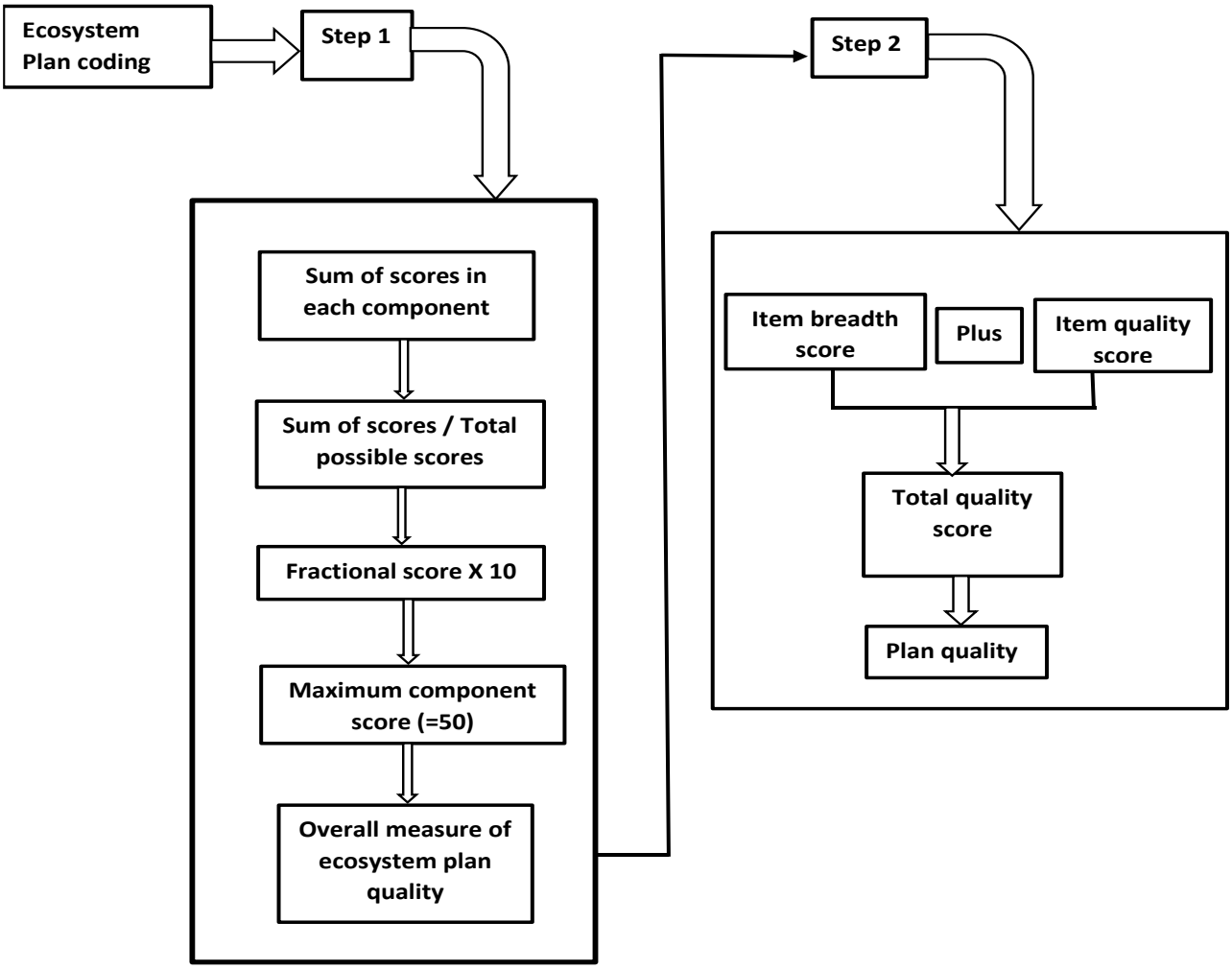

Figure 2.3: Flow chart for Plan quality assessment

3.6.2.1: Step1: Standardization of component-wise scores based upon Brody's 2003 method

From Figure 3.3, activities in step 1 were meant to obtain the overall measure of ecosystem plan quality by standardizing all the scores of the plan components (Berke et al., 1996, 1998) following three steps. First, the actual scores for each indicator were summed within each plan component. Secondly, the sum of the actual scores was divided by the total possible scores of each plan component. Thirdly, the fractional score was multiplied by 10 to standardize results for better interpretation and reduce the chance of error especially with small values.

This placed each plan component on a scale of (0-10) and a total maximum plan quality score of 50 by summing the scores of each component, i.e. (Factual Basis, Goals and Objectives, Inter-

Organizational Coordination & Capabilities for Ecosystem Management, Policies, Tools, & Strategies and Implementation) (Berke et al., 1996, 1998; Godschalk et al., 1999; Brody 2003).

3.6.2.2 Step 2: Derivation of plan quality score based upon item breadth and quality

To provide a deeper analysis aimed at providing greater detail, ability of local plans to integrate the principles of ecological management and traditional knowledge systems in Uganda. This involved item breadth which measured the percentage of the sample that included an item in the plan coding protocol. Item quality analysis, if the item was not only included in the plan but its level of detail, or strength of a particular indicator. The total item score combined the previous 2 measures to provide insight into the overall quality of an item. The significance of an item that is not often included in the plan but done so with high quality can thus be determined. This used additional measures based on several technics by Godschalk et al. (1999). These unpacked further the results from evaluating plans against planning protocol looking at each issue-based indicator in the protocol following three aspects, i.e. their presence, quality and a total quality issue score.

a) Item breadth was got by dividing the actual number of plans that addressed the issue by total plan in the sample with a scale of (0-1).
b) Item quality score was got by; dividing total score of all plans that addressed the item by total number of plans that addressed the issue with a scale of (0-2). This scale was later converted to (0-1) which was got by dividing the value after calculation by 2 which is the maximum limit and multiplying it by 1 which is the maximum limit for the new scale.
c) Total item score which was got by adding the total breadth plus item quality with scale of (0-2).

3.6.3 Variations in the integration of ecological principles in land resources management plans over space, ecosystem and time

The total plan quality scores arising from 3.6.2 above were used to analyze the variations in the integration of ecological principles in land resources management plans over space, ecosystem and time. A matrix was developed showing the year the plans were developed with their corresponding scores. Further, plans were categorized basing on the ecosystems that is; wetlands,

forests and catchments, with their corresponding scores. Also, a matrix showing plans based on regions, that is; central, eastern, western and northern with their corresponding scores was also computed. To analyze these three scenarios, a one-way Analysis of Variance (ANOVA) was computed from the total plan quality scores. The ANOVA model was considered appropriate because the three scenarios above which were the independent factors were categorical verses the continuous dependent variable, which was the total plan quality scores (Sture, 2016; Eleisa, 2009; Shaw, Mitchell-olds, & Sep 2007). To cater for the unbalanced sample sizes within the groups of the three scenarios, type III sums of squares was used at 95% confidence interval. The one-way ANOVA model is given by Equation (1) below.

$y_{ij} = \mu_i + \varepsilon_{ij}$, where $j = 1, \ldots, n_i$ and $i = 1, 2, 3$ (1)

y_{ij} is the j^{th} plan quality scores of the i^{th} level, $E(y_{ij}) = \mu_i$, $\varepsilon_{ij}'s$ are the random error term which are assumed to be independent and normally distributed that's $\varepsilon_{ij} \sim N(0, \sigma^2)$.

The estimated mean plan quality scores of each category was used in the comparison to represent the i^{th} categories defined based on regions where the plans were developed, ecosystem type and time when the plan was developed in the interval of 5 years from 2001-2016. On the basis of this model, two hypotheses were tested namely;

1- Land resources management plans in Uganda do not integrate ecological principles and traditional knowledge.
2- There is no significant variation in the integration of ecological principles and traditional knowledge over space, ecosystem and time in land resources management plans in Uganda.

3.7 Limitations of the study

Accessibility to locally mediated ecosystem management plans proved to be a very hard task given the fact that those archived with NEMA were mainly those mediated at a national level and therefore not fitting to the study requirements and interest. However, links with various districts were established from where the plans used in this study were obtained.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION

4.1 Introduction

This chapter consists of the presentation of the results and their corresponding discussion from the development of a natural resources management plan coding protocol and the use of the tool to assess the extent to which natural resources management plans developed at the local level in Uganda integrate ecological principles and traditional knowledge as well as the ecosystem, spatial and temporal variations therein.

4.2 Developing a localized coding protocol for land resources management plans for Uganda

The inputs that guided the process leading to the development of a plan coding protocol for usage in Uganda are shown in the table in Appendix III. The process involved a review of early works, and first considered the indicators that were exclusively used by Brody (2003; 2004) and have not changed, for their meaning in the western world also applies here, those modified by others (e.g. Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; Berke et al., 2012), but based upon Brody's (2003) original thinking, and those that are new and were introduced by others (Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; Berke et al., 2012) and were not in Brody's (2003) work. This information was tested against local knowledge to generate new indicators, here referred to as indicators introduced by this study.

The table in Appendix III indicates the indicators and components for the development of a coding protocol based on that developed by Brody (2003) which is taken as a blue print and as such; the 5 components used by Brody were also taken in the present study. However, some indicators were maintained, others were modified, and new ones introduced, to fit the present study. Factual basis component has 32 indicators while Brody's has 34. Goals and objectives have 12 indicators while Brody had 14. Inter-organization coordination and capabilities for ecosystem management has 15 indicators while Brody had 13. Policy, tools and strategies has 22 indicators while Brody had 31 and implementation as the last component has 8 indicators just

like what Brody had. The outcome of the assessment above gave rise to the coding protocol shown in Appendix IV**.** These findings are discussed under the following subsections.

4.2.1 Factual basis

One of the indicators under the factual basis component is ecosystem boundaries/edges which relate to the geographical extent of the ecosystem (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Meyerson, 2012; and Berke et al., 2012) which was taken as ecological boundaries.

Ecological zones/habitat types as used by Brody (2003), Brody et al. (2004), Termorshuizen et al. (2007) and Meyerson (2012) demonstrates the environmental problems which help planners to identify solutions during the planning process. In this study, ecological zones/habitat types were represented by two indicators that is; ecological habitat and ecological functions.

Brody (2003) and other researchers didn't consider the fact that ecosystem functions are different from services and benefits. According to Fisher et al. (2011) there is need to differentiate functions from services and benefits when evaluating ecosystems management plans. Ecosystem benefits have a direct effect on human welfare. These benefits are related however; they are different from the services that provide them. For example, wetlands provide benefits or values that arise from many ecological functions associated with wetlands (wetland academy web; http/www.epa.gov/watertrain). In this study, benefits and functions were treated as separate indicators to cater for the unique traditional benefits and services that ecosystems offer.

Species ranges/diversity was another indicator under factual basis which was considered by Brody (2003), Brody et al. (2004), and Termorshuizen et al. (2007). According to this indicator, planners should identify areas of high diversity including species ranges/diversity in order to protect these resources (Brody, 2003). In this study, the above-mentioned indicators have been separated into two that is, species range which relates to species extent in terms of behavior and species diversity which considers the species complexity in terms of composition of plant species, genetic and ecosystem diversity.

Habitat corridors in the work by Brody (2003), Brody et al. (2004) and Termorshuizen et al. (2007) are areas of unique properties that provide special transit zones for species migration. In this study, habitant corridors are taken as corridors. For the indicators; vertebrate species, soils classified, vegetation classified, wildlife classified, climate described, ground water resources, surface hydrology (Brody, 2003; Brody et al., 2004; Termorshuizen et al. (2007) and Meyerson (2012) and graphic representation of trans-boundary resources as used by Brody (2003), Brody et al. (2004), Termorshuizen et al. (2007) and Tang et al. (2008) was co-opted in the current study. Invasive/exotic species as used by Brody (2003) was taken as invasive and alien plant species; landscape features (mountains, hills, rock out crops, etc.) in the place of other prominent landscapes, whereas threatened/endangered species identified by (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Berke et al., 2012) was considered in its native form and common resource management as a new indicator.

The above indicators make the foundation for the factual basis of critical natural resources which should draw attention from the planners in land resources management. The indicators; vegetation cover mapped, marine resources and other water resources, used by Brody 2003 were left out in this study. Secondly, key ownership indicators considered for plan quality analysis included; management status identified for conservation lands (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Meyerson, 2012) and identification of new lands for conservation were modified in this study in this study. Thirdly, human impact deals with ecosystem concerns that restrict human development in the work by (Brody, 2003/4). This gave rise to population and economy which was classified as present and future population and present and future economy. Termorshuizen et al. (2007) and Meyerson (2012) identified existing capacity and future demand for public infrastructure which was taken as public infrastructure. Nutrient loading, water pollution, fragmentation of habitat and existing environmental regulations described in the work by Brody (2003) was considered as is. Alteration of water ways changed to water abstraction and diversion in line with ground water and surface hydrology. Wetlands developed in the work by Brody (2003) and Termorshuizen et al. (2007) was also considered in this study. Existing land use and land supply, and future land demands for various uses (e.g. housing, commercial, industrial, public facilities) in work by Termorshuizen et al. (2007), Tang et al. (2008) and Meyerson (2012) was used in the current study.

4.2.2 Goals and Objectives

The component of goals and objectives was guided by the indicators; protect integrity of ecosystem in the work by (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007, Tang et al., 2008; Meyerson, 2012; Berke et al., 2012), which in the study was taken as; protect ecosystems integrity. Protect natural processes/functions (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008; Berke et al., 2012) was modified as, protect high biodiversity, represent native species within protected areas (Brody, 2003; Brody et al., 2004), maintain intact patches of native species (Brody, 2003; Brody et al., 2004; Meyerson, 2012), establish priorities for native species/habitat protection (Brody 2003, Brody et al., 2004, and Tang et al., 2008), protect rare/endangered species (Brody, 2003; Brody et al., 2004, protect rare/endangered landscape elements (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007), balance human use with maintenance of viable wildlife population (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007; Tang et al., 2008;) was taken as is in the study, restore ecosystem critical habitat in the work by Brody (2003), Brody et al. (2004), Tang et al. (2008) Meyerson (2012) and Berke et al. (2012) modified to restoration of degraded areas; maintain intergenerational sustainability of ecosystems (Brody, 2003, Brody et al., 2004, Termorshuizen et al., 2007) and lastly presence of measurable objectives (Brody, 2003; Brody et al., 2004), was modified to "SMART" objectives that is; specific, measurable, reliable, and time-bound objectives.

4.2.3 Inter-organizational Coordination and Capabilities

This component identifies the need for coordination with other authorities' land owners and organizations to generate an effective land use plan. The study considered district transboundary resources in Uganda. Indicators that addressed critical factors fostering collaboration included; vertical and horizontal collaboration modified from indicators; coordination within jurisdiction to protect ecosystems and other organizational/stakeholders identified. Coordination to protect transboundary resources in the work by (Brody, 2003; Brody et al., 2004; Tang et al., 2008) was modified to transboundary consideration. Mechanisms to protect communal resources was incorporated as a new indicator. The Inter-government bodies specified in work by Brody (2003), Brody et al. (2004), Tang et al. (2008) and Meyerson (2012) was covered under

indicators; identify key stakeholders, map/define their responsibilities and initiate mechanisms for collaboration if no working relationships exist. Information sharing changed to; generate and share information, and integration with other environmental plans/policies was modified to; response to local and international policies in the work by (Brody, 2003; Brody et al., 2004; Tang et al., 2008; Meyerson, 2012); bearing in mind the fact that a good plan should respond to policies from international to local policies integrate strategies with bigger plans. Brody (2003) identified commitments of financial resources which was separated into; source of financial resources and commitment of financial resources in the work by (Tang et al., 2008; Meyerson 2012; Berke et al., 2012). Identified state review of local plans; an indicator considered by Meyerson (2012) and Berke et al. (2012) was modified to; plan approval and provision for review by the district. State provision of support for local governments an indicator in the work by (Meyerson, 2012 Berke et al., 2012) was modified to; identify sources of technical expertise locally (at the district) to design and implement plans whereas conflict management process outlined, and participation in ecosystem based initiative indicators and other forms of coordination in the work by (Brody et al., 2004; Tang et al., 2008; Meyerson, 2012) was considered in the study.

4.2.4 Policies, Tools, and Strategies

This component actualizes the goals and objectives by defining actions to protect ecosystems. (Brody et al., 2004; Tang et al., 2008; Meyerson, 2012). Most of the policies, tools and strategies identified by Brody were modified to cater for unique circumstances in the Ugandan setting categorized into 4 major branches.

Restrictions on native vegetation removal which was modified to, protection of indigenous vegetation, exotic species controls changed to control against exotic plant and animal species in the work by (Brody, 2003; Brody et al., 2004; Termorshuizen et al., 2007); phasing of developments to protect habitat, control on contraction to protect habitat in the work by (Brody, 2003; Brody et al., 2004; Tang et al., 2008) was taken as is; buffer requirements in the work by (Brody, 2003; Brody et al., 2004; Tang et al., 2008) modified to environmental buffers; specific mitigation measure to protect habitats by Brody (2004) and Tang et al. (2008) was considered as was. The new indicators incorporated under this component include; seasons for exclusion of use

of resources, mechanisms to allow competing uses of land, provision for traditional practices, (e.g. bush fallowing, rotational grazing for resource regeneration) ecosystem zones preserved for cultural heritage, Traditional restrictive naming of ecosystem zones and species, identified species for traditional use (e.g. selective collection of firewood). Brody (2003) talked about other regulatory tools which was considered as other formal regulatory tools e.g. bylaws and other informal regulatory tools e.g. taboos.

The sub-component; incentive-based tools, dealt with approaches to encourage land owners to protect the degraded natural resources in their communities as opposed to their misuse (Brody, 2003). Indicators included; tax incentives and refundable performance deposit bonds which were considered in line with the National Environmental Act (1995).

In the land acquisition programs, component shows the capacity to fund the purchase of critical habitats and sensitive lands by the respective jurisdictions (Brody, 2003). These were also streamlined in the Uganda National Environmental Act chapter 153 part (ix). In the study, environmental easement modified from conservation easement (Brody, 2003). Environmental restoration order was taken up as a new indicator from Uganda National Environmental Act. Other land acquisition techniques were co-opted from Brody (2003).

Other policies dealt with items that don't easily fall into land-use or environmental tools but are important in implementing the principles of ecosystem management like Education programs that focus on protection of the environment and ways to effect resource use behavior especially at the local level where the resource users are in direct contact with the environment. Indicator; Promotion of awareness/Knowledge/Education was modified to promotion of formal public education, for example through environmental training , Barazas and community meetings where the public is involved with all the administrators, politicians and technical staff to inform the people the state of their environment and informal public education that is promotion of environmental awareness through sensitization on radios, television, newspapers and posters in the work by (Tang et al., 2008; Meyerson, 2012; Berke et al., 2012), control of public investments and projects (Brody, 2003; Brody, 2004; Berke et al., 2012). Monitoring of ecological health and human impacts an indicator by Brody (2003) was considered under implementation.

4.2.5 Implementation

Implementation indicates commitment to carry out policy driven action and show how a plan can, after adoption become an enduring instrument (Brody, 2003; Brody, 2004; Berke et al., 2012). It conceptualizes a commitment to implementing a final plan in future and not how well the plan is implemented after adoption. The study considered indicators; developed work plan modified from clear time tables in the work by (Brody, 2003; Brody et al., 2004, Tang et al., 2008; Berke et al., 2012) identifying all stakeholders involved in implementation and designating their responsibilities in the work by (Brody, 2003; Brody et al., 2004; Tang et al., 2008; and Berke et al., 2012) was taken as is, monitoring plan effectiveness and responding to new information that can be adopted by the community in response to stated goals and objectives, identifying sources of technical assistance in the work by (Meyerson, 2012; Berke et al., 2012) locally from the district for designing and implementing plans. Describe enforcement specified in the work by (Brody. 2003, Brody et al., 2004) which modified to mechanism for enforcement by (Meyerson, 2012); determine fines against misuse and encroachment in the work by Brody et al. (2004) and Tang et al. (2008) was modified to impact fees to protect habitants and Tax disincentives to deter bad environmental behavior as a new indicator as in the Uganda National Environmental Act.

4.3 The extent to which land resources management plans in Uganda integrate principles of ecosystem management

To achieve the second objective and answer question one and two of the study, the developed plan coding protocol (**Appendix IV**) was used. The results in line with this objective are presented in tables 4.1, 4.2, 4.3, 4.5, 4.6, 4.7, 4.8, 4.9, 4.9 and Appendices; VI & VII and their analyses given accordingly under the following sub-sections.

4.3.1 Overall plan quality

The first phase involved analysis of overall plan quality in terms of integration of ecological principles on the basis of whether a given indicator had been included and detailed explanations given in the plan(s) or not using the plan scoring sheets shown in Appendix V. The results from this analysis are shown in the table in Appendix VI. From the table, the highest quality plan scored 32 (on the scale of 0-50) and with average components' score of 6.4 (on the scale of 0-10)

i.e. Nyabajjuzi community wetland management plan 2004-2008 which was followed by Ziba community-based wetland management plan in Wakiso (2004-2006) with overall quality score of 31 and average components score of 6.2. Meanwhile Katum Forest Management plan had the lowest quality score (i.e. 14 and with average components' score of 2.8). These findings reveal that whereas some plans performed fairly above average, no plan had a score above 32 which on the scale of 1-50, indicated poor plan quality. Out of the 27 plans, 13 had scores below 25 (average) whereas 14 plans had scores above average. This means that, to a large extent, analyzed land resources management plans integrated ecological principles all thought in general the quality of these plans is low. In addition, forest and catchment management plans on average performed poorly as compared to wetland management plans. This could imply that, either wetlands are widespread and widely used that attracts more management interventions or that they are at the verge of degradation at a rate higher than that of other ecosystems such that much more attention is given towards them. Besides, the findings could also signify that knowledge about management of wetlands is abundantly available as a result of earlier realization of threats to these valuable ecosystems. Narrowing down to specific plan components' performance, the results also revealed different, but generally relatively low mean component scores as shown in Table 4.1.

Table 4.1: Descriptive statistics for Plan Components' Quality Scores

Component	Mean	Standard Deviation
Factual Basis	5.63	0.93
Goals & Objectives	3.96	1.58
Inter-Organizational Coordination	5.52	1.37
Tool, Policies, Strategies	3.19	1.21
Implementation	5.67	1.94
Total Ecosystem Plan Quality	**23.97**	**7.03**

Table 4.1 indicates that three components; implementation, factual basis and inter-organizational coordination had the highest mean scores (above 5) on the scale of 0-10 whereas two components; goals & objectives and tools, policies and strategies had low mean scores (below 4 on the scale of 0-10). These results signify that whereas some effort is realized in taking stock of the existing ecosystem and coordinating stake holders to implement plans at the local level, the objectives for management of these ecosystems are not streamlined to capture key aspects and

that plans are bound to fail during implementation given the fact that the tools, policies and strategies for implementation are not provided for. The mean score for total ecosystem quality for all the plans was 23.97 which, on the scale of 0-50 indicates a relatively weak effort to incorporate ecological principles and traditional knowledge systems of resources management at the local level across all ecosystems in different parts of the country. These findings therefore suggest the rejection of the first null hypothesis that land resource management plans in Uganda do not integrate ecological principles and traditional knowledge.

4.3.2 Plan component and item scores

Results from the second phase of plan analysis provided a more detailed explanation on plan quality which is not shown by results on the extent to which local management plans integrate ecological principles and traditional knowledge systems. The analysis was done according to specific indicators under each component. Three aspects were evaluated on each of the indicators, that is, issue breadth, issue quality and total issue quality. Item breadth evaluated whether a plan addressed an indicator of ecological principles or not (measured on scale 0-1), issue quality evaluated not only mere address of an item, but the quality of the item(s) and total issue quality was measured on a 0-2 scale, as seen in the following subsections.

4.3.2.1 Factual basis

Under this component, 32 plan quality indicators were evaluated, and the results are shown in Table 4.2. The table reveals that plans considered only three items wholly; ecological habitant, ecological services and ecological benefit which had not only been identified but also whose details description had been given. Most plans did not wholly address indicators; nutrient loading (which had the lowest item breadth scores 0.04), habitant corridors, water abstraction and diversion, Invasive and Alien plant species, Groundwater resources, identification of new lands for conservation and present and future population. The results signify a small extent of application of ecological elements under factual basis plan component.

Table 4.2: Issue-Based Scores for Factual Basis Plan Component

Indicators	Issue Breadth	Issue Quality	Total Issue Quality
Ecosystem Boundaries	0.96	0.96	1.92
Ecological habitats	1.00	0.77	1.77
Ecological functions	0.96	0.70	1.66
Ecological service	1.00	0.66	1.66
Ecological benefit	1.00	0.79	1.79
Species ranges (Behavioral extent)	0.67	0.60	1.26
Corridors	0.37	0.78	1.15
Vertebrate species	0.85	0.75	1.60
Diversity (Species /genetic/ecosystem)	0.96	0.88	1.85
Vegetation classified	0.93	0.76	1.69
Wildlife classified	0.70	0.74	1.44
Soil quality assessment	0.78	0.83	1.61
Threatened and endangered species	0.70	0.68	1.39
Invasive and Alien plant species	0.48	0.54	1.02
Climate	0.78	0.93	1.71
Representation of trans boundary resources	0.93	0.89	1.82
Common resource management	0.74	0.74	1.48
Eco systems mapped (including buffers)	0.74	0.73	1.47
Groundwater resources	0.26	0.50	0.76
Surface hydrology	0.93	0.75	1.68
Landscape features (Mtns, Hills, Rock outcrops etc.)	0.89	0.86	1.75
Management status for conservation lands identified	0.85	0.87	1.72
Identification of new lands for conservation	0.33	0.56	0.89
Present and future population	0.48	0.65	1.14
Present and future economy	0.89	0.75	1.64
Planning for public infrastructure	0.56	0.70	1.26
Nutrient Loading	0.04	0.50	0.54
Water abstraction and diversion	0.44	0.60	1.05
Fragmentation of habitat	0.74	0.74	1.48
Water Pollution	0.67	0.75	1.42
Existing land use and land supply, and future land demands for various uses(e.g., housing, commercial, industrial, public facilities)	0.96	0.83	1.79
Existing environmental regulations described.	0.63	0.81	1.44

The results in Table 4.2 signify that ecosystem management plans in Uganda mostly address issues related to the physical/visible elements of the ecosystems but pay little or no attention to the functional elements like habitant corridors, ground water, and identification of potential lands for conservation. This can however be accounted for by the extreme technicalities involved in ecosystem explorations; owing to the fact that ecological knowledge at local community level in Uganda is not wholly developed. The Ecosystems stakeholders at the community level therefore can identify key elements to be addressed in the plan but fail to give a detailed description of such indicators because they have no further knowledge about them, as reflected in the items scores.

4.3.2.2 Goals and Objectives

Under the goals and objectives component, the quality of 12 indicators were evaluated and the results are shown in Table 4.3

Table 4:3 Issue-Based Scores for Goals and Objectives Plan Component

Indicator	Issue Breadth	Issue Quality	Total Issue Quality
Protect ecosystem integrity	0.67	0.61	1.28
Protect natural processes/functions	0.70	0.71	1.41
Protect high biodiversity	0.78	0.62	1.40
Maintain intact patches of native species	0.33	0.56	0.89
Establish priorities for native species/habitat protection	0.52	0.59	1.11
Protect rare/endangered landscape elements	0.37	0.50	0.87
Represent native species within protected areas	0.41	0.52	0.93
Maintain intergenerational sustainability of ecosystems	0.52	0.59	1.11
Balance human use with maintenance of viable wildlife population	0.78	0.74	1.52
Protect ecosystems integrity	0.74	0.64	1.38
Restoration of degraded areas	0.70	0.66	1.36
Presence of measurable objectives (SMART objectives)	1.00	0.75	1.75

Table 4.3 shows that, indicators under goals and objectives faired above average in terms of consideration in the planning process for management of ecosystems in Uganda. However, indicators including, maintenance of intact patches of native species of plants and animals and representation of native species within protected areas scored far below average in terms of quality scores (i.e. 0.3 & 0.41). Generally, indicators under goals and objectives scored slightly above average. This implies these ecological principles were largely integrated in planning. These imply that planning to a larger extent considered integrating ecological principles under goals and objectives plan component.

The results in Table 4.3 imply that local ecosystem management plans initiated at the local level in Uganda are not well intended to promote ecological principles as indicated by the low-quality scores of specific indicators. The slightly above average scores for issue breadth of the specific indicators signify that the planners try to address key goals and objectives but the details on these are not given. Ecological management indicators like maintaining intact patches of native species had the lowest quality scores which means in most of the plans, native species of plants and animals are not sought to be protected even during the planning process which can provide some explanation as to why some species are undergoing extinction as reported elsewhere. Presence of measurable objectives had the highest item breadth scores, however, having measurable objectives may not necessary imply having well intended objectives to protect ecosystems.

4.3.2.3 Inter-organizational coordination and capabilities

The Inter-Organization Coordination and capabilities Component had 14 indicators against which plan quality was assessed and the findings are displayed in Table 4.4 below.

Table 4.4: Issue-Based Scores for Inter-organizational coordination and capabilities for ecosystem management

Indicator	Issue Breadth	Issue Quality	Total Issue Quality
Other organization/stakeholders identified	0.93	0.81	1.74
Vertical and Horizontal collaboration	0.93	0.78	1.71
Mechanism to protect communal resources	0.56	0.70	1.26
Plan approval by District and provision for review	0.44	0.79	1.24
Identify all key stakeholders	0.93	0.85	1.78
Define key stakeholders' responsibilities	0.89	0.89	1.77
Initiated mechanisms for collaboration if not existent	0.56	0.52	1.07
Generate and share information	0.70	0.66	1.36
Conflict management process outlined	0.56	0.77	1.32
Participation in ecosystem-based initiatives	0.78	0.63	1.41
Sources of financial resources	0.93	0.73	1.66
Commitment of financial resources	0.74	0.96	1.70
Response to local and international policies	0.67	0.64	1.31
Identified local sources of technical expertise to design and implement plans	0.63	0.66	1.29

Table 4.4 reveals that indicators of ecological principles of ecosystem management under inter-organizational coordination and capabilities had issue breadth scores above 0.4 but below 0.94, issue quality scores above 0.5 but less than 1 on a scale of 0-1. Plan approval by District and provision for review registered the lowest scores followed by mechanisms to protect communal resources and mechanisms for collaboration. The average quality score for this component was 5.52 making it the third best in overall component score.

The results shown in Table 4.4 imply that local communities try to address issues related with combining efforts and resources to manage ecosystems. Coordination by stakeholders is meant to solicit for resources to implement resource management plan which could give explanations as to why the component registered above average scores. However, a big percentage of the plans having no consideration for collaboration and protection of communal resources means that, in places where ecosystems are managed as common resources, they are likely to be protected from over use and misuse. Inter-organization coordination and capabilities component provides a window through which stakeholders can be mobilized to provide the necessary resources needed to manage ecosystems which means that it doesn’t only have to be addressed in the plans but

also detailed descriptions need to be given on how the plan implementers will go about it to ensure that the plans are implemented successfully. Having issue breadth scores less than zero for most of the indicators thus implies that there is a lot that is still lacking in terms of provision for inter-organizational coordination and capabilities. Nakiyemba et al. (2013) points out inadequate institutional capacity, knowledge gaps of existing legal frameworks and lack of cooperation and coordination as some of the challenges faced by decentralized management of wetland resources in Uganda.

4.3.2.4 Policies, Tools, and strategies

This component had 22 indicators of ecological management against which plan quality was evaluated and the results are shown in Table 4.5. From this table, out of the 22 indicators under policies tools and strategies component, 12 had issue breadth scores above average (>0.5) on the scale of 0-1 while 10 indicators had scores below 0.5. Two indicators, that is, restrictive naming of ecosystem zones and species and environmental easement scored 0. This component also had the lowest mean score (3.19) on the scale of 0-10 as compared to the rest of the components.

Table 4.5: Issue-Based Scores for the Policies, Tools, and Strategies Component

Indicator	Issue Breadth	Issue Quality	Total Issue Quality
Protection of indigenous vegetation	0.52	0.61	1.13
Control against Exotic plant and animal species	0.30	0.72	1.02
Environmental buffers	0.59	0.70	1.30
Phasing of development to protect habitat	0.37	0.63	1.00
Controls on construction to protect habitat	0.37	0.63	1.00
Seasons for exclusion of use of resources	0.52	0.71	1.23
Mechanisms to allow competing uses of land	0.63	0.62	1.25
Specific mitigation measures to protect habitants	0.70	0.74	1.44
Provision for traditional practices (e.g. Bush fallowing/rotational grazing to allow resource regeneration)	0.67	0.60	1.26
Ecosystem zones preserved for cultural heritage	0.81	0.67	1.49
Traditional restrictive naming of ecosystem zones and species	0.00	0.00	0.00
Identified species for traditional use, e.g., selective firewood collection	0.89	0.66	1.55
Other formal regulatory tools e.g. bylaws	0.74	0.71	1.45
Other informal regulatory tools e.g. taboos	0.30	0.53	0.83
Other incentive-based tools	0.52	0.71	1.23
Environmental deposit bonds	0.11	0.58	0.69
Environmental easements	0.00	0.00	0.00
Environmental restoration order	0.11	0.50	0.61
Other land acquisition techniques	0.30	0.66	0.95
Control of public investments and projects	0.44	0.54	0.99
Promotion of formal public education e.g. Barazas, trainings	0.85	0.71	1.56
Promotion of informal public education e.g. awareness sensitization on Radios and televisions, newspapers, posters.	0.85	0.64	1.49

It was established in this study that whereas ecosystems management relies on policies, tools and strategies to ensure their sustainability, plans drawn at community level in Uganda do not put in to consideration this fact. This contradicts with the findings by Opio (2008) who reported that Uganda's policy and legal framework was adequate to ensure sustainable use and management of wetlands in the country. However, same study recommended for more regulations to make the laws more effective, which signals an agreement with the current study that the policies, tools, and strategies for managing ecosystems are not wholly addressed by the local planners.

Nakiyemba et al. (2013) while studying the decentralized wetland resource management in the Lake Victoria basin, discovered that policy had not fully realized its intended outcomes which means that land resource planners have not developed fully capacity to manage natural resources as shown by the findings in the current study too.

4.3.2.5 Implementation

Implementation plan component had eight indicators of ecological management which were assessed, and the findings are presented in the Table 4.6.

Table 4.6: Issue-Based Scores for Implementation Component

Indicator	Issue Breadth	Issue Quality	Total Issue Quality
Identify stakeholders to do implementation	0.89	0.78	1.67
Designation of responsibility	0.85	0.90	1.75
Provision of technical assistance	0.89	0.74	1.63
Developed Work plan	0.81	0.84	1.66
Regular plan update and assessments	0.56	0.83	1.39
Mechanism for enforcement	0.67	0.72	1.39
Monitoring plans	0.85	0.78	1.63
Fines against encroachers and misuse	0.15	0.75	0.90

From table 4.6 above it can be noted that 7 out of 8 indicators under the implementation component scored above average in terms of issue breadth, issue quality and total issue quality. The lowest score was registered by the indicator; fines against misuse and encroachers (0.15) followed by regular plan update and assessments. These results mean that most planners at the community level are quite aware that plans have to show how they are going to be implemented to meet the intended goals and objectives. Identifying stake holders, providing technical assistance and designating responsibilities for those to be involved in plan implementation were shown by the results in Table 4.6 as being taken seriously by local ecosystem planners in Uganda as indicated by scores close to 1.

Further discussions from Table 4.1 indicated implementation component mean scores to be above average (5.67) the highest quality component as compared to the other four components.

However, paying little attention to measures against encroachers and miss users of ecosystem and having no provision for plan updates and assessment down, plays other important considerations for plan implementation. It means the encroachers are not effectively hesitated from destroying vital ecosystems and that since they go un-punished, the number is likely to increase thus jeopardizing other efforts to protect the system(s). More to that, it becomes difficult to evaluate the performance of a given plan where plan assessment and updates are not provided for in the planning process and therefore the principle of sustainability of an ecosystem is ignored. Ideal plans need to provide for regular updates and review to improve on weak areas.

From the above discussion, having realized overall plans quality score of 23.97 (which was below average on the scale 0-50) and below average item breadth scores for 60% of ecological principles' indicators, part of the first null hypothesis is rejected in favor of the alternative hypothesis that local resources management plans in Uganda integrate ecological principles. However, the integration is to a small extent.

The study also established that wetland ecosystem management plans had fairly good plan component scores as compared to forest and catchment ecosystem. The components with best item scores included factual basis and implementation whereas components; goals and objectives and tools and strategies had the lowest scores. Tang et al. (2008) stated that plan implementation translates policies, tools and strategies into tasks and assigns them to each party involved. Implementation as a component should establish ways of meeting the goals and objectives of a plan and how well to improve the performance of policy, tools and strategies. Generally, this study established that the quality of ecosystems management plans developed at the local level in Uganda is very low and far below average on the scale of 1- 50. This is related to the findings by Brody (2003) when he evaluated the ability of local jurisdictions to plan for the management of ecosystems in Florida-USA.

4.4 The extent to which local land resources management plans in Uganda integrate traditional knowledge systems

The mean plan scores and issue-based scores for traditional knowledge indicators incorporated into the five plan components were extracted for further analysis in line with the third study

objective. As observed in Appendix VII, plan scores were computed without traditional knowledge indicators to examine the contribution of traditional knowledge towards overall plan quality. The results revealed that overall average plan quality score with traditional knowledge indicators was 23.96 and 22.89 without traditional knowledge indicators, on a scale of 0-50 giving a difference of 1.07. This represents 4.7% contribution towards overall average plan quality scores which is a relatively small contribution. However, the issue-based scores were generally above average (Table 4.7).

Table 4.7: Issue-Based Scores for traditional knowledge systems

Indicator	Issue Breadth	Issue Quality	Total Issue Quality
Provision for traditional practices	0.67	0.60	1.26
Ecosystem zones preserved for cultural heritage	0.81	0.67	1.49
Traditional restrictive naming of ecosystem zones and species	0.00	0.00	0.00
Identified species for traditional use	0.89	0.66	1.55
Other informal regulatory tools e.g. taboos	0.30	0.53	0.83
Common resource management	0.74	0.74	1.48

Table 4.7 reveals that five out the six indicators of traditional knowledge systems had above 0 on the scale of 0-1 meaning they were at least addressed in the land resources management plans reviewed in this study. Indicators; common resource management and identified species of plants and fauna for traditional uses had high issues breadth (0.89), issue quality (0.66) (measured on a scale of 0-1) and Total issue quality (1.55) (measured on a scale of 0-2), whereas traditional restrictive naming of ecosystem zones and species had the lowest scores. Besides other informal regulatory tools like taboos had very low item scores.

The above results imply that although local resources management plans in Uganda integrate traditional knowledge, the extent is still low given the small contribution (4.7%) towards overall plan quality thus answering the second research question accordingly. However, part of the null hypothesis that local resources management plans in Uganda do not integrate ecological principles and traditional knowledge is rejected in favor of the alternative.

The results in Table 4.7 indicated that traditional knowledge is catered for in the planning for the management of ecosystems at the local level but at a level that cannot significantly protect the ecosystems from degradation. The plans having no provision for aspects like traditional restrictive naming of ecosystem zones and species means that ecosystems are not protected under local level planning and management. These findings also signify that traditional practices of natural resources management are being wiped out as communities embrace practices from elsewhere that may not be applicable to the local setting. As seen in Appendices VII, the study findings indicated that to a small extent, ecosystem management plans developed at the local level in Uganda integrate traditional knowledge. It was also observed that key traditional practices like restrictive naming of ecosystems had not been completely provided for in the planning process and yet this and others have been shown to have protected ecosystems from encroachment elsewhere. This possibly provides explanations as to why resources degradation continues under the custody of local communities. Kyasiimire (2010) in his study reports that some traditional practices contribute significantly to resource conservation whereas others contribute towards degradation. The findings in the current study mean that the current traditional practices in the areas under study are mainly those that contribute to degradation as they emphasis overuse rather than conservation. Obua, Banana & Turyahabwe (1998) state that communities develop a negative attitude towards forest management practices where there are strict rules on forest resource utilization and therefore communities need to be empowered as co-managers to benefit from forest resources in their vicinity.

4.5 Variation in integration of ecological principles and traditional knowledge across space, ecosystem and time.

The ecosystems' plan component scores where compared on the basis of ecosystem, space and time period, to establish variations that exist therein in terms of extent to which these plans integrate ecological principles and in line with the third objective of the study.

4.5.1 Variation in integration of ecological principles over space

The plan scores shown in Appendix IV were compared basing on space from where the plans were drawn to show whether there were significant differences in the integration of ecological

principles and traditional knowledge systems in resources planning at the local level using ANOVA and the results are shown in the Table 4.8.

Table 4.8: ANOVA statistics for plan scores by space

Parameter	Df	Sum Sq.	Mean Sq.	F Value	Pr (>F)
Space	3	88.44	92.481	1.6598	0.2034
Residuals	23	408.52	17.762		

Significance. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

From the ANOVA Table 4.8, it can be observed that even though there were variations in integration of ecological principles (as shown by the mean squares) in ecosystem management plans drawn at the local community level in Uganda, these variations over Uganda's space (regions) were not significant as indicated by the p-value (0.20). This means that the different spaces had relatively similar plans. The results in line with this are further shown in Figure 4.1

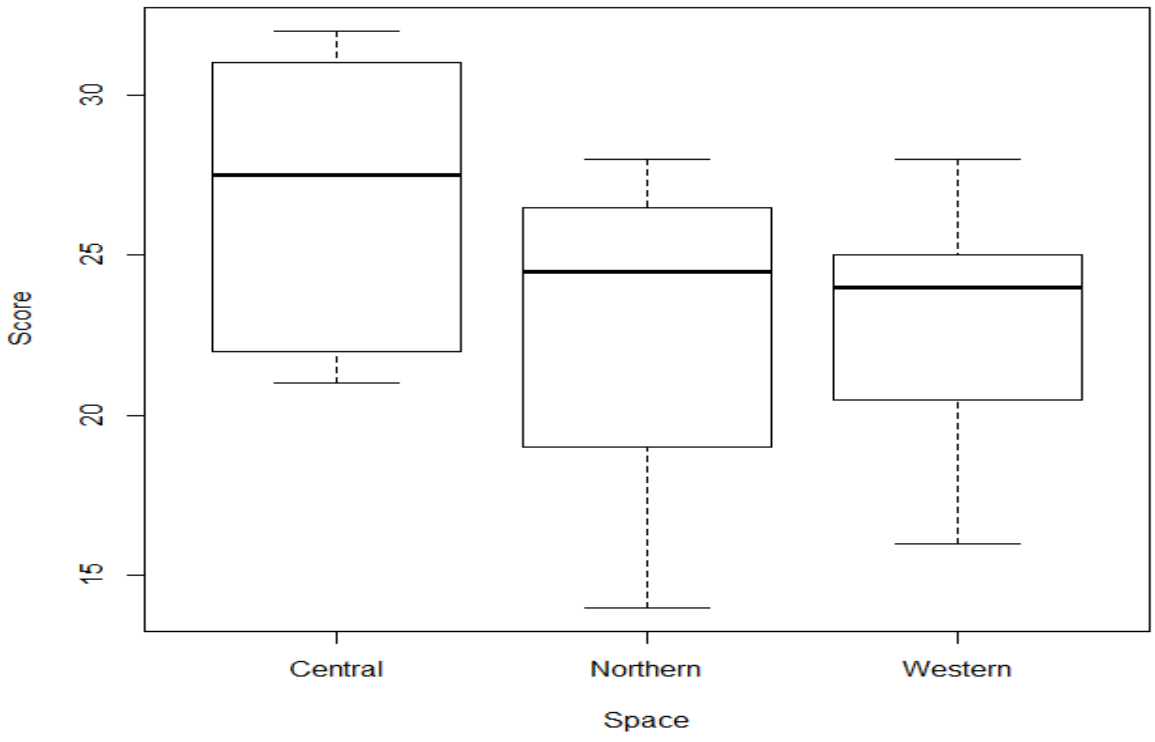

Figure 4.1: Variations in plan scors over space/region

These results imply that all regions in Uganda face similar challenges in the planning for management of ecosystems at the local community level. The findings shown in Figure 4.1 additionally drive to a conclusion that variations in plans are not different across all regions.

4.5.2 Variation in integration of ecological principles across ecosystems

To assess the variations in the integration of ecological principles and traditional knowledge across the three ecosystems, one-way ANOVA statistics of the total plan scores were computed and the results are shown in the table below.

Table 4.9: ANOVA statistics for Plan component scores by Ecosystem

Parameters	Sum Sq	Df	F-value	Pr(>F)
Ecosystem	178.14	3	3.5159	0.0153 *
Residuals	301.90	22		
Significance. codes: 0 ‘***’ 0			1 ‘**’ 0	.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’

Table 4.9, it is noted that ecosystem management plans initiated at the local community level vary significantly at 95% confidence interval, in terms of integration of ecological principles across ecosystems for the three ecosystems as shown by the p-value of 0.02. Further analysis of specific ecosystem plan scores revealed that Wetland ecosystems had higher mean scores than forest and catchment ecosystems. From boxplots in Figure 4.2, the variations are significant across all ecosystems

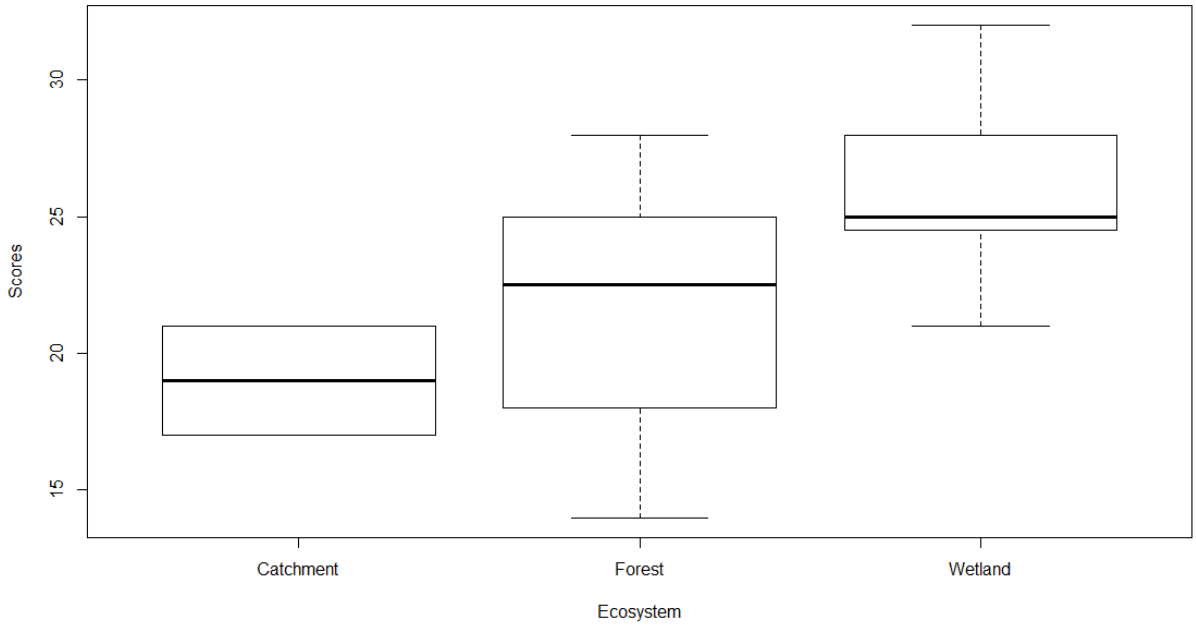

Figure 4.2: Variations in plan scors across ecosystems

4.5.3 Variation in integration of ecological principles over time

To examine variations in the integration of ecological principles and traditional knowledge in terms of time, to answer the third research question, plans were grouped into four categories according to the year (time) they were initiated (2001-2005, 2006-2010, 2011-2015 & 2016-2018) and thereafter one-way ANOVA with their scores was used, leading to the results presented in Table 4.10.

Table 4.10: Variation in integration of ecological principles over time

Parameters	Sum Sq	Df	F value	Pr(>F)
Time	105.6	2	3.2426	0.05747*
Residuals	374.5	23		
Significance codes:	0 '****'	0	001 '***'	0.01 '**' 0.05*,

With p-value of 0.057, the results in Table 4.9 indicate that there is a borderline significant difference in the integration of ecological principles and traditional knowledge over time. This means that, for the consecutive time periods; 2001-2005, 2006-2010, 2011-2015 & 2016- 2018,

the quality of land resources management plans in Uganda improved slightly. This is also shown by the exploratory analysis of results shown in the Figure 4.3 below.

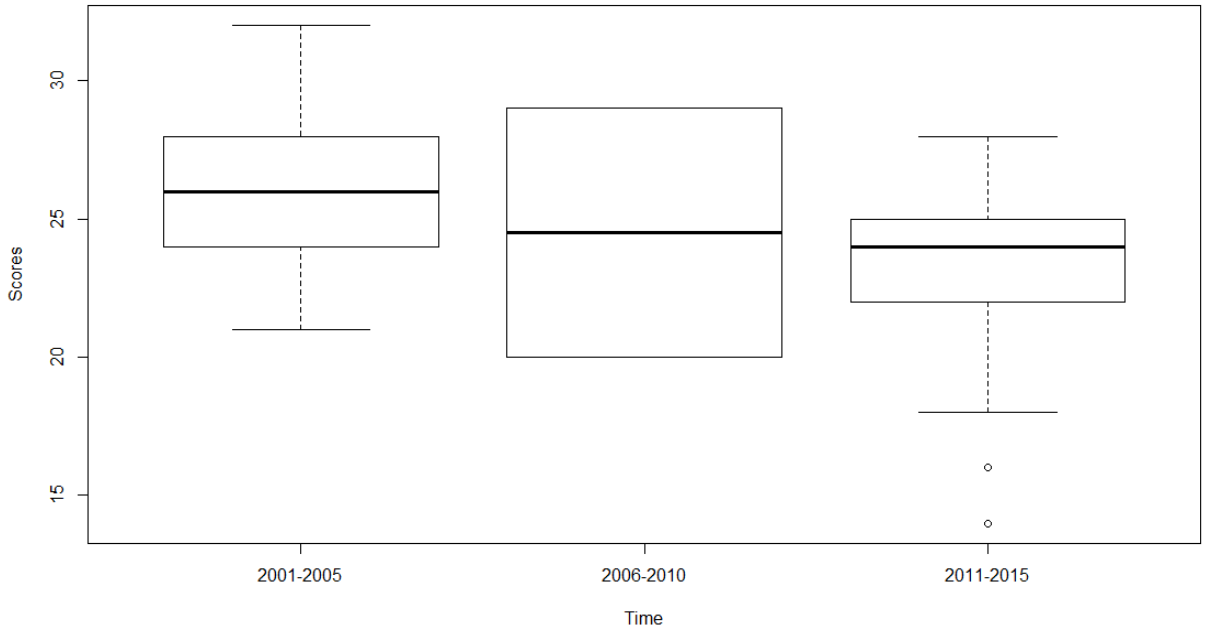

Figure 4.3: Variations in plan scores over time

These results above are in agreement with the belief that plan quality improves as planners gain more knowledge of ecosystem management over time through awareness, sensitization and technological advancement. In addition, two plans out of the 27 plans analyzed in relation to time that's, (Nyabihoko CBWMP in Ntungamo & Lake Mulehe CBWMP in Kisoro) also revealed vertical improvement in planning with ecological principles which is in-line with the ANOVA results in table 4.10. These results here are in agreement with the findings by Berke et al. (2012) whose study involved analysis and review of ecosystems management plans developed between 1995 and 2012. They attempted to ascertain, if any, improvements in planning had been registered and the study concluded that plan quality improves over time. This implies that even in Uganda, experience in planning develops and therefore consequent planning registers better results.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Natural resources are of global importance and therefore need to be carefully managed at all levels amidst natural and human disturbances. In Uganda with decentralized management, local communities are meant to govern their resources based upon the understanding that specific resource use decisions that promote their sustainability or degradation are made at community level. A study was undertaken to assess the extent of integration of ecological principles and traditional knowledge in land resources management plans.

- A management plan evaluation coding protocol putting into consideration ecological principles and traditional knowledge systems was developed by expanding beyond the parameters used by previous scholars (in the literature). That is,

  - 40 indicators were those used exclusively by Brody (2003),
  - 25 indicators were those modified by other scholars from Brody (2003),
  - 11 indicators were introduced by other scholars and,
  - 17 indicators were introduced by the current study.

- This protocol was used to assess the integration of ecological principles and traditional knowledge in land resources management plans in Uganda. The results indicated that out of the 27 plans, 2 plans scored above 30, 12 plans scored between 25-29, while 13 plans sored below 25, on the plan quality scale of 0-50. This means that majority plans were poor implying that their level of integration of ecological principles and traditional knowledge was low.
- When tested for variations, it was revealed that, there were no significant variations in the integration of ecological principles and traditional knowledge in space/regions. However, there were significant variations in terms of ecosystem and time. This implies that there has been a change in planning over time and also across ecosystems as reflected by ANOVA results in Tables 4.9 and 4.10.

5.2 Conclusions

It is possible to adopt the management plan cording protocol in this country as suggested by this study although some improvements can be made in areas to do with associations of traditional knowledge and ecological principles that is, how the two reflect one another and the best way of parameterizing them. In its current form, the planning protocol reveal weaknesses in local land resource management plans in Uganda which is wholly attributed to lack of attention to ecological principles and traditional knowledge. It can be argued that these plans are generally poor for that reason.

The first null hypothesis was rejected in favor of the alternative hypothesis that land resources management plans initiated at the local community level in Uganda do integrate ecological principles and traditional knowledge to a smaller extent.

The null hypothesis that there are no significant variations in the integration of ecological principles and traditional knowledge in local resources management plans across ecosystem, space and time was rejected for ecosystems and time and accepted for space. Thus, the integration of ecological principles and traditional knowledge in local resource management plans in Uganda varies from one ecosystem to another and over time.

5.3 Recommendations

The following recommendations can be made basing on the findings of this study.

i. The results in this study indicated that the current plans are performing below average in terms of integration of ecological principles and traditional knowledge. This calls for technical support in facilitating land resources management planning at community level. At the same time, sensitization and monitoring of traditional knowledge and ecological principles of natural resources management should be promoted in a way of equipping the resource managers and planners at community level in the sustainable management of these ecosystems. It will also enable local communities to develop robust plans which will help to curb degradation and manage ecosystems sustainably.

ii. There is need to provide for review and update of the resource management plans initiated at the community level to address ecological principles as well as traditional knowledge aspects that may have been ignored or needed more emphasis in the previous planning process.

iii. Whereas this study has enabled the development of a plan cording protocol sensitive to ecological principles and traditional knowledge systems and used it to evaluate ecosystem management plans initiated at the community level, actual implementation of the plans was not assessed which points towards future research needs.

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APPENDICES

Appendix I: Natural Resources Management Plans Obtained for the Study

No:	Plan Title	Nature of plan	District
1	Forest management plan for conservation of Alimugonza community (2002 - 2011)	Forest management plan	Masindi
2	Community forest management plan for Motokai forest (2011 - 2020)	Forest management plan	Masindi
3	Community forest management plan for Tengele forest (2011-2020)	Forest management plan	Masindi
4	Forest management plan for Ongo forest (2007 - 2016)	Forest management plan	Masindi
5	Community based wetland management plan for lake Nyabihoko wetland (2014-2018)	Wetland management plan	Ntungamo
6	Nabajuzzi community-based wetland management plan (2004-2008), Masaka district	Wetland management plan	Masaka
7	Oleicho wetland management plan (2001-2004), Kumi district,	Wetland management plan	Kumi
8	Ikona wetland management plan (2002-2007), Kabale district, Maziba sub county	Wetland management plan	Kabale
9	Agony community wetland management plan (2015-2020)	Wetland management plan	Otuke
10	Aminopio community wetland management plan (2015-2020)	Wetland management plan	Otuke
11	Lutembe Bay wetland community management plan (2004-2006)	Catchment management plan	Wakiso

12	Ngoto community wetland management plan, Kanungu district (2004-2009)	Wetland management plan	Kanungu
13	Mende community-based wetland management plan, Wakiso district (2004-2006)	Wetland management plan	Wakiso
14	Rucece community-based wetland management plan, Nyokyojo sub-county Mbarara district (2004)	Wetland management plan	Mbarara
15	Rushebeya-Kanyabaha wetland management plan, Kabale district (2001-2005)	Wetland management plan	Kabale
16	Lwajjali community-based wetland management plan, Goma sub-county Mukono district (2005)	Wetland management plan	Mukono
17	Muhoora wetland management plan. Mugusu and Karambi sub-counties, Kabarole district (2010-2014)	Wetland management plan	Kabarole
18	Lake Mulehe community-based wetland management plan. Nyundo and Nyakabande sub-counties, Kisoro district (2015-2020)	Wetland management plan	Kisoro
19	Ziba community-based wetland management plan, Wakiso district (2004-2006)	Wetland management plan	Wakiso
20	Rwebembera William Forest Management plan (2012-2022)	Forest management plan	Kibale
21	Kabwijamu Forest Management plan (2012-2022)	Forest management plan	Kibale
22	Robinson Kizza Forest Management plan (2016-2026)	Forest management plan	Kalangala

23	Forest Management plan Orom-Gogo community forest (2015)	Forest management plan	Lamwo
25	Forest Management plan for Katum community forest (2015)	Forest management plan	Lamwo
26	Forest Management plan for conservation of Kiganzu Chimpanzee Village Forest (2015)	Forest management plan	Masindi
27	Draft Management plan for Namugoga wetland ecosystem (2005)	Wetland management plan	
28	Queen Elizabeth National Park (General management plan). UWA September 2000	National park management plan	Kasese
29	Mountain Elgon National Park plan. UWA 2009-2019	National park management plan	Mbale
30	Murchison falls National Park (General Management plan) UWA July 2001	National park management plan	Pakwach
31	Forest Management Plan for Kalangala falls. Central forest reserve (2010-2-20). Ministry of water and environment.	Forest management plan	Kalangala
32	Collaborative forest management agreement of kalinzu central forest reserve	Forest management plan	Bushenyi
33	Batwa Ngahinga-Bwindi forest management plan May 2001 (Penninah Zaninka)	Forest management plan	South westen Uganda
34	Management plan KIkonda forest reserve. Global-woods. Kiboga county in Kyankwanzi District January 2017	Forest management plan	Kyankwanzi
35	Nkusi sub-catchment management plan. Hoima, Kibale, Masindi	Catchment management plan	Hoima,Kibale and Masindi

36	Wambabya river catchment	Catchment management plan	Masindi
37	Kiha-Kacukura wetland management plan Hoima-Masindi 2011-2016	Wetland management plan	Hoima and Masindi
38	Oyam-Tochi wetland management plan. 2014	Wetland management plan	Oyam and Gulu
39	Awojja water catchment management plan	water catchment management plan	Mbale and Tororo
40	Collaborative forest management for Namatale forest reserve. Bumulisi compartment	Forest management plan	Mbale district
41	Collaborative forest management plan for Tororo central forest reserve. Nyngole area	Forest management plan	Tororo district
42	Nyamuriro wetland management planning process. Community based wetland management plan development	Wetland management plan	Kabale
43	Waki Sub-Catchment Plan	Catchment management plan	Hoima, Kibale and Masindi
44	Kiiha Kachukura Ecosystem Wetland Management plan	Wetland management plan	Hoima

Appendix II: Plan indicator selection sheets

Indicator (s)	**Brody, 2003 (Ecosystem)**	**Brody et al 2004 (watersheds)**	**Termorshuizen et al 2007 (Ecosystems)**	**Tang et el 2008 (Hazard)**	**Meyerson 2012 (Hazards)**	**Berke et al 2012 (Hazards)**	
Ecosystem boundaries	x	x	x	x	x	x	
Ecological zones/habitats	x	x	x		x	_	
Ecological functions	x	x	x		x	_	
Species ranges/diversity	x	x	x			_	
Habitat corridors	x	x	x			_	
Vertebrate species	x	x	_			_	
Biodiversity/species richness	x	x	x		x	_	
Vegetation classified	x	x	x		x	_	
Wildlife classified	x	x	_		x	_	
Conservation lands/wetlands & Land cover mapped	x	x	x	x		_	
Threatened/endangered species	x	x	x	x		x	
Exotic species (of plants)	x	x	_			_	
Climate	x	x	x			_	
Groundwater resources	x	x	x			_	
Surface hydrology	x	x	x			_	
Representation of transboundary resources	x	x	x	x		_	
Other prominent landscapes	x	x	x			_	

Capability assessment/Land capability	_	_	_			x	
Present and future population and economy	_	_	x			x	
Existing land use and land supply, and future land demands for various uses (e.g., housing, commercial, industrial, public facilities)	_	_	x	x	x	_	
Existing capacity and future demand for public infrastructure	_	_	x		x	_	
State of natural environment resources and constraints	_	_	x	x	x	_	
Management status for conservation lands identified	x	x	x		x	_	
Wetlands development	x	x	x			_	
Nutrient Loading	x	x	_			_	
Water Pollution	x	x	_			_	
Alteration of Waterways	x	x	_			_	
Other impacts/loss of biodiversity	x	x	x			_	
Protect ecosystem integrity	x	x	x	x	x	x	
Protect natural processes/functions	x	x	x	x		x	
Protect high biodiversity	x	x	_			_	
Maintain intact patches of native species	x	x	_		x	_	
Establish priorities for native species/habitat protection	x	x	_	x		_	
Protect rare/endangered landscape elements	x	x	x			_	
Protect rare/endangered species	x	x	_			_	
Represent native species within protected areas	x	x	_			_	
Maintain intergenerational sustainability of ecosystems	x	x	x			_	

Balance human use with maintenance of viable wildlife population	x	x	x	x		_	
Restore ecosystems/critical habitat	x	x	_	x	x	x	
Presence of measurable objectives	x	x	_			_	
Other organizations/stakeholders identified	x	x	_			x	
Coordination to protect trans boundary resources	x	x	_	x		_	
Coordination within jurisdiction to protect ecosystems	x	x	_	x		_	
Intergovernmental bodies specified	x	x	_	x	x	_	
Information sharing	x	x	_	x	x	_	
Integration with other environmental plans/policies	x	x	_	x	x	_	
Conflict management process outlined	x	x	_			_	
Commitment of financial resources	x	x	_			_	
Coordination with private sector	_	x	_		x	x	
Participation in ecosystem-based initiative	_	x	_	x	x	_	
State review of the local plans	_	_	_		x	x	
State provisions of support for local governments	_	_	_		x	x	
Restrictions on native vegetation removal	x	x	_			_	
Exotic species controls	x	x	x			_	
Buffer requirements	x	x	_	x		_	
Public or vehicular access controls	x	x	_	x		_	
Phasing of development to protect habitat	x	x	_			_	
Controls on construction to protect habitat	x	x	_	x		_	
Protected areas/sanctuaries	x	x	x		x	_	

Urban growth boundaries to protect ecosystems	x	x	_			_	
Actions to protect resources in other jurisdictions	x	x	_		x	_	
Promotion of awareness/knowledge	_	_	_	x	x	x	
Acquisition	_	_	_			x	
Financial assistance	_	_	_	x	x	X	
Specification of principles to guide public and private land use decisions to achieve goals	_	_	_			_	
Specific mitigation measures to protect habitants	_	x	_	x		_	
Impact fees to protect habitats	_	x	_			_	
Designation of special taxing districts	x	x	_			_	
Control of public investments and projects	x	x	_			x	
Designation of responsibility	x	x	_	x	x	x	
Provision of technical assistance	x	x	_	x	x	x	
Clear timetable for implementation	x	x	_	x		x	
Enforcement specified	x	x	_		x	_	

Appendix III: Plan quality components and Indicators

Components	Indicators used exclusively by Brody (2003)	Indicators modified by others from Brody (2003)	Indicators introduced by others	Indicators introduced by this study
Factual Basis	Ecological habitants	Ecosystem boundaries	Ecological services & ecological benefits	
	Ecological functions	Species ranges and Species diversity	Present and future population	Common resource management
	Vertebrate species	Corridors	Present and future economy	Identification of new lands for conservation
	Areas with high biodiversity/species richness Species/genetic/ecosystem diversity-	Invasive & alien plant species	Planning for public infrastructure	
	Vegetation classified	Ecosystems mapped including buffers	Wetlands development	
	Wildlife classified	landscape features	Existing land use and land supply, and future land demands for various uses	
	Threatened & endangered species	Water abstraction and diversion		
	Climate described			
	Soils classified			
	Graphic representation of transboundary resources			
	Ground water resources			
	Surface hydrology			
	Management status identified for conservation lands			
	Nutrient loading			
	Fragmentation of habitat			
	Water pollution			
	Other factors/impacts			
	Existing environmental regulations described			
Goals and Objectives	Protect natural processes/ functions	Protect ecosystems integrity-		
	Protect high biodiversity	Restoration of degraded areas		
	Maintain intact patches of native species	SMART objectives		
	Establish priorities for native species /habitat protection			
	Protect rare/endangered landscape elements			

	Protect rare/endangered species			
	Represent native species within protected areas			
	Maintain intergenerational sustainability of ecosystems			
	Balance human use with maintaining viable wildlife populations			
Inter-Organizational Coordination & Capabilities for Ecosystem Management	Other organizations/stakeholders identified	Vertical and horizontal coordination	Plan approval by district and provision for review	Mechanisms to protect communal resources
	Conflict management processes	Transboundary consideration	Local sources of technical expertise to design and implement plans	Define key stakeholders' responsibilities
	Participation in ecosystem-based initiatives	Identify key stakeholders	Commitment of financial resources	Initiate mechanisms for new collaboration
	Other forms of coordination	Generate and share information		
		Response to local and international policies		
		Source of financial resources-		
Policies, Tools, & Strategies	Phasing of development to protect habitat	Control against exotic plant and animal species		Season for exclusion of use of resources
	Controls on construction to protect habitat	Environmental buffers		Mechanisms to allow competing uses of land
	Specific mitigation measures to protect habitats	Protection of indigenous vegetation		Provision for traditional practices
	Other formal regulatory tools	Environmental easements		Ecosystem zones preserved for cultural heritage
	Other incentive-based tools	Formal public education programs		Traditional restrictive naming of ecosystem zones and species
	Other land acquisition techniques	Informal public education programs		Identified species for traditional use
	Control of Public Investments and Projects			Informal regulatory tools
				Environmental deposit bonds
				Environmental restoration order
Implementation	Identify stake holders to do implementation	Developed work plan	Provision of technical assistance	Regular plan updates and assessments
	Designation of their responsibilities	Mechanism for enforcement	Identify source of technical assistance	Monitoring for plan effectiveness and response to new information
		Determine fines against encroachment and misuse		Tax disincentives

Appendix IV: Ecosystem Plan Coding protocol

Factual Basis		
	1. Resource Inventory	
Ecosystem boundaries	Ecological habitants	Ecological functions- (Ecological services- & ecological benefits
Species ranges and Species diversity	Corridors	Vertebrate species
Areas with high biodiversity/species richness- (species/genetic/ecosystem diversity	Vegetation classified	Wildlife classified
	Threatened & endangered species	Invasive & alien plant species
Climate described	Soils classified-, Graphic representation of trans boundary resources	Ecosystems mapped including buffers
Common resource management-	Landscape features	Ground water resources-**,** Surface hydrology
	2. Ownership Patterns	
Management status identified for conservation lands	Identification of new lands for conservation	
	3. Human Impacts	
Present and future population	Present and future economy	Planning for public infrastructure
Wetlands development	Nutrient loading	Fragmentation of habitat
Water pollution	Water abstraction and diversion	
Existing environmental regulations described	Existing land use and land supply, and future land demands for various uses e.g. housing, commercial, industrial, public facilities.	
Goals and Objectives		
Protect ecosystems integrity	Protect natural processes/ functions	Protect high biodiversity

Maintain intact patches of native species	Establish priorities for native species /habitat protection	Protect rare/endangered landscape elements
Protect rare/endangered species		Represent native species within protected areas
Maintain intergenerational sustainability of ecosystems	Balance human use with maintaining viable wildlife populations)	Protect ecosystems integrity
Restoration of degraded areas		SMART objectives
Inter-Organizational Coordination & Capabilities for Ecosystem Management		
Other organizations/stakeholders identified		Vertical and horizontal coordination
Transboundary consideration	Mechanisms to protect communal resources	Plan approval by district and provision for review
Identify key stakeholders	Define key stakeholders' responsibilities	Initiate mechanisms for new collaboration
Generate and share information	Conflict management processes Participation in ecosystem-based initiatives	
Response to local and international policies	Local sources of technical expertise to design and implement plans Other forms of coordination	Source of financial resources Commitment of financial resources
Policies, Tools, & Strategies		
	A. Regulatory Tools	
Control against exotic plant and animal species	Environmental buffers	Protection of indigenous vegetation
Phasing of development to protect habitat	Controls on construction to protect habitat	
Specific mitigation measures to protect habitats	Season for exclusion of use of resources	Mechanisms to allow competing uses of land

Provision for traditional practices e.g. Bush fallowing/rotational grazing to allow resource regeneration)	Ecosystem zones preserved for cultural heritage	
Traditional restrictive naming of ecosystem zones and species	Identified species for traditional use (e.g. selective firewood collection)	Other formal regulatory tools e.g. Bylaws
Informal regulatory tools e.g. Taboos		
	B. Incentive-Based Tools	
Environmental deposit bonds		Other incentive-based tools
	C. Land Acquisition Programs	
Environmental easements	Environmental restoration order	Other land acquisition techniques
	D. Other Policies	
Control of Public Investments and Projects	Formal public education programs	Informal public education programs

	Implementation	
Identify stake holders to do implementation and designation of their responsibilities	Provision of technical assistance (locally from the district for designing and implementing plans)	Identify source of technical assistance
	Developed work plan	Regular plan updates and assessments
Mechanism for enforcement	Monitoring for plan effectiveness and response to new information-	Determine fines against encroachment and misuse
Tax disincentives		

Appendix V: Plan scoring sheet

Plan Quality Indicators Data coding/collection Sheet				
	Indicators	**Comments**	**Score**	**Page**
	Factual Base			
	Ecosystem Boundaries	0. No description of ecosystem boundaries given 1. Ecosystem boundaries are defined. 2. Wetland/forest boundaries are defined and described in detail in the plan		
	Ecological habitats	0. No description of ecological habitats given 1. Ecological habitats defined but not detailed 2. Ecological habitats are defined and well described in the plan		
	Ecological functions	0. No description for ecological functions 1. Ecological functions given but not detailed 2. Ecological function described and detailed		
	Ecological service	0. No description for ecological service 1. Ecological service given but not detailed 2. Ecological service described and detailed		
	Ecological benefit	0. No description for ecological benefit 1. Ecological benefit given but not detailed 2. Ecological benefit described and detailed		
	Species ranges (Behavioral extent)	0. No description given for species range. 1. Species range identified 2. Species range identified, and detailed description given		
	Corridors	0. No corridors identified in the plan 1. Corridors identified but not detailed 2. Detailed description of corridors given in the plan		
	Vertebrate species	0. No description of vertebrate species identified 1. Vertebrate species identified but not described 2. Vertebrate species identified and described in detail		
	Diversity (Species /genetic/ecosystem)	0. No species, genetic, and ecosystem diversity identified 1. Species genetic and ecosystem diversity given but not detailed 2. Species, genetic and ecosystem diversity described in detail		
	Vegetation classified	0. No vegetation classified 1. Vegetation classified but not detailed 2. Detailed classification of identified vegetation		
	Wildlife classified	0. No wildlife classified 1. Wild life classified but not detailed 2. Detailed wildlife classification		

	Soil quality assessment	0. No soil quality assessment provided for 1. Soil quality assessment not explicitly provided for 2. Soil quality assessment fully provided for		
	Threatened and endangered species	0. No threatened/endangered species identified 1. Threated/ endangered species identified but not described 2. Threatened/endangered species identified and described in detail		
	Invasive and Alien plant species	0. No Invasive and Alien plant species identified 1. Invasive and Alien plant species described but not detailed. 2. Invasive and Alien plant species described in detail		
	Climate	0. No description on climate of the plan area 1. Description on climate given but not detailed 2. A detailed description of climate of the plan area		
	Representation of transboundary resources	0. No representation of transboundary resources 1. Transboundary resources represented but not detailed 2. Detailed representation of transboundary resources given		
	Common resource management	0. There is no common resource management 1. Common resource management identified but not detailed 2. Detailed common resource management given		
	Eco systems mapped (including buffers)	0. No description of systems mapped including buffers given 1. Description of systems mapped including buffers but not detailed 2. Detailed description of systems mapped including buffers		
	Groundwater resources	0. No description of groundwater resources 1. Description of groundwater resources given but not in detail 2. Detailed description of groundwater resources given		
	Surface hydrology	0. No description of surface hydrology given 1. Description of surface hydrology given but not detailed 2. Detailed description of surface hydrology given		
	Landscape features (Mtns, Hills, Rock outcrops etc.)	0. No landscape features identified and described 1. Landscape features identified and described but not in detail 2. A detailed description of landscape features		

	Management status for conservation lands identified	0. No management status for conservation lands is given 1. Management status for conservation land identified but not detailed 2. A detailed management status for conservation lands identified		
	Identification of new lands for conservation	0. No identification of new lands for conservation seen in the plan 1. Identification of new lands for conservation given but not detailed 2. Detailed description of new lands for conservation given in the plan		
	Present and future population	0. No consideration of present and future population 1. Present and future population considered but no details given 2. Detailed consideration of present and future population given		
	Present and future economy	0. No consideration of present and future economy 1. Present and future economy considered but no details given 2. Detailed consideration of present and future economy given		
	Planning for public infrastructure	0. No planning for public infrastructure 1. Planning for public infrastructure given but not detailed 2. Detail description of planning for public infrastructure given		
	Nutrient Loading	0. No nutrient landing sources identified 1. Nutrient loading sources identified and described but not in detail 2. Detailed description of nutrient loading is given		
	Water abstraction and diversion	0. No water abstraction and diversion identified 1. Water abstraction and diversion identified but not described in detail 2. Detailed description of water abstraction and diversion given		
	Fragmentation of habitat	0. No fragmentation of habitat given in the plan 1. Fragmentation of habitat given but not detailed 2. Detail description of fragmentation of habitat given in the plan		
	Water Pollution	0. No description of water pollution given 1. Description of water pollution given but not in detail 2. Detailed description of water pollution in the plan		

	Existing land use and land supply, and future land demands for various uses (e.g., housing, commercial, industrial, public facilities)	0. No existing land use and land supply, and future land demands for various uses given 1. Existing land use and land supply, and future land demands for various uses given but not detailed 2. Detail description of existing land use and land supply, and future land demands for various uses given		
	Existing environmental regulations described	0. No existing environmental regulations described 1. Existing environmental regulations described but not detailed 2. Detail description of existing environmental regulation given.		
	Goals and Objectives			
	Protect ecosystem integrity	0. No protection measures of ecosystem integrity identified 1. Measures for protection of ecosystem integrity identified but not detailed 2. Detailed description of ecosystem integrity protection given		
	Protect natural processes/functions	0. No protection of natural processes/functions given 1. Protection of natural processes/integrity given but not detailed 2. Detailed Protection of natural processes/functions given		
	Protect high biodiversity	0. No protection of high biodiversity 1. Protection of high biodiversity given but not detailed 2. Detailed protection of high biodiversity given		
	Maintain intact patches of native species	0. No maintenance of intact patches of native species identified in the plan 1. Maintenance of intact patches of native species identified but not detailed 2. Detailed identification of maintenance of intact patches of native species given in the plan		
	Establish priorities for native species/habitat protection	0. No established priorities for native species/habitat protection identified in the plan 1. Established priorities for native species/habitat protection identified in the plan but not detailed 2. Details for establishment of native species/habitat protection is seen in the plan		
	Protect rare/endangered landscape elements	0. No protection of rare/endangered landscape elements seen in the plan 1. Protection of rare/endangered landscape elements identified but not detailed		

		2. Detailed Protection of rare endangered landscape elements identified in the plan		
	Represent native species within protected areas	0. No representation of native species within protected areas seen in the plan 1. Representation of native species within protected areas identified but not detailed 2. Detailed representation of native species within protected areas identified in the plan		
	Maintain intergenerational sustainability of ecosystems	0. No maintenance of intergenerational sustainability of ecosystems in the plan 1. Maintenance of intergenerational sustainability of ecosystems given but not in detail 2. Detailed maintenance of intergenerational sustainability of ecosystem given in the plan		
	Balance human use with maintenance of viable wildlife population	0. No balance of human use with maintenance of viable wildlife population seen in the plan 1. Balance of human use with maintenance of viable wildlife population given but not detailed 2. Detailed balance of human use with maintenance of viable wildlife population is given in the plan		
	Restoration of degraded areas	0. No restoration of degraded areas in the plan 1. Restoration of degraded areas identified but not detailed 2. Detailed restoration of degraded areas is identified in the plan		
	Presence of measurable objectives (SMART objectives)	0. No presence of measurable objectives in the plan 1. Presence of measurable objectives but not detailed 2. Detailed description of measurable objectives identified in the plan		
	Inter-organizational coordination and capabilities for ecosystem management			
	Other organization/stakeholders identified	0. No other organization/stakeholders identified in the plan 1. Other organization/stakeholders identified but not detailed in the plan 2. Detailed description of other organization/stakeholders identified in the plan		
	Vertical and Horizontal collaboration	0. No vertical and horizontal collaboration identified in the plan 1. Vertical and horizontal collaboration identified in plan but not detailed 2. Detailed description of vertical and horizontal collaboration given in the plan		

	Mechanism to protect communal resources	0. No mechanism to protect communal resources seen in the plan 1. Mechanism to protect communal resources seen but not detailed 2. Detailed description of mechanism to protect communal resources seen in the plan		
	Plan approval by District and provision for review	0. No plan approval by District and provision for review identified in the plan 1. Plan approval by the District and provision for review identified but not in detail 2. Detailed plan approval by District and provision for review identified in the plan		
	Identify all key stakeholders	0. No key stakeholders identified in the plan 1. Key stake holders identified but not in detail 2. Detailed description of key stake holders identified in the plan		
	Define key stakeholders' responsibilities	0. No key stake holders' responsibility described in plan 1. Key stake holders' responsibility described but not in detail 2. Detailed description of key stake holders' responsibility given in the plan		
	Initiated mechanisms for collaboration if not existent	0. No initiated mechanisms for collaboration if not existent seen in the plan 1. Initiated mechanisms for collaboration if not existent identified but not in detail 2. Detailed description of initiated mechanisms for collaboration if not existent given in the plan		
	Generate and share information	0. No generation and information sharing identified in the plan 1. Generation and information sharing identified but not detailed 2. Detailed generation and information sharing identified in plan		
	Conflict management process outlined	0. No conflict management process outlined in the plan 1. Conflict management process outlined but not detailed 2. Detailed conflict management process outlined in the plan		
	Participation in ecosystem-based initiatives	0. No participation in ecosystem-based initiative identified in the plan 1. Participation in ecosystem-based initiative identified but not detailed 2. Details on participation in ecosystem-based initiative are identified in the plan		

	Sources of financial resources	0. No sources of financial resources identified in the plan 1. Sources of financial resources identified but not in detail 2. Detailed sources of financial resources identified in the plan		
	Commitment of financial resources	0. No commitment of financial resources and their sources identified in the plan 1. Commitment of financial resources and their sources identified but not detailed in plan 2. Detailed commitment of financial resources and their sources identified in the plan		
	Response to local and international policies	0. No response to local and international policies in the plan 1. Response to local and international policies seen but not detailed 2. Detailed response to local and international policies identified in the plan		
	Identified local sources of technical expertise to design and implement plans	0. No local sources of technical expertise to design and implement plans is identified in the plan 1. Identified local sources of technical expertise to design and implement plans but not in details 2. Details on local sources of technical expertise to design and implement plan is identified and given in the plan		
	Other forms of coordination	0. No other forms of coordination identified in the plan 1. Other forms of coordination identified but not in detailed 2. Detailed description of other forms of coordination identified in the plan		
	Policy, tools and strategies			
	Protection of indigenous vegetation	0. No protection of native vegetation identified in the plan 1. Protection of native vegetation identified but not in detail 2. Detailed description of protection of native vegetation given in the plan		
	Control against Exotic plant and animal species	0. No exotic plant and animal species control identified in the plan 1. Exotic plant and animal species control identified but not in detail 2. Detailed description of exotic plant and animal species control is identified in the plan		

	Environmental buffers	0. No environmental buffers identified in the plan 1. Environmental buffers identified but not in detail 2. Detailed description of environmental buffers identified in the plan		
	Phasing of development to protect habitat	0. No Phasing of development to protect habitat identified in the plan 1. Phasing of development to protect habitat identified but not in detail 2. Detailed description of phasing for development to protect habitat identified in the plan		
	Controls on construction to protect habitat	0. No controls on construction to protect habitat seen in the plan 1. Controls on construction to protect habitat identified but not in detail 2. Detailed description of controls on construction to protect habitat is given in the plan		
	Seasons for exclusion of use of resources	0. No seasons for exclusion of use of resources identified in the plan 1. Seasons for exclusion of use of resources identified but not in detail 2. Detailed description of Seasons for exclusion of use of resources identified in the plan		
	Mechanisms to allow competing uses of land	0. No mechanisms to allow competing uses of land identified in the plan 1. Mechanisms to allow competing uses of land identified but not in detail 2. Detailed description on mechanisms to allow competing uses of land identified in the plan		
	Specific mitigation measures to protect habitants	0. No specific mitigation measures to protect habitant identified in the plan 1. Specific mitigation measures to protect habitats identified but not in detail 2. Detailed description of specific mitigation measures to protect habitats identified in the plan		
	Provision for traditional practices (e.g. Bush fallowing/rotational grazing to allow resource regeneration)	0. No provision for traditional practices identified in the plan 1. Provision for traditional practices identified but not in detail 2. Detailed description of provision for traditional practices identified in the plan		
	Ecosystem zones preserved for cultural heritage	0. No ecosystem zones preserved for cultural heritage identified in the plan 1. Ecosystem zones preserved for cultural heritage identified but not in detail 2. Detailed description of ecosystem zones preserved		

		for cultural heritage identified in the plan		
	Traditional restrictive naming of ecosystem zones and species	0. No traditional restrictive naming of ecosystem zones and species identified in the plan 1. Traditional restrictive naming of ecosystem zones and species identified but not in detail 2. Detailed description of traditional restrictive naming of ecosystem zones and species identified in the plan		
	Identified species for traditional use, e.g., selective firewood collection	0. No identified species for traditional use given in the plan 1. Identified species for traditional use given but not in detail 2. Detailed description of identified species for traditional use given in the plan.		
	Other formal regulatory tools e.g. bylaws	0. No other formal regulatory tools identified in the plan 1. Other formal regulatory tools identified but not in detail 2. Detailed description of Other formal regulatory tools identified in the plan		
	Other informal regulatory tools e.g. taboos	0. No other informal regulatory tools identified in the plan 1. Other informal regulatory tools identified but not in detail 2. Detailed description of Other informal regulatory tools identified in the plan		
	Other incentive-based tools	0. No other incentive-based tools identified in the plan 1. Other incentive-based tools identified but not in detail 2. Detailed description of other incentive-based tools identified in the plan		
	Environmental deposit bonds	0. No environmental deposit bonds identified in the plan 1. Environmental deposit bonds identified but not in detail 2. Detailed description of environmental deposit bonds identified in the plan		
	Environmental easements	0. No environmental easements identified in the plan 1. Environmental easements identified but not in detail 2. Detailed description of environmental easements identified in the plan		

	Environmental restoration order	0. No environmental restoration order identified in the plan 1. Environmental restoration order identified but not in detail 2. Detailed description of environmental restoration order identified in the plan		
	Other land acquisition techniques	0. No Other land acquisition techniques identified in the plan 1. Other land acquisition techniques identified but not in detail 2. Detailed description of other land acquisition techniques identified in the plan		
	Control of public investments and projects	0. No controls of public investments and projects seen in the plan 1. Control of public investments and projects identified but not in detail 2. Detailed description of control of public investments and projects identified in the plan		
	Promotion of formal public education e.g. Barazas, trainings	0. No promotion of formal public education identified in the plan 1. Promotion of formal public education identified but not detailed 2. Detail description of formal public education identified in the plan		
	Promotion of informal public education e.g. awareness/ sensitization on Radios and televisions, newspapers, posters	0. No promotion of informal public education identified in the plan 1. Promotion of informal public education identified but not in detail 2. Detailed description of promotion of informal public education identified in the plan		
	Implementation			
	Identify stakeholders to do implementation	0. No stakeholders to do implementation identified in the plan 1. Identified stakeholders to do implementation given in the plan but not in detail 2. Detailed description of identified stakeholders to do implementation given in the plan		
	Designation of responsibility	0. No designation of responsibility identified in the plan 1. Designation of responsibility identified but not in detail 2. Detailed description of designation of responsibility identified in the plan		

	Provision of technical assistance	0. No provision of technical assistance identified in the plan 1. Provision of technical assistance identified but not in detail 2. Detailed description of provision of technical assistance identified in the plan		
	Developed Work plan	0. No developed work plan is given 1. Developed Work plan is given but not in detail 2. Detailed description of a developed work plan given		
	Regular plan update and assessments	0. No regular plan update and assessments identified in the plan 1. Regular plan update and assessments identified but not in detail 2. Detailed description of regular plan update and assessments identified in the plan		
	Mechanism for enforcement	0. No Mechanism for enforcement seen in the plan 1. Mechanism for enforcement given but not in detail 2. Detailed description of mechanism for enforcement given in the plan		
	Monitoring plans	0. No monitoring plans identified 1. Monitoring plans identified but not in detail 2. Detailed description of monitoring plans given		
	Fines against encroachers and misuse	0. No fines against encroachers and misuse identified in the plan 1. Fines against encroachers and misuse identified but not in detail 2. Detailed description fines against encroachers and misuse identified in the plan		

Appendix VI: Plans' components and Total Quality Scores

	Plan Description					Components					
No:	Plan Title	Ecosystem	District	Region	**Year**	Factual Basis	Goals & Objectives	Inter-Organizational Coordination	Tools Policies, Strategies	Implementation	Total Plan Quality Score
1	Forest management plan for conservation of Alimugonza community (2002 - 2011)	Forest	Masindi	Central	2001-2005	7	5	4	4	8	**28**
2	Community forest management plan for Motokai forest (2011 - 2020)	Forest	Masindi	Western	_	6	5	6	4	4	**25**
3	Community forest management plan for Tengele forest (2011-2020)	Forest	Masindi	Western	_	5	5	5	5	6	**26**
4	Forest management plan for Ongo forest (2007 - 2016)	Forest	Masindi	Western	2001-2005	5	4	4	3	4	**20**
5	Community based wetland management plan for lake Nyabihoko wetland (2014-2018)	Wetland	Ntungamo	Western	2011-2015	7	2	5	4	7	**25**
6	Nabajuzzi community-based wetland management plan (2004-2008), Masaka district	Wetland	Masaka	Western	2011-2015	7	6	7	4	8	**32**
7	Oleicho wetland management plan (2001-2004), Kumi district,	Wetland	Kumi	Western	2006-2010	5	4	6	4	9	**28**
8	Ikona wetland management plan (2002-2007), Kabale district, Maziba sub county	Wetland	Kabale	Western	2011-2015	5	4	7	4	5	**25**
9	Agony community wetland management plan (2015-2020)	Wetland	Otuke	Western	2011-2015	7	4	6	4	7	**28**
10	Aminopio community wetland management plan (2015-2020)	Wetland	Otuke	Western	2011-2015	5	1	7	3	9	**25**
11	Lutembe Bay wetland community management plan (2004-2006)	Wetland	Wakiso	Central	2016-2018	6	4	7	3	6	**26**
12	Ngoto community wetland management plan, Kanungu district (2004-2009)	Wetland	Kanungu	Northern	2011-2015	7	5	6	2	4	**24**
13	Mende community-based wetland management plan, Wakiso district (2004-2006)	Wetland	Wakiso	Northern	2011-2015	6	5	5	5	8	**29**
14	Rucece community-based wetland management plan, Nyokyojo sub-county Mbarara district (2004)	Wetland	Mbarara	Central	2006-2010	5	4	6	4	5	**24**

15	Rushebeya-Kanyabaha wetland management plan, Kabale district (2001-2005)	Wetland	Kabale	Central	2001-2005	5	6	6	4	6	**27**
16	Lwajjali community-based wetland management plan, Goma sub-county Mukono district (2005)	Wetland	Mukono	Central	2001-2005	5	1	6	4	5	**21**
17	Muhoora wetland management plan. Mugusu and Karambi sub-counties, Kabarole district (2010-2014)	Wetland	Kabarole	Central	2001-2005	5	5	6	2	7	**25**
18	Lake Mulehe community-based wetland management plan. Nyundo and Nyakabande sub-counties, Kisoro district (2015-2020)	Wetland	Kisoro	Eastern	2001-2005	4	2	7	3	7	**23**
19	Ziba community-based wetland management plan, Wakiso district (2004-2006)	Wetland	Wakiso	Northern	2011-2015	6	6	6	5	8	**31**
20	Rwebembera William Forest Management plan (2012-2022)	Forest	Kibale	Northern	2011-2015	6	1	5	2	4	**18**
21	Kabwijamu Forest Management plan (2012-2022)	Forest	Kibale	Western	2001-2005	5	5	7	1	5	**23**
22	Robinson Kizza Forest Management plan (2016-2026)	Forest	Kalangala	Western	2011-2015	6	4	5	2	5	**22**
23	Forest Management plan Orom-Gogo community forest (2015)	Forest	Lamwo	Western	2011-2015	5	6	6	3	4	**24**
24	Forest Management plan for Katum community forest (2015)	Forest	Lamwo	Western	2011-2015	4	3	4	1	2	**14**
25	Forest Management plan for conservation of Kiganzu Chimpanzee Village Forest (2015)	Forest	Masindi	Western	2001-2005	5	3	2	2	4	**16**
26	Wambabya river catchment	Catchment	Masindi	Western	2001-2005	6	5	2	1	3	**17**
27	Waki Sub-Catchment Plan	Catchment	Hoima, Kibale and Masindi	Western	2001-2005	7	2	6	3	3	**21**

Appendix VII: Plans' components and Total Quality Scores without traditional knowledge indicators

	Plan Description					Components					
No:	Plan Title	Ecosystem	District	Region	Year	Factual Basis	Goals & Objectives	Inter-Organizational Coordination	Tools Policies, Strategies	Implementation	Total Plan Quality Score
1	Forest management plan for conservation of Alimugonza community (2002 - 2011)	Forest	Masindi	Central	2001-2005	6	5	4	3	8	**26**
2	Community forest management plan for Motokai forest (2011 - 2020)	Forest	Masindi	Western	_	6	5	6	3	4	**24**
3	Community forest management plan for Tengele forest (2011-2020)	Forest	Masindi	Western	_	5	5	5	4	6	**25**
4	Forest management plan for Ongo forest (2007 - 2016)	Forest	Masindi	Western	2001-2005	5	4	4	2	4	**19**
5	Community based wetland management plan for lake Nyabihoko wetland (2014-2018)	Wetland	Ntungamo	Western	2011-2015	7	2	5	3	7	**24**
6	Nabajuzzi community-based wetland management plan (2004-2008), Masaka district	Wetland	Masaka	Western	2011-2015	7	6	7	2	8	**30**
7	Oleicho wetland management plan (2001-2004), Kumi district,	Wetland	Kumi	Western	2006-2010	5	4	6	4	9	**28**
8	Ikona wetland management plan (2002-2007), Kabale district, Maziba sub county	Wetland	Kabale	Western	2011-2015	5	4	7	3	5	**24**
9	Agony community wetland management plan (2015-2020)	Wetland	Otuke	Western	2011-2015	6	4	6	3	7	**26**
10	Aminopio community wetland management plan (2015-2020)	Wetland	Otuke	Western	2011-2015	5	1	7	2	9	**24**
11	Lutembe Bay wetland community management plan (2004-2006)	Wetland	Wakiso	Central	2016-2018	6	4	7	2	6	**25**
12	Ngoto community wetland management plan, Kanungu district (2004-2009)	Wetland	Kanungu	Northern	2011-2015	6	5	6	1	4	**22**
13	Mende community-based wetland management plan, Wakiso district (2004-2006)	Wetland	Wakiso	Northern	2011-2015	5	5	5	3	8	**26**
14	Rucece community-based wetland management plan, Nyokyojo sub-county Mbarara district (2004)	Wetland	Mbarara	Central	2006-2010	5	4	6	3	5	**23**
15	Rushebeya-Kanyabaha wetland management plan, Kabale district (2001-2005)	Wetland	Kabale	Central	2001-2005	5	6	6	3	6	**26**

16	Lwajjali community-based wetland management plan, Goma sub-county Mukono district (2005)	Wetland	Mukono	Central	2001-2005	5	1	6	3	5	**20**
17	Muhoora wetland management plan. Mugusu and Karambi sub-counties, Kabarole district (2010-2014)	Wetland	Kabarole	Central	2001-2005	5	5	6	2	7	**25**
18	Lake Mulehe community-based wetland management plan. Nyundo and Nyakabande sub-counties, Kisoro district (2015-2020)	Wetland	Kisoro	Eastern	2001-2005	4	2	7	2	7	**22**
19	Ziba community-based wetland management plan, Wakiso district (2004-2006)	Wetland	Wakiso	Northern	2011-2015	5	6	6	4	8	**29**
20	Rwebembera William Forest Management plan (2012-2022)	Forest	Kibale	Northern	2011-2015	6	1	5	1	4	**17**
21	Kabwijamu Forest Management plan (2012-2022)	Forest	Kibale	Western	2001-2005	5	5	7	1	5	**23**
22	Robinson Kizza Forest Management plan (2016-2026)	Forest	Kalangala	Western	2011-2015	5	4	5	1	5	**20**
23	Forest Management plan Orom-Gogo community forest (2015)	Forest	Lamwo	Western	2011-2015	5	6	6	3	4	**24**
24	Forest Management plan for Katum community forest (2015)	Forest	Lamwo	Western	2011-2015	4	3	4	1	2	**14**
25	Forest Management plan for conservation of Kiganzu Chimpanzee Village Forest (2015)	Forest	Masindi	Western	2001-2005	5	3	2	1	4	**15**
26	Wambabya river catchment	Catchment	Masindi	Western	2001-2005	6	5	2	1	3	**17**
27	Waki Sub-Catchment Plan	Catchment	Hoima, Kibale and Masindi	Western	2001-2005	6	2	6	3	3	**20**