Land Tenure Dynamics and Integrated Watershed Management

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by

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Abstract

The thesis investigates land tenure dynamics and integrated watershed management. We consider integrated watershed management as a process and act of holistically managing the environment in a given delineated spatial unit, considering both upstream and downstream systems connectivity for social and ecological systems sustainability. Integrated watershed management incorporates several implementation approaches, including integrated water resources management. In the research's first primary objective, we survey the state of integrated watershed management in dynamic land tenure contexts. The second main objective, we examine the relationship between land tenure and integrated watershed management. Proactively, the third objective assesses the relevant land and related resources legislation responsiveness to integrated watershed management and the land tenure dynamic and conceptualises for reforms. Analysing and acquiring data involves qualitative and quantitative methods.

The methods include primary data collection through catchment surveys, questionnaires administration, focus group discussions, interviews, and catchment reconnaissance observation. Complimentary data consists of systematic literature reviews, secondary satellite imagery and other Geographical Information System (GIS) data. The methods applied produced both unit and spatial data, with unit data mostly from households as the primary units of analysis and interaction. The data is managed and analysed using GIS tools like ArcMap, QGIS and statistical tools in Ms Excel, SPSS, and R. The study mainly draws case studies from the global south, targeting catchments in the Victoria and Albert basin lakes in Eastern Africa. The main findings and tentative conclusions include (a) integrated watershed management approaches improve water resources governance and resource management amidst land tenure dynamics. The evidence shows a significant difference in the performance of water resources governance markedly better in the catchment with integrated water resources management practices than in the base catchment unaffected by these practices. The finding contributes to the aspirations for promoting integrated watershed management approaches for improved resource governance and the concept that resource management measures depend on governance effectiveness. However, the potential of integrated watershed management encounters limiting social factors such as land tenure. According to the comprehensive literature review (b), land tenure relates to various aspects of integrated watershed management, including driving land use and cover changes. As such, we confirm a relationship between land use and cover changes proportional areas losses ranging between 80% - 95% of woodland and indigenous forests in the case study area in the Lake Victoria basin. This degree of land use and land cover change, the functionality of other change driving factors perceived and the degree of adopting sustainable practices depends on the prevailing land tenure. Achieving integrated watershed management, conversant of the land tenure role, requires an enabling legal and institutional environment. However, the research findings for main objective (c) show the prevailing legislation needs to be more responsive to allow effective integrated watershed management. As such, we suggest reforms and provide model legislation provisional suggestions. We recommend several areas for future research, including assessing the legal feasibility of integrated watershed management and land tenure responsive legislation and the needed land administrative reforms to deliver on ensuring sustainability and sustainable development.

The research enhances our understanding of the potential and possibilities of land tenure during integrated watershed management. The study also furnishes scholars, resource managers, policymakers, and program evaluators with more information for decisions.

Zusammenfassung

Untersucht wird die Dynamik zwischen Landbesitz und integriertem Management von Flusseinzugsgebieten vergleichend am Beispiel von drei Flusseinzugsgebieten im Gebiet des Lake Victoria/Uganda. Das integrierte Management von Flusseinzugsgebieten ist ein Prozess des ganzheitlichen Managements der Umwelt in einer abgegrenzten räumlichen Einheit, wobei sowohl die vorgelagerte als auch die nachgelagerte Systemkonnektivität berücksichtigt werden, um die Nachhaltigkeit sozialer und ökologischer Systeme zu gewährleisten. Das integrierte Flusseinzugsgebietsmanagement umfasst mehrere Ansätze zur Umsetzung, einschließlich des integrierten Wasserressourcenmanagements.

In einem ersten Schritt wird der Stand der Forschung zu Themen des integrierten Flusseinzugsgebietsmanagements in dynamischen Landbesitzkontexten erarbeitet. In einem zweiten Schritt wird die Beziehung zwischen Landbesitz und integriertem Management von Flusseinzugsgebieten betrachtet. In einem dritten Schritt wird die Reaktionsfähigkeit der relevanten Gesetze in Ugandabewertet sowie die damit verbundenen Ressourcen in Bezug auf integriertes Flusseinzugsgebietsmanagement, Landbesitzdynamik und auf die Konzipierung von Reformen.

Die zur Anwendung gekommenen Methoden umfassen die Erhebung von Primärdaten im Flusseinzugsgebiet, Fokusgruppendiskussionen, Interviews und Erkundungsbeobachtungen im Einzugsgebiet. Die ergänzenden Daten umfassen Satellitenbilder und flächendifferenzierte Daten zu den lokalen Umweltbedingungen. Die Verarbeitung der flächendifferenzierten Daten erfolgte mit Hilfe Geographischer Informationssysteme, die statistische Datenanalyse erfolgte mit Hilfe von Ms Excel, SPSS und R.

Die Studie stützt sich hauptsächlich auf drei Fallstudien aus den Einzugsgebieten von Lake Victoria und Lake Albert, Ostafrika. Zu den wichtigsten Ergebnissen gehört, dass integrierte Managementansätze für Flusseinzugsgebiete die regionale Ressourcenmanagement verbessern. Die Befunde zeigen einen signifikanten Unterschied in der Leistung der Wasserressourcenbewirtschaftung, die deutlich besser in Einzugsgebieten mit integrierten Wasserressourcenmanagementpraktiken sind als in Einzugsgebieten, die von diesen Praktiken unbeeinflusst sind. Die Ergebnisse tragen dazu bei eine verbesserte Ressourcenverwaltung für integrierte Flusseinzugsgebietsmanagementansätze anzustreben und konzeptionell zu berücksichtigen. Das Potenzial eines integrierten Flusseinzugsgebietsmanagements stößt jedoch auf einschränkende soziale Faktoren wie Landbesitz. Entsprechend den Ergebnissen der Literaturrecherche bezieht sich Landbesitz auf verschiedene Aspekte des integrierten Managements von Flusseinzugsgebieten, einschließlich von Landnutzungs und Landbewirtschaftung. In den Fallstudien deuten Landnutzungsänderungen auf proportionale Flächenverluste hin, die zwischen 80% und 95% der von einheimischen Wäldern bewachsenen Flächen betreffen. Dieser Grad der Landnutzungsänderung, die Funktionalität der steuernden Faktoren und der Grad der Übernahme nachhaltiger Landnutzungspraktiken hängen im Wesentlichen von den vorherrschenden Landbesitzverhältnissen ab. Um ein integriertes Flusseinzugsgebietsmanagement zu erreichen das auch die Rolle des Landbesitzes berücksichtigt, ist ein entsprechendes rechtliches und institutionelles Umfeld erforderlich. Die Analyse der bestehenden Gesetzeslage zeigt, dass die geltende Gesetzgebung für die Berücksichtigung von Landbesitzverhältnissen bei der Umnweltplanung im weiteren Sinne offener gestaltet sein muss, um ein effektives integriertes Flusseinzugsgebietsmanagement zu ermöglichen.

Dedication

I dedicate this dissertation to the many people who have supported me on this academic journey. Your wishes, sacrifices, moral and financial support have brought me thus far. I will forever be grateful.

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BC	Before Christ
CbWRM	Catchment based Water Resources Management
CFA	Cooperative Framework Agreement
DAAD	German Academic Exchange Service
DEM	Digital Elevation Model
DRC	Democratic Republic of Congo
DWRM	Directorate of Water Resources Management
FAO	Food and Agricultural Organisation
FDG	Focus Discussion Groups
FU	Freie Universität Berlin
GIS	Geographic Information System
GWP	Global Water Partnership
ITCZ	Inter-tropical Convergence Zone
IWM	Integrated Watershed Management
IWRM	Integrated Water Resources Management
LULCC	Land Use Land Cover Change
MWE	Ministry of Water and Environment
NBI	Nile Basin Initiative
NEMA	National Environment Management Authority
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
RCMD	Regional Centre for Mapping of Resources for Development
REDD+	Reducing Emissions from Forest Degradation and Deforestation
SDG	Sustainable Development Goals
SRTM	Shuttle Radar Topography Mission
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNSD	United Nations Sustainable Development

USGS	United States Geological Survey
WMZ	Water Management Zone
WRI	World Resources Institute
WUC/A	Water User Committee/Association

CHAPTER 1: INTRODUCTION

1.1 Background

The research broadly focuses on land tenure and integrated watershed management-a holistic land and water resources management approach using the watershed as a unit of analysis. Integrated watershed management includes the management of land, water, biota, and other natural resources as well as human resources in a defined area - a watershed - for ecological, social, and economic purposes (Wang et al., 2016). Initially, the focus was on watershed management, as a process corresponding, guiding and organising land, human and natural resource usage in a watershed, ensuring the sustenance of the environment (Biswas, 1990; Schütt and Förch, 2004; Thiemann et al., 2018; Wang et al., 2016). Watershed management achieved some degree of effectiveness as a natural resource management tool and a land resource management system (Tennyson, 2005). A concept of integrated watershed management recognizes that resources in a drainage basin are interconnected, so successful problem-solving requires joint actions and responses from stakeholders and actors at different levels in the drainage basin. In addition, watershed management also evolved, given the wide variety of natural and societal components such as human resource development, water and soil use, and agriculture, resulting in competing interests in most cases (Schütt and Förch, 2004). Therefore, integrated watershed management is a holistic problem-solving strategy that integrates the various actors to protect and restore ecosystems' physical, chemical, and biological integrity and human health to provide the base for sustainable economic growth (National Research Council, 1999).

Integrated watershed management is practiced in various parts of the world. However, the adoption and effectiveness especially in the global south, encounters more challenges in application (García, 2008; Gebregergs et al., 2022; UNEP, 2021; United Nations et al., 2012). This research focuses on land tenure among the spectrum of potential challenges and limitations to integrated watershed management. Land tenure encompasses individuals' or groups' legally or customarily defined relationship to the land (FAO, 2002a, 2022a). Thus, the research broad hypothesis is that effectiveness, adoption, and implementation of integrated watershed management are affected by land tenure, resultant practices and the complexities termed "land tenure dynamics". The hypothesis follows sections of research indicating land tenure affecting attributes of integrated watershed management, such as sustainable land use and management measures' adoption and effectiveness (Gebremedhin and Swinton, 2003; Knowler and Bradshaw, 2007; Liu et al., 2018; Mozzato et al., 2018; Soule et al., 2000). Land tenure is also crucial in resource degradation since it determines ownership, use, and influences decision-making. Therefore, land tenure is one of the potential and fundamental factors for to landscape restoration and management opportunities programs or degradation neutrality. (FAO, 2002a; Unruh et al., 2019).

The research answers the questions from both a broader and localised and a case studies approach. Thus, critically examining the land tenure dynamic and integrated watershed management relation. In sub-Saharan countries like Uganda, land tenure appears as one of the potential and fundamental stumbling blocks to landscape restoration and management opportunities programs (MWE and IUCN, 2016), appears in land scape related researches as one of the drivers of land use and cover changes (Ebanyat et al., 2010; Mwanjalolo et al., 2018), and thus, affecting the progressive effects expected from integrated watershed management. Despite the pre-assumptions and fragmented evidence, limited empirical evidence exists about

the relationship between land tenure and integrated watershed management, holistically. The research, therefore, contributes to a holistic understanding needed to improve land tenure administration and integrated watershed management as complimentary factors, for sustainability.

Land tenure may differ across geographical settings but composes of private, communal, state, or public formations, aware of continuing land and other resources reforms, especially in the global south. (Chigbu et al., 2017; FAO, 2002a; Kasimbazi, 2017). The existence of multiple land tenure characters and attributes, likely influences the practicality and applicability of integrated watershed management and leading to limited adoption of sustainable watershed management measures. The land tenure arrangements also impact the socio-economic, political, and environmental situation. Thus, several proposals to reform land and related resources governance remain. The reforms include efforts to streamline rights, solve internal conflicts, rationalize distortions in land relations, and "modernize" indigenous tenure (Okuku, 2006; Otto et al., 2019).

1.2 Research objectives

I examine integrated watershed management in dynamic land tenure settings as the overall objective. In addition, I aim at the following specific objectives.

1. To survey the state of integrated watershed management under dynamic land tenure contexts.
2. To examine the relationship between land tenure and integrated watershed management.

3. Assess relevant land and related resources legislations' responsiveness to land tenure and integrated watershed management and conceptualise responsive reforms.

The dissertation particularly aligns with the following broad questions investigating land tenure and integrated watershed management, inform related reforms into valuable tools for sustainability, sustainable resources management and development.

a) What is the state of integrated watershed management in such a land tenure dynamic context?

b) How is the relationship between land tenure and integrated watershed management?

c) How responsive is the prevailing legislation to integrated watershed management and land tenure dynamics?

These, in a broader sense, social inquiries are assessed alongside the natural landscape characteristics of the study regions.

1.3 Organisation of the Dissertation

This research dissertation assesses the land tenure and integrated watershed management relationship using a watershed case as the central spatial unit for analysis. Chapter one introduces the research background, questions, and objectives. I also briefly highlight the key research outputs in the form of papers in section 1.4.

The second chapter provides the state-of-the-art in available literature. Specifically, the section establishes the conceptual genesis, definitions, character, debates, and progresses relating to integrated watershed management. In addition, orientation on the linkages between land tenure and integrated watershed management, including highlighting some of the catchment-based land tenure dynamics from the target study area, is offered credible attention in chapter two.

The third chapter provides a brief description of the general study area.

The proceeding sections are a compilation of research papers and manuscripts organised in Chapters 4,5,6,7. Each chapter provides the article title, an indication of publication or peer review status, the license of copyrights implied and access links. In addition, the chapter includes all the sections within the paper, which in most papers include the abstract, introduction, research objectives, methods and materials, results and the respective discussion, and a conclusion. Finally, each chapter includes a section briefing about the chapter linking with other chapters.

In chapter 8, the research findings are synthesized, conclusions, recommendations and areas for further research are identified.

1.4 Contribution of the papers

As a cumulative dissertation, it contains four research papers, which are organised in chapters 4,5,6 and 7.

Chapter 4: Integrated Water Resources Management Approaches to Improve Water Resources Governance. Published: Water *2020*, 12, *3424*. https://doi.org/10.3390/w12123424
Own contribution: 80%

The paper responds to objective 1 of the study, which is about surveying the state on the progress, effect, and possible limiting factors of integrated watershed management in dynamic land tenure contexts. Starting with an assumed homogeneity of a land tenure system and so the likely effect, this case study paper aligns with the research needs identified in the literature, especially the functionality of integrated watershed management and the possibility of improving water resources governance as a case. The case study compares two sub-catchments,

one exposed to integrated water resources management (IWRM) projects and another not exposed to IWRM projects, in the Lakes Edward-Albert basin of Uganda.

The study applies field survey methods and techniques, primarily questionnaires, for data collection. The results show a significant difference in water resources governance and, eventually, the water resources management effectiveness among the two sub-catchments, with the catchment exposed to IWRM performing better.

Although the study sub-catchments share a similar land tenure system (Native freehold tenure system), I emphasise the differentiated results from integrated watershed management application. I also learn that individual households and communities land tenure is dynamic but lack a comprehensive evaluation of the land tenure scenario under the framework of integrated watershed management.

Chapter 5: Linking Land Tenure and Integrated Watershed Management—A Review. Published: Sustainability 2020, 12(4), 1667; https://doi.org/10.3390/su12041667

Own contribution: 80%

As indicated in chapter 4, land tenure commonly surfaces as a limiting factor to IWRM effectiveness. This paper establishes the state of the art regarding land tenure and integrated watershed management. A systematic review of related literature examines the concept of land tenure, identifying the role of land tenure in integrated watershed management and the critical land tenure dynamics. The paper identifies several roles of land tenure, including land tenure as a driver of land use and cover change, the influence of human decisions and actions, and a basis for other resource tenures such as tree tenure and water tenure. Dynamics is a term devised to denote a discourse marked with assertions, suppositions, questions and sequences of statements in importance (Muskens et al., 2011), include land tenure security, land tenure

systems, land succession and gender. The review notes that the available literature can inform decisions about integrated watershed management by demonstrating the various linkages. However, the scholarship available needs more capacity to inform the holistic principle of integrated watershed management, contextual measures, and the level of significance of the relationship. The research gap is especially significant as land tenure changes continuously. In addition, catchments face new social and environmental pressures, including climate change and population growth, social and economic instabilities, and demanding sustainability goals.

Chapter 6: The relationship of land tenure, land use and land cover changes in Lake Victoria basin. Published: Land Use Policy Volume 126,March 2023, 106542 https://doi.org/10.1016/j.landusepol.2023.106542

Own contribution: 75%

Land use, land cover, and changes are essential indicators of the watersheds condition. The paper, therefore, narrows down to understanding the relationship between land tenure and watersheds, focusing on land use and land cover changes in the Lake Victoria basin in Eastern Africa. The study applies satellite imagery and survey data to establish and measure the significance of the relationship between land tenure and three aspects of land use land cover:

- the extent of changes
- the perceived drivers of land use and land cover change
- the adoption of sustainable land use practices

Contextual explanations behind the results are explored across three distinct land tenure systems: Customary, Mailo and Native freehold tenure. The results indicate a statistically significant relationship existing between land tenure and land use land cover variables examined. However, all watersheds studied have experienced adverse changes in the order of

Customary, Mailo and Native freehold tenure. The paper suggests land tenure responsiveness in integrated watershed management applications.

Chapter 7: Towards Legislation Responsive to Integrated Watershed Management Approaches and Land Tenure.

Published in Sustainability 2023, 15(3), 2221;https://doi.org/10.3390/su15032221

Own contribution: 85%

The paper is informed by the results in the previous chapters 4, 5, and 6. The paper applies qualitative research methods mainly, reviewing relevant literature including legislations, and conceptualising a model legislation that is integrated watershed management and land tenure responsive. The process includes consolidating the integrated watershed management concept, the land tenure concept in terms of public and private rights coexisting, measuring the responsiveness of the prevailing land tenure on integrated watershed management and finally determining the responsiveness of the prevailing legislation to land tenure and integrated watershed management. To enable a holistic and institutionally relevant examination, the research considers both catchment and country scales in the assessment. The results indicate a tense public and private tenure coexistence in catchments. However, the respective land tenure is found more enabling of sustainable practices according to perception. The gap to ensure effectiveness of integrated watershed management is, therefore, due to the less responsive legislations. After recommending for reforms, further studies to assess the legal gaps and feasibility of our suggestions are recommended.

CHAPTER 2: STATE OF THE ART

In this section, the state of the integrated watershed management approaches and progress-affecting factors such as land tenure in the literature is compiled.

2.1 Integrated watershed management approaches conceptual genesis and definitions

Resource management concepts and approaches have characterised an extensive portion of resource management and governance research, discussions, and practices (Bunch et al., 2011; Medema et al., 2008). Some of the pronounced approaches include the watershed management (WM) approach and the integrated water resource management (IWRM) approach. The watershed management approach refers to resources management, with the watershed as the primary organising unit dating to 2000 BC, though the term "integrated'' was added in the mid-20th century (Wang et al., 2016). The integrated water resources management (IWRM), is viewed as a process that "promotes coordinated development and management of water, land and related resources, in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital systems", and dates to the United Nations Conference on Water (Mar del Plata 1977) mainly, and through several years after that (Global Water Partnership, 2000; Rahaman and Varis, 2005).

The wider adoption and institutionalisation of integrated approaches for the management of land and related resources, however, gained momentum since the 1992 United Nations conference on the Environment and Development. The conference set of resolutions and referred to as Agenda 21 that is, the 21st century agenda, emphasised 'integrated approaches to the planning and management of land resources' in chapter 10 (United Nations Sustainable

Development, 1992). The development of different concepts has continued over time, depending on what issues require integration into industrial practice, research, and academia.

2.2 The character and debates in integrated watershed management

Integrated watershed management approaches seek a move away from the conventional, sectoral ways of managing resources, thus, advancing integration of understanding , operating and sustaining natural and human systems (Global Water Partnership, 2000). Integrated approaches also seek a process of conservation, development, and optimal utilisation of the available natural resources in a watershed on a sustained basis (Winnegge, 2005). As such, a construct called integrated watershed management, which is a holistic and integrated approach for sustainable management of a watershed area is sustained. A watershed is understood as an ecological system which can only survive as a unit. Thus, from a knowledge based perspective, understanding the components, relationships and processes in the watershed is essential (Schütt and Förch, 2004; Thiemann et al., 2018).

Integrated watershed management approaches continue conceptually to develop as a patchwork, adopting the prevailing implementation principles such as the Dublin water principles as approach principles and depending on existing institutional and legal infrastructures (Rahaman and Varis, 2005; Solanes and Gonzalez-Villarreal, 1999; Wang et al., 2016). The approaches seem like philosophical guides and recommendations for regional and national institutions to adapt and develop a befitting integrated watershed management approach (Global Water Partnership, 2000).

The initial phases of including integrated watershed management approaches into resource management and governance were optimistic. However, fears are also prevalent given the

possibility of continuity of the conventional command and control measures being implemented alongside integrated approaches and thus, contradicting failing to deliver on expected outcome (Biswas, 2008; Fischhendler and Heikkila, 2010; Jewitt, 2002). A common primary question in the integrated approaches discourse is how to integrate, apply, and measure outcomes (Mcdonnell, 2008; Rajaei et al., 2021). Other questions include whether integrated watershed management approaches are a mere buzzword or prescription, whose useful time elapsed (Biswas, 2008). These and more questions lead to contextual definitions and ultimately designing befitting integrated watershed management approaches, taking an instance of agricultural settings (Ferreyra et al., 2008).

Integrated approaches are occasionally approached as a polarised discourse whose social-political applicability and mediation of the different institutional practices, negotiation of competition and requirements of social agreements and agreeability is costly (Saravanan et al., 2009). Indeed establishing integrated approaches requires enduring the political navigations (Mehta et al., 2017, 2014). As such, the uptake of integrated approaches was marginal across the years (Biswas, 2008; Medema et al., 2008; Merrey, 2008; Saravanan et al., 2009).

The viability of a conventional or integrated watershed management approach depends on the institutional framework. As such, in some cases, there is an inability to see any significant differences between conventional or integrated watershed management approaches results (Matondo, 2002). The debates initiated caused a new understanding, such as avoiding the conception of integrated approaches as a maxim (Gain et al., 2013; Rahaman and Varis, 2005), but rather appreciating the approaches from an epistemological pluralism, considering the prescriptive, practical, and discursive dimensions for instance (Mukhtarov and Gerlak, 2014). Considering integrated approaches as ideas and not constants or metric approaches, say to,

water resources management, reduces the assumed conceptual rigidness, blocking alternative models and possibly better views or ways of thinking in practice (Giordano and Shah, 2014).

A conceptual and practical debate about integrated watershed management reveals knowledge gaps and coordination needs. The tricky question is how to effectively connect and integrate natural, physical, and social sciences knowledge without knowledge competition (Alaerts and Dickinson, 2008; Alaerts and Kaspersma, 2019; Buuren, 2013; Godinez-Madrigal et al., 2019; Mcdonnell, 2008). In response, various knowledge support systems emerge for decision making (Anzaldi et al., 2014). They include knowledge data bases for practitioners and researchers like the Global Water Partnership (GWP) toolbox (GWP, 2022a), FAO's Sustainable Forest Management Toolbox (FAO, 1986), and Freie Universität Berlin E-learning platforms about Integrated Watershed Management approaches - https://www.geo.fu-berlin.de/en/v/iwm-network/learning_content/introduction_iwm/index.html (Freie Universität Berlin/Department of Earth Sciences, 2013).

Additional supportive methodologies for the implementation of integrated watershed management approaches include games, scenarios development and models, measurement indicators and indexes (Biswas et al., 2012; Hamilton et al., 2015; Kelly (Letcher) et al., 2013; Michetti and Zampieri, 2014; Pompeu et al., 2018; Reinhardt et al., 2018; Rubiano et al., 2006; Turner et al., 2016; Wahidi et al., 2015).

While a great deal of knowledge guides a shift from concept to practice, and occasionally re-defining the concept and practice, other sections indulge in administering scales of operation such as at basin or catchment scales (Kumar et al., 2019; Medema et al., 2008; Zhang et al., 2022).

As well as providing evidence and experience for continuity, practical projects also contribute to the knowledge base. The practice of integrated watershed management concept dates back to 2000 BC, but conceptual, principles and relevance refinement continue through research and practice (Berking et al., 2018; Rahaman and Varis, 2005; Roth et al., 2016; Wang et al., 2016). Several such studies evaluating measures have provided a mixture of results.

I note, for instance, cascade tanks as a watershed management measure, control sedimentation and erosion in Sri Lanka (Bebermeier et al., 2017; Rajaei et al., 2021). Integrated watershed management in selected catchments in Ethiopia results in land restoration, land degradation control, terrestrial carbon stocks improvements, soil and runoff reduction and control due to integrated (Alemayehu et al., 2009; Gessesse et al., 2020; Haregeweyn et al., 2012; Teka et al., 2020; Yaekob et al., 2020). Integrated watershed management approaches are contributing to tourism development in Canada (Dodds, 2020) and improve public health indicators in India (Nerkar et al., 2016, 2015).

Contrary observations include an examination of reported success stories of integrated approaches application in Mexico and institutional review in Israel indicating the persistence of conventional and political systems in influencing the outcomes rather than integrated approaches application (Fischhendler and Heikkila, 2010; Godinez-Madrigal et al., 2019). In other implementing areas, integrated approaches shape and re-construct the institutional arrangements into catchment-based water management and administration zones (Bandaragoda and Babel, 2010; Global Water Partnership, 2015a; Songa et al., 2015). Generally, the holistic nature of integrated watershed management approaches results in multiple impacts (Pathak et al., 2013).

Observably, integrated watershed management approaches register success and criticism. However, depending on when one interacts with the concept, specific questions persist, partly because integrated approaches seem a small step for a concept, yet a giant step for practice (García, 2008). Hardship is attributed to socio and political dynamics (Blomquist and Schlager, 2005; Global Water Partnership, 2000; Karr and Schlosser, 1978; Muhereza, 2006). Additional limitations relate with the sustainability and maintenance of measures (Gebregergs et al., 2022; Yaekob et al., 2020), the relevant knowledge generation and application (Mcdonnell, 2008), resource governance (Abeywardana et al., 2018; Bakker et al., 2008; Tantoh, 2018; Uhlendahl et al., 2011). Integrated watershed management measures also fail to ensure a balanced trade-off between conservation and development. Conservation choices are costly, less chosen, and costly to maintain compared to other social-economic investments (Sandker et al., 2009). When tested for adaptiveness, indicative results point to more demands for adaptiveness of the approaches, to achieve expected outcomes such as climate change resilience (Gain et al., 2013). Integrated watershed management require an enabling environment, which is still characterised by fragmented policy, legal and institutional frameworks (GWP, 2017, p. 2017).

At least 186 United Nations member states implement the integrated watershed management approaches through the auspices of the Sustainable Development Goals (UNEP, 2021).

2.3 Integrated watershed management implementation and linkages with land tenure

Integrated watershed management approaches varies according to knowledge and overall knowledge management systems, actions and actors' perceptions, physical environment conditions, possible hazards in watersheds, effects on carbon stocking (Gaus et al., 2021; Gessesse et al., 2020; Mcdonnell, 2008; Pourghasemi et al., 2020; Rushemuka et al., 2014). The application of integrated approaches across the various geographical settings also

encounters diverse land tenure and resources equity dynamics (Ratna Reddy et al., 2017). Available studies for instance, indicate the likelihood of varying land tenure systems affecting the landscape structure (Fox, 2002; Stanfield et al., 2002). Particularly, because the land and property regimes and regulatory structures define equity and benefit-sharing among watershed users and stakeholders. Well-defined rights are essential for equity, contribution, sustainability, and a sense of ownership. The process also minimises regulatory resentment in watersheds related management. Moreover, the distribution of rights further affects the distribution of costs and subsequent monitoring needed for such a spatial commons like catchments (Ratna Reddy et al., 2017).

Catchments' variable land rights record integrated watershed management approaches benefitting landowners more than other groups, especially those with less land rights (Ratna Reddy et al., 2017). Profoundly, equity is tied to sustainability, especially intergenerational equity (Allan and Rieu-Clarke, 2010), and also forms a core implication for integrated watershed management.

Considering every resource and issue in an area elevates the human relationships and interaction in integrated watershed management. One such relationship is the human-land relationship, commonly defined as tenure (FAO, 2002a). Land tenure is a more pronounced social aspect among watershed management actions in the global south, for reasons that include the higher dependence on land for production directly, but also the existence of land governance systems still undergoing reforms (FAO, 2022b; FAO et al., 2006; Wolter and FAO, 2017). The land also carries multiple socio-economic, cultural and symbolic values, environmental and psychological values (Leonardi and Browne, 2018; Otto et al., 2019).

2.4 Land tenure dynamics particular to the case study area

Land tenure studies inclusive of the study area around the Lake Victoria basin in sub-Saharan Africa tend to view land tenure in three chronological parts: pre-colonial, colonial, and post-colonial periods. Observably, the values about land are consistent as they are dynamic throughout time and space (Leonardi and Browne, 2018). In the pre-colonial period, land tenure systems were customary and defined according to a traditional setting, guidelines, and values. Customary systems accrued during the colonial and post-colonial periods alongside a systematic introduction of land tenure systems by the colonial power in each geographic space (Batungi and Rüther, 2008; Cotula and Chauveau, 2007; Peters and Kambewa, 2007). There were a series of land tenure reforms in the post-colonial period, but they mostly adopted land practices and values from other global state or former colonial countries (Home, 2021). Reforms have sought to iron out 'historical land injustices' where land was a reward to royalists and loyalists, patriarchal rights, a symbol of power and social dominance, modernisation and tenure security (Batungi and Rüther, 2008; Bruce and Migot-Adholla, 1994; Okuku, 2006). The history and practices have considerably changed over time, thus, characterising land tenure as a dynamic. Taking the term land tenure dynamic as a reference to what is changing and the processes involved concerning land over the years in the East African context, the following are drivers are enlisted, majorly from (Otto et al., 2019);

a) Local setting traditions and multiple governance systems characterised with *defacto* and *dejure* practices.
b) Colonial effects that shaped land reforms during and continuously post-colonial era.
c) Re-nationalisation and state monopolies policies on land.
d) Economic liberalization – including promotion of private property regimes.

e) Globalisation and subsequent foreign investments in mass land acquisition for energy production, food for export, tourism and recreation facilities.
f) Domestic elites alienating and controlling both rural land and land on the periphery of cities practices.
g) Growing population of the 'landless' due to migration, land sales, and the general lack of land to afford buying or inherit.
h) Accelerating migration from rural to urban areas in the region.
i) The growing land market and commodification of land in the region.
j) Urbanisation and establishment of settlement programs like refugee and internally displaced people camps.
k) Introduction of "formal'' accreditations such as land titles and leases.
l) State led land-use policies and programmes aimed at resource sustainability and conservation.
m) Policy and regulatory failures including persistent concern over food, other resources insecurity and rural poverty.
n) Land reforms (Batungi and Rüther, 2008; Peters and Kambewa, 2007).
o) The need for tenure security (Bruce and Migot-Adholla, 1994; Holland et al., 2022).
p) Established role of land tenure in sustainable development, climate change risks management (Murken and Gornott, 2022; Ranjan et al., 2022).

Major effects from the dynamic land tenure are recorded around land administration especially land tenure formalisation, definition of land rights, land values, social classes and power (Batungi and Rüther, 2008; Chimhowu, 2019; Leonardi and Browne, 2018). Despite the range of modification pressure, customary land tenure systems or practices seem to persist. In most parts of sub-Saharan Africa where both statutory and customary rules, thus multiple and overlapping rights and interests exist (Chimhowu, 2019; Cotula and Chauveau, 2007; Otto et

al., 2019). The dynamic land tenure situation affects rural food production and livelihoods for instance (Cotula and Chauveau, 2007). The situation also bears a dynamic view of relation to land among the people (Chimhowu, 2019) , which is critical to resource use, management and sustainability, as land tenure affects sustainable land use decisions and conservation outcomes (Akram et al., 2019; FAO, 2002a; Gebremedhin and Swinton, 2003; Somarriba-Chang, 1997).

CHAPTER 3: STUDY AREA DESCRIPTION

3.1 Study location

The study majorly examines case studies catchments found in the transboundary water basins of Lake Albert and Edward, and Lake Victoria in the segment of Uganda (figure 3.1). The country Uganda (figure 3.1) is bordered by Kenya in the East, Tanzania in the South, Rwanda in the Southwest, the Democratic Republic of Congo in the West and South Sudan in the North. The case study area is mainly Uganda, with sample catchments located in Lakes Albert Water Management Zone and the Lake Victoria Water Management Zone according to the country' ascribed approach to implementing integrated watershed management. The two water management zones provide comparable sub-catchments for integrated watershed approaches and various land tenure systems. In addition, the two water management zones have a history of watershed-related interventions in selected catchments by the host government in partnership with development partners.

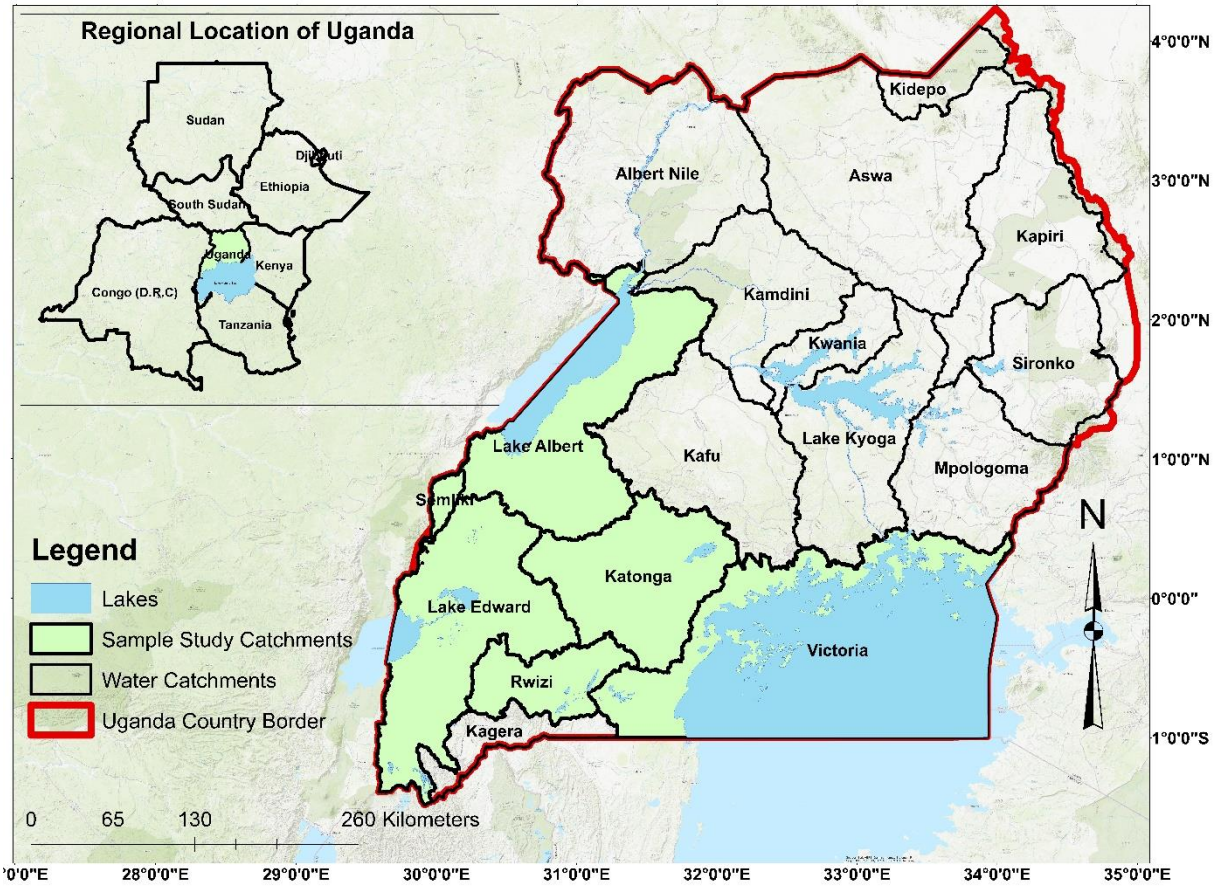

Figure 3.1: A map of the general study area-Uganda and the sample study catchments.

3.2 The hydrological and climatic conditions

The study area lies astride the equator, with a climate generally described as tropical wet, annual temperatures varying between 12 ^{o}C and 32 ^{o}C and annual rainfall amounting between 800mm-1700 mm (Kizza et al., 2009; NEMA, 2009a; UNMA, 2022). The climatic conditions in Uganda also indicate changes, characterised by a positive anomaly of the temperatures as shown by figure 3.2 of the ranked mean annual temperature anomalies (^{o}C) for the period 1950-2021 relative to the years 1981-2010 (UNMA, 2022).

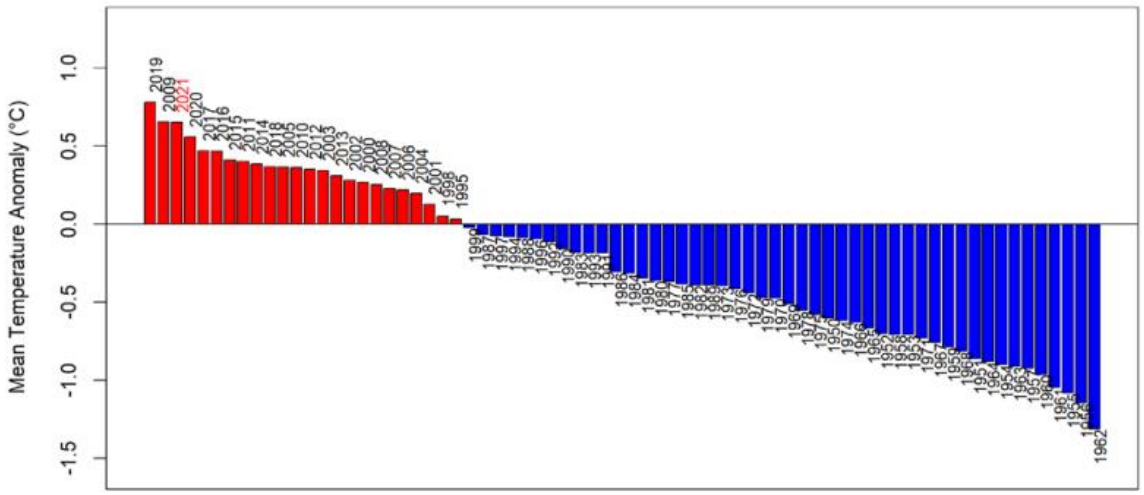

Figure 3.2: Shows the ranked mean annual temperature anomalies (°C) over Uganda for the period 1950 - 2021 relative to 1981-2010. Data considers all functional weather stations in the country. Temperature anomalies are more than the long-term mean value and indicated by the red colour while blue represents years with temperature anomalies more than the long-term mean value (UNMA, 2022).

Generally, the country has experienced an increase in temperature, recording ~ 0.23 °C/decade increase between 1950-2021. The increase in temperature is followed by an observed increase in mean annual precipitation in some regions of the country. The area's rainfall is largely Bi-annual. Thus, at least two marked dry seasons are the June-August, January-March seasons, and rainy seasons (March-May, September to December), except for the north-eastern regions, which experience one rainfall season and one dry season. The annual rainfall is higher around the Lake Victoria basin, with an annual rainfall amount of between 1200-2200 mm, followed by high Mountains like the Elgon, Rwenzori and Kigezi highlands regions. Lower rainfall distributions happen in the so-called 'cattle corridors' which include sections of north-eastern Uganda and parts of the Lake Victoria and Lake Albert basins around Semliki. (MWE and DWRM, 2013; NEMA, 2009a). According to figure 3.3, however, the years 2019 and 2021 show an increase in the Mean Annual Rainfall when compared to the 1981-2010 years as the basis for the Long Term Mean (LTM). The distribution around the country varies, with some regions recording an increase and others a decrease (UNMA, 2022).

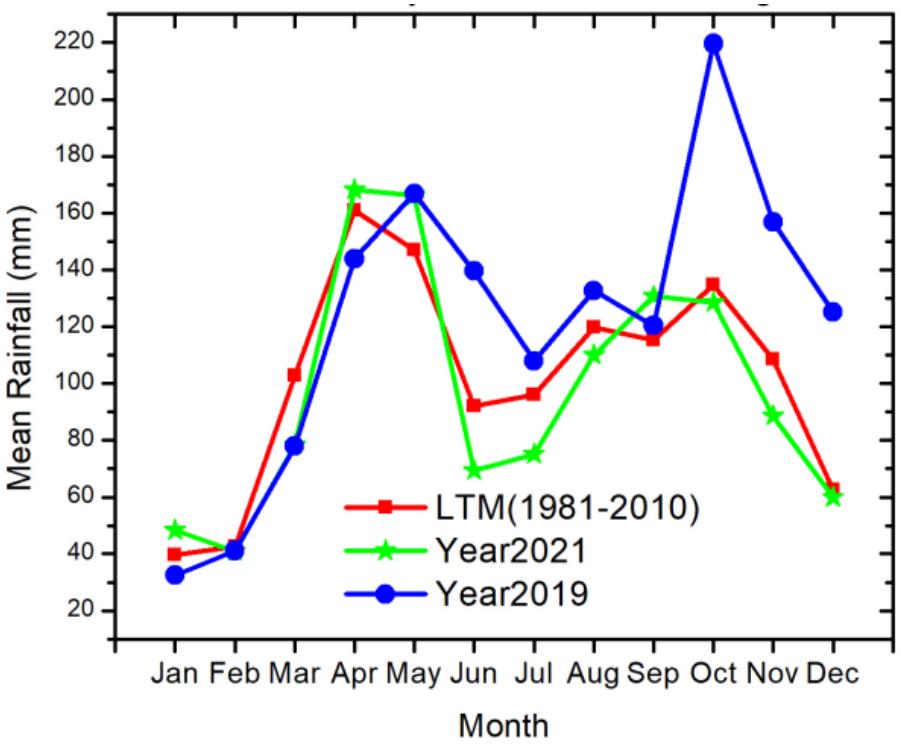

Figure 3.3: Shows the mean monthly rainfall (mm) as annual cycle of Uganda 2019 (blue), 2021 (green), and averaged for the reference period 1981-2010 (red). Data considers all functioning weather stations in the country (UNMA, 2022).

The climatic conditions in the region differ according to the altitude, relief, Intertropical Convergence Zone (ITCZ) and monsoon winds. In turn, the weather and climate conditions influence a significant part of the hydrological systems. The hydrology of Uganda consists of mostly freshwater resources, including lakes, rivers, ground waters, and wetlands, making up at least 17% of the country's total land area. Notable, however, about 65% of the water resources are transboundary surface water systems. In addition, the groundwater potential is limited due to a lack of 'true aquifers. (MWE et al., 2016; MWE and DWRM, 2013; Onyutha et al., 2021).

3.3 The geological, topographical, and soil conditions

The areas in Uganda are largely underlaid with pre-Cambrian crystalline basement rocks that have been modified through high-grade metamorphism, sedimentary cover depositions, rift faulting and volcanic activities (MWE and DWRM, 2013).The topography is characteristically plateau-like between the western and eastern Africa rift valley, with an average altitude of 1300 m above sea level (m.a.s.l.), interrupted by some high rising mountains, mostly resulting from volcanic activities, except the Rwenzori Mountain which towers 5,100 m.a.s.l.
Weathering processes resulted in ferrallitic mainly, and ferruginous soils characteristics in the study area. The soil types further descend into 13 categories, with the examined catchments dominated by ferrasols, regosols, nitisols and planosols (MWE et al., 2016; MWE and DWRM, 2013; NEMA, 2009a).

A combination of physical and social factors to influence the landscapes, soil fertility and erosion status in Uganda. Consequently, erosion is the leading form of and factor at about 85%, to an estimated 41% of the Country is categorised as experiencing degradation, while 12% is severally degraded (Vågen et al., 2016). The catchments of the Lake Victoria and Lake Albert in the Uganda segment are among the highly susceptible areas to erosion and degradation according to figure 3.4.

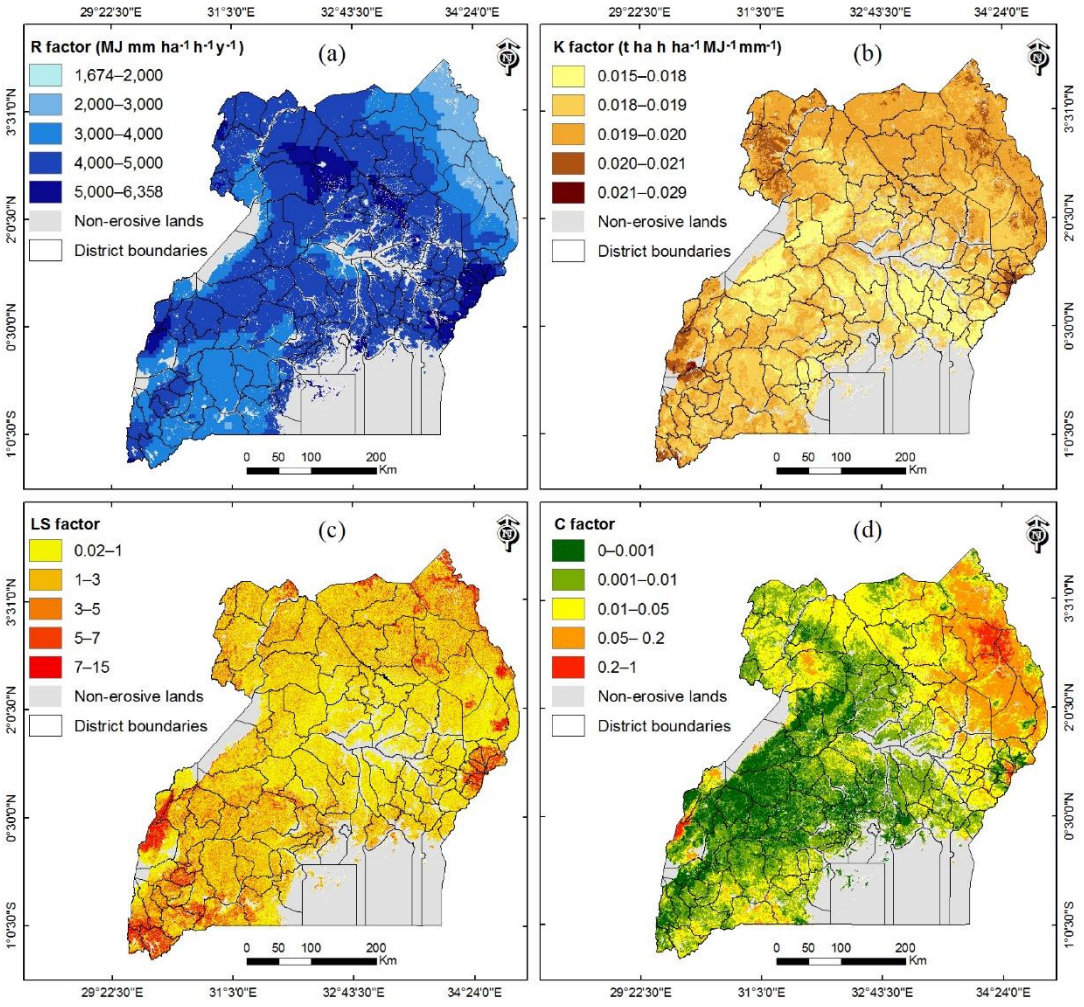

Figure 3.4: Revised Universal Soil Loss Equation (RUSLE) factor maps showing the rainfall-runoff erosivity factor (a) ; soil erodibility factor (b); slope length and slope steepness factor (c); and cover management factor (d) for Uganda (Karamage et al., 2017).

3.4 Land use and cover

The land use and land cover of Uganda falls into four broad covers that is farmed ecosystems, natural vegetation, surface water and built surface (MWE and DWRM, 2013). The sub-categories comprise of open water, wetlands, subsistence agriculture, large-scale farmlands, grassland, bushland, impediments, built-up area, tropical high forests, coniferous forests, deciduous plantations, and woodland as shown in figure 3.5 (Mwanjalolo et al., 2018; NEMA, 2009a). The vegetation is predominated with savannah, rain forest and afromontane related vegetation types (NEMA, 2009a, 2010). Uganda, like other countries in the Lake Victoria basin

countries experiences land use and land cover changes. The drivers of the changes include the growing population, agricultural extension, soil fertility changes, and land tenure (Egeru and Majaliwa, 2010; Mugisha, 2002; Mugo et al., 2020; Mwanjalolo et al., 2018).

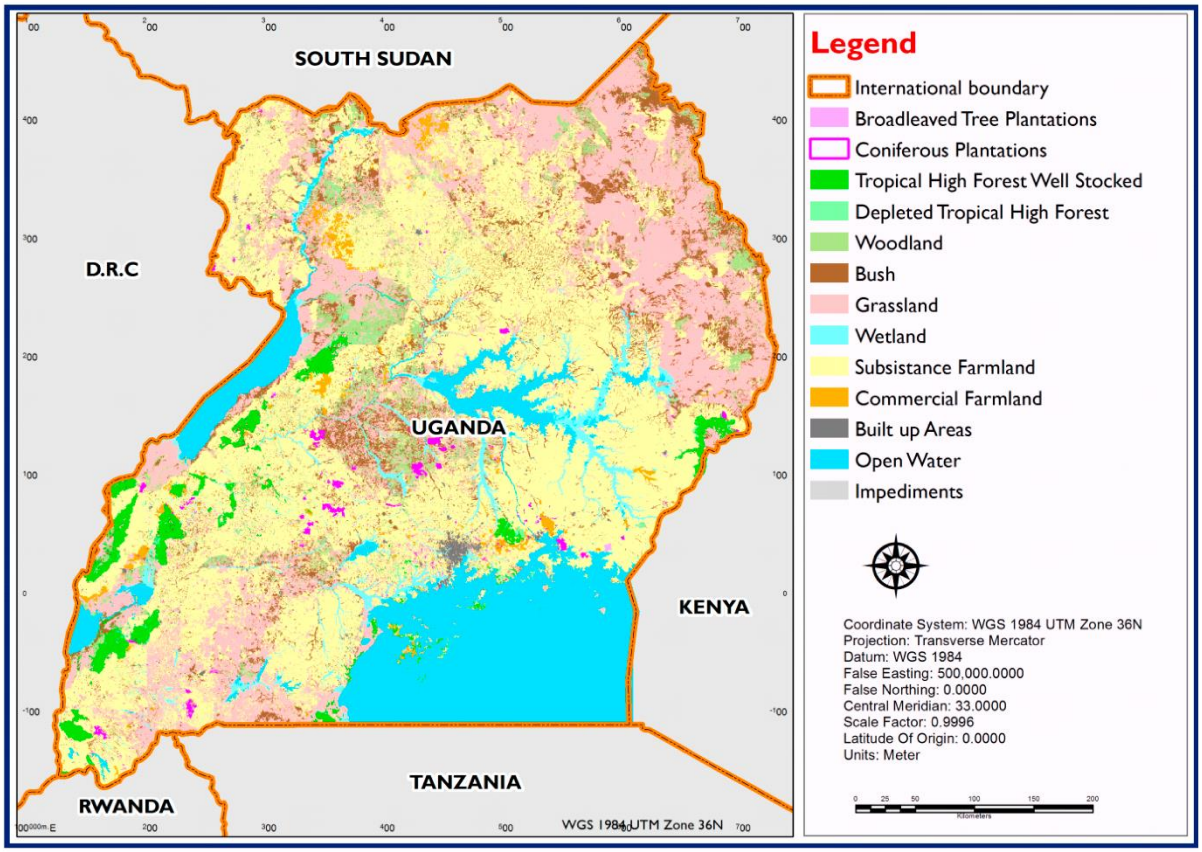

Figure 3.5: The land use and land cover situation of Uganda for the year 2015 (Mwanjalolo et al., 2018).

3.5 Geo-political and socio-economic situation

Various ethnic groups and tribes inhabit the study area. Each ethnic group hosts distinct but usually related languages, traditional institutions, and leadership. Subsequently, various socio-cultural practices relating to land and natural resources tenure, management, and governance exists. The land tenure is characterised by mainly what can be categorised as state, public, private, communal lands. For the case of Uganda, the aforementioned land exist on either of

the four land tenure systems, that is, freehold, customary, leasehold and mailo (Kasimbazi, 2017; Okuku, 2006).

The governments, through the relevant agencies coordinates the overall resources governance situation along with the political and administrative lines of office. However, the levels of political democracy and the legislative effort, social distribution of power, security, and stability in the region are different (Berman, 2010; Cheeseman et al., 2018, 2018; Gibbon et al., 1995; Tripp, 2004). The situation impacts the socio-economic and sustainable environmental management spectrum in the region.

The total population of the current East African Countries that share the basins of Lake Victoria and Lake Albert is approximately 293 million people, with an estimated growth rate of 3.5% in 2021 (World Bank, 2022). The region is equally experiencing several other changes driven by natural and human-induced actions such as climate change, land use and land cover changes.

Agriculture, especially small-scale agriculture, is a predominant socio-economic activity. Other economic activities include wildlife and tourism, energy production, mainly hydropower, oil and gas, fishing, mining, and small-scale businesses, among others (Lake Victoria Basin Commission and GRID-Arendal, 2017; NEMA, 2009a, 2010). With most member states in the study area categorising as developing nations, poverty, and direct dependence on natural resources for a livelihood is high (Collier, 2010; The World Bank, 2021).

3.6 Integrated watershed management application in the study area

Integrated watershed management is promoted as one of the approaches to ensure effective resource management, participation and achievement of various socio and ecological goals in the study area. Indicators of progress include the implementation of pilot projects, the operationalisation of zonal administration offices to water, such as the four water management zones (WMZ) that is Kyoga, Upper Nile, Albert, and Victoria. Land administration is also approached according to a zonal arrangement , and the Development of catchment management plans, among other actions in Uganda. Although other integrated watershed management approaches exist, all regional states subscribe mainly subscribe to integrated water resources management (IWRM) through relevant institutions (Global Water Partnership, 2015a).

However, despite the past and current efforts, the catchments still bear challenges, including degradation, contentious land and other catchment property rights, high and growing population, and water resource imbalances.

Katusiime J, Schütt B. Integrated Water Resources Management Approaches to Improve Water Resources Governance. *Water*. 2020; 12(12):3424. https://doi.org/10.3390/w12123424

CHAPTER 4: INTEGRATED WATER RESOURCES MANAGEMENT APPROACHES TO IMPROVE WATER RESOURCES GOVERNANCE

Abstract

The water crisis can alternatively be called a governance crisis. Thus, the demand for good water governance to ensure effective water resources management and to attain specific water goals is growing. Many countries subscribe to the Integrated Water Resources Management (IWRM) approach to achieve this goal. The Integrated Water Resources Management approach aims to ensure a process that promotes the coordinated development and management of water, land, and related resources in a drainage basin to maximise economic and social welfare equitably without compromising the sustainability of vital ecosystems. The design of the Integrated Water Resources Management approach, including its pillars and principles, aspires to good water governance and effective resource management. However, empirical studies examining this hypothesis and analysing the impact of the Integrated Water Resources Management approach on water resources governance are limited, especially in developing countries. Therefore, we characterised and compared the water resources governance aspects of two catchments in Uganda's Lake Albert basin. One of the catchments was exposed to integrated water resources management projects, while the other had no exposure to integrated water resources management projects. Some of the factors that supported the comparability of the two sites included spatial proximity linking into a related hydrological and social-economic setup, common water needs and belonging to the same water administration zone. Comparing both areas led us to analyse whether there was a difference in water resources governance actions, as well as in the quality of water resources governance, under the same overall water management and administrative zone. The data were based on field surveys using questionnaires and information guides in both catchments. The results show that the performance of water resources governance is markedly better in the catchment with Integrated Water Resources Management practices than the base catchment unaffected by these practices. Key themes examined include water resources governance styles, water resources governance systems presence, functionality, the performance of good governance principles, and water resources management effectiveness. The findings contribute to the aspirations for the promotion of integrated water management approaches for improved water resources governance, and the concept that the effectiveness of water resources management measures depends on governance effectiveness. Water governance is significant, as it spells out the power, rights, decisions, and priorities relating to given water resources and communities.

Keywords: IWRM, Good water governance, Catchment management, Effectiveness

4.1 Introduction

Water forms and plays a vital role in both the environment and human life (Heathcote W, 2009). However, with only 2.5% as freshwater and the rest saline, little water is readily available for the many demands of humankind, testing the illusion of inexhaustibility (Shiklomanov, 2000). Consequently, the global water crisis, which is characterised by increased water demand, limited access to clean water, ineffective water resources management and uncertainties, can alternatively be called a governance crisis (UNESCO and World Water Assessment Programme (United Nations), 2006).

Water possesses ecological, social-cultural, economic, political, and spiritual interests and potential uses. The advancement of integrated resources management and or catchment-based resource management approaches aims at bringing all watershed components, water resource users, managers and respective interests together for holistic consideration (Heathcote W, 2009; United Nations, 1977; United Nations et al., 2012; United Nations Sustainable Development, 1992). One such approach is the Integrated Water Resources Management (IWRM) approach, which follows the recommendations of the landmark United Nations Conference on Environment and Development Agenda 21 of 1992, Section2. The recommendations also led to the establishment of the Global Water Partnership (GWP) in 1996 to foster an integrated approach to water resources management while advancing governance and management of water resources for sustainable and equitable development (United Nations, 1977; United Nations et al., 2012; United Nations Sustainable Development, 1992). Integrated water resources management is defined as a process that promotes the coordinated development and management of water, land and related resources to maximise economic and social welfare equitably without compromising the sustainability of vital ecosystems (Brachet and Valensuela, 2012).

The implementation of an integrated water resources management approach requires the establishment of an enabling environment, including appropriate policies, strategies and legislation, institutional framework and management instruments (Agarwal and Global Water Partnership, 2000) , while applying the four water principles of (Agarwal and Global Water Partnership, 2000; Solanes and Gonzalez-Villarreal, 1999) :

- *Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;*
- *Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels;*
- *Women play a central part in the provision, management and safeguarding of water; and*
- *Water has an economic value in all its competing uses and should be recognized as an economic good as well as a social good.*

Although integrated water resources management and water governance concepts are related, they are not mutually exclusive (Allan and Rieu-Clarke, 2010; Jacobson et al., 2013, 2010, p. 201; Lautze et al., 2011). Indeed, the concept of integrated water resources management and or basin approaches result from the desire to transform water governance (Tropp, 2007). The interest in improving water governance, including while implementing integrated water resources management approaches is also indicated in the United Nations Sustainable Development Goal 6 and target reports (Jiménez et al., 2020; Rosa, 2017; UN Water, 2018). Possible reasons for focusing on water governance include the documented limitations and challenges of implementing the integrated water resources management concept around the world (Lautze et al., 2011; Solanes and Gonzalez-Villarreal, 1999). Addressing the symptoms of inadequate provision of water services and dwindling water resources while neglecting the root causes of unequal power balances, unfair patterns between and within countries, and deficits in democratization is questionable (UNESCO and World Water

Assessment Programme (United Nations), 2006). The deficits extend to exclusion of informal and customary systems of water management and governance in developing countries reforms (Kapfudzaruwa and Sowman, 2009; Malzbender et al., 2005). Therefore, water management challenges cannot be exclusively solved through infrastructural means, but also through addressing water resources governance. The integrated water resources management approach deals with water governance and water management, which differ conceptually but are interrelated. Water management refers to the primary mechanism through which actions are implemented to achieve set goals (Grigg, 2011), and involves the application of structural interventions like soil erosion, flood control infrastructures as well as non-infrastructural interventions like behavioural change, education, water resources assessment, allocation, pollution monitoring and control, financial management, information management, and planning for human and environmental purposes (Jacobson et al., 2013). Water governance refers to the mechanisms through which rules that guide the water actions and plans are established and enforced (Lautze et al., 2014).

Several countries in Eastern Africa, Mediterranean, Caribbean, Central and Eastern Europe, South Asian among other regions practice or subscribe to the integrated water resources management approach through the Global Water Partnership (Vieira et al., 2020). In this contribution, we focus on cases from Uganda in Eastern Africa, where integrated water resources management pilot projects were set up in selected catchments to examine the contribution of the approach to improving water resources governance. The study (a) evaluates whether there was a significant difference in water resources governance in catchments where integrated water resources management practices were implemented, and (b) assesses whether catchments experienced good water governance, and thus, the possibility of water resources management effectiveness. We hope the findings contribute

empirical evidence regarding the potential of integrated water resources management approaches in alleviating the water governance crisis for the purpose of scale-up.

4.1.1 The concept and context of water resources governance

Water resources governance is believed to influence water resources management by spelling out power, ownership, boundaries, decision making and course of actions. As such, when governance is ineffective, management is likely to be ineffective, as evidenced by resource quality and quantity deterioration, limited access to operational resources, high costs of service delivery and implementation inefficiency (Bucknall, 2006). Water resources governance roles specifically include: (a) supporting the formulation and implementation of water resources related institutions, legislations, and policies; (b) offering clarification on the roles and responsibilities of government, civil society and the private sector water resources and services, enabling inter-sectoral dialogue and co-ordination, stakeholder participation and conflict management; and (c) defining water rights and regulation (Kooiman, 1993). Water use systems are, therefore, supported by management and governance components (Bucknall, 2006; Kooiman, 1993).

Governance concepts and definitions including water governance vary widely (Castro, 2007; Jiménez et al., 2020; Tropp, 2007). The concepts of governance may include varied systems of power and decision making, whether developed and enforced by markets, hierarchies, or networks. Governance may also encompass activities of social, political, and administrative actors seen as purposeful efforts to guide, steer, control, or manage the pursuance of public goods (Pahl-Wostl, 2015; Termeer et al., 2010). At a higher hierarchical level, governance includes the exercise of economic, political, and administrative authority to manage the

country's affairs at all levels and viewed as a composition of the mechanisms, processes and institutions through which citizens and civic groups articulate their interests, exercise their legal rights, meet their obligations, and mediate their differences—a view that adds an element of the functionality of prevailing systems and structures (UNDP, 1997). Water resources governance is also defined variably, as documented in (Jiménez et al., 2020), though we particularly relate to the view of water governance as encompassing a range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services in society (Rogers et al., 2003). The diverse views about water resources governance are reported to often inform divergent policy strategies and decisions. Some of the views mimic political processes, characterised by the confrontation of rival political theories grounded on different values and principles or synonymous to the government (Castro, 2007; Tropp, 2007).

Water resources governance also gained attention as a process of pragmatic "pluralism". The pluralism process envisages different types of interaction resulting from (a) the articulation of the classic forms of authority embodied in the state (hierarchical organisations), (b) the private sector (driven by market competition), and (c) the voluntary sector or "civil society" (characterised by citizens' voluntary action, reciprocity, and solidarity) by water actors. These thus encompass the notions of "public-private partnership" and "tri-partite partnership" (Castro, 2007; Jacobson et al., 2013; Tropp, 2007). Other arguments include appreciating water resources governance as a subset of a country's general governance system and consistent with other resources sectors' governance for effective management of water resources (Tortajada, and Joshi, 2013).

Good governance, a term used about a system that adheres to certain principles in water

resources governance, demands representation of various interests in water-related decision-making and the recognition of the role of power and politics as important components (Jacobson et al., 2013). Examples of water governance principles include transparency, accountability, responsiveness, equity and inclusion, stakeholder participation, rule of law, integrity, effectiveness, and efficiency in service delivery (Valk and Keenan, 2011). Several institutions and stakeholders highlight varying governance principles of interest but underscore accountability, participation that seeks to involve every stakeholder in the decision-making process, and transparency where all relevant information is shared in a timely fashion (Allan and Rieu-Clarke, 2010; Havekes et al., 2016; Jacobson et al., 2010; Lautze et al., 2014; Rogers et al., 2003; Valk and Keenan, 2011).

Consequently, good governance is associated with effective water resources governance and leading to effective water resources management. Similarly, poor governance is associated with failing a range of technical solutions for water problems (Bucknall, 2006). However, water resources governance status monitoring and studies find measuring descriptive and relative terms such as 'good', 'weak', 'bad' and the compound 'good governance principles' challenging (Rogers et al., 2003), when it comes to generalisable consensus. Other considerations in the discussion on governance include the scale and level of water-related actions. Thus, the need to design a governance system fit for the spatial and jurisdictional scale of the resource (Nunan, 2018; Tai, 2015; Termeer et al., 2010; Valk and Keenan, 2011).

Some of the approaches to address scale issues in water governance resulted into (a) the integrated water resources management approach to focus at the different functional, operational, organizational and constitutional levels in water resources management which interlink as decision-making levels (Rogers et al., 2003); (b) the idea of multilevel governance to facilitate administrative and ecological scales at supranational, national, regional, and local level, including the threefold displacement of state power and control

upwards to international actors and organizations, downwards to regions, cities, and communities, and outwards to civil society and non-state actors (Peters and Pierre, 2001; Termeer et al., 2010) and (c) adopting flexible governance styles like adaptive governance, network governance and earth system governance to solve scale, flexibility and certainty issues in governance (Folke et al., 2005; Huitema et al., 2009; Pahl-Wostl et al., 2007). The above-mentioned innovations ensure the adaptation of governance responses to territorial specificities, context-informed design and according to needed solutions (Huitema et al., 2009; OECD, 2015).

The scale and level of action issue in natural resources management possibly influenced some of the conceptual shifts from the monocentric forms of governance (Termeer et al., 2010) . Monocentric governance mainly features the state as the centre of power, authority and control over society, economy, and resources compared to multi-stakeholder approaches in which state authority appreciates mutual interdependences. Accordingly, monocentric governance involves setting the agenda of societal problems, deciding upon policy goals and means, and the top-down implementation of policies unlike polycentric, networking, multilevel, earth system, adaptive governance systems, collaborative governance systems (Kooiman, 1993; Termeer et al., 2010). In table 4.1, we highlight the water resources governance systems focused on further in the study.

Table 4.1 A summary description of select resources systems of governance.

Water Resources System of Governance	Operational Meaning
Conventional	Also known as monocentric, "the government perspective", "hierarchical governance", "command and control systems of governance", or the "classical modernist approach of governance", where government centralises most powers at the top and commands from top-down while governing resources (Kooiman, 1993; Tantoh, 2018).

Collaborative	A governance arrangement where one or more public agencies directly engages non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative to make or implement public policy or manage public programs or assets. Collaborative governance involves criteria, actors, and decisions by consensus. The focus of the collaboration is on public policy or public management (Ansell and Gash, 2007).
Polycentrism	Polycentric governance is characterised by an organisational structure where multiple independent actors mutually order their relationships with one another under a general system of rules. Polycentric governance comprises of multiple decision-making centres each with substantive autonomy and also located at varying levels (Aligica and Tarko, 2012; Tarko, 2015; Thiel, 2016). Emphasis is put on deconcentrating power from political actors and instead keeping it dispersed among organised actors (Boettke et al., 2015; Kooiman, 1993; Tarko, 2015).
New Public Management (NPM)	A reformed public management administration theory or concept bred by the need to bring economics and markets to supplement governance. Easily understood as a Public-Private-Partnership (Asif and Dawood, 2017; Gruening, 2001; Manning, 2001).
Traditional	In some settings, indigenous, cultural or traditional form a core part of the power and, decision-making regarding natural resources and the water governance system (Kapfudzaruwa and Sowman, 2009; Malzbender et al., 2005).

4.1.2 Case of water resources governance in Uganda: trends and status

Uganda's water resources include an estimated mean annual rainfall of about 1200 mm, the River Nile's annual flow, which exceeds 25 km^3, and water storage in the county's broad lake system supplied by various rivers and stream systems, with lakes Victoria, Albert, Edward, and Kyoga as major lakes. However, potential evaporation amounts to up to 75% of the annual rainfall. The predicted average increase in water use ranges between 2.8 to 14.1 % in 2030 and

groundwater withdraw is estimated to increase up to 15% by 2030—developments that make water resources management an important activity in Uganda (MWE and DWRM, 2013). The legal definition of water resources given by the Uganda Water Act (1997) includes 'water flowing or situated upon the surface of any land or contained in any river, stream, watercourse or other natural courses for water like lakes, pans, swamps, marshes or springs, whether or not it has been altered or artificially improved; groundwater; and such other water as the Minister may from time to time declare to be water'(Uganda Law Commision, 1995a). The legislation in the Uganda Water Act (1997) additionally designates the government as the overseer of water resources rights in Section 5. The Uganda Water Act of 1997 is operationalised through the Uganda Water Policy of 1999, recognising the need for the Integrated Water Resources Management (IWRM) approach. The policy actions included reforming the water resources management approach; thus, the Catchment-based Water Resources Management (CbWRM) model, composed of four water management and administration zones, was delineated in 2010 to ably implement integrated water resources management (Global Water Partnership, 2015a; Mehta et al., 2017; Rubarenzya, 2008; Songa et al., 2015; Uganda Law Commision, 1995a; United Nations et al., 2012).The water and environment sector policies reform process included relevant stakeholders experimenting with the integrated water resources management approach through projects since 2006 in select catchments like rivers Mpanga and Rwizi (Global Water Partnership, 2015a). The process resulted in the gradual establishment of Catchment Management Organisations (CMO) to facilitate stakeholder-driven integrated water resources management and development. Each Catchment Management Organisation (CMO) is composed of the Catchment Stakeholder Forum (CSF), Catchment Management Committee (CMC), Catchment Technical Committee (CTC) and the Catchment Secretariat (CS). The operations of the organisations are guided by the Catchment Management Operations manuals, plans, guidelines, strategies, and the broader water

resources governance framework consisting of the Constitution of Uganda and other relevant legislation, mainly the National Wetland Policy (1995), National Environment Management Policy (1994), National Environment Management Act (1995), and Land Act (1998). The 1995 Uganda Constitution specifically commits to taking all practical measures to promote a good water management system, protect the environment, ensure accountability and rules for public officeholding and foreign policy objectives beneficial to transboundary issues. It additionally stipulates the duties of citizens under the national objectives and directive principles of state policy.

Uganda still faces water resources management effectiveness challenges, regardless of sector reforms and subscription to the integrated water resources management approaches. Water management effectiveness challenges relate to institutional financing and capacity, sectors coordination, management approaches, policy implementation, enforcement of legislation. Other challenges include resource conflicts, population growth and related land water demands, conflicting political decisions, climate change and the biophysical limitations from complex and transboundary hydrological systems (Global Water Partnership, 2015a; Jacobson et al., 2013; MWE and DWRM, 2013; Ruettinger and Taenzler, n.d.; Songa et al., 2015). Therefore, solutions through research are needed. Similarly, the water crisis progressively documented around the world is characterised by water resources management ineffectiveness due to governance. Consequently, the promotion of integrated water resources management approaches as a solution (UNESCO and World Water Assessment Programme (United Nations), 2006; United Nations, 1977; United Nations et al., 2012; United Nations Sustainable Development, 1992).

While both integrated water resources management and governance have coverage in literature, no explicit study explains whether integrated water resources management approaches

improve the water resources governance. We therefore compare the water resources governance situation of two catchments of the rivers Mpanga and Semliki. The Mpanga river catchment was exposed to substantial integrated water resources management projects while the Semliki River catchment is unexposed. Exposure to integrated water resources management is expected to enhance good water governance possibilities following the conceptual pillars and principles (Allan and Rieu-Clarke, 2010; Biswas, 2008; Lautze et al., 2011). To prove this hypothesis, we examined the water resources governance situation, comparing two catchments, one affected and one unaffected by integrated water resources management measures in the form of projects.

The prevailing water resources governance was evaluated based on the definitions provided by the Global Water Partnership (Rogers et al., 2003) and the United Nations Development Program (1997) view of governance (UNDP, 1997), the water governance principles (Allan and Rieu-Clarke, 2010; Havekes et al., 2016; Jacobson et al., 2010; Lautze et al., 2014; Rogers et al., 2003; Valk and Keenan, 2011). Study conceptualization guidance and reference tools used include the user's manual on water governance assessment of the United Nations Development Programme (Jacobson et al., 2013).

4.1.3 Study area

The study area is in the Lake Albert basin, administered as the Albert Water Management Zone in Uganda. The sampled catchments include that of river Mpanga as a catchment affected by integrated water resource management practices pouring into Lake George and the catchment of river Semliki as the control site unaffected by integrated water resource management practices, pouring into Lake Albert (figure 4.1 and 4.2).

The major socio-economic activities in the areas include agriculture, pastoralism, tourism,

fisheries and the developing oil and gas industry (NEMA, 2010). Geologically, the area is characterised by the pre-Cambrian Tooro-Buganda rock systems, mainly composed of intrusive rocks. Tectonically, the Albert Water Management Zone belongs to the Cenozoic rift basin system, developed along the Precambrian Mozambique orogenic belt (Schlüter, 2008; Schlüter and Hampton, 1997). The rifting was initiated during the Late Oligocene or Early Miocene; sandstones, siltstones, clay stones and shales characterize the Cenozoic basin infill (NEMA, 2009b). Regional climate corresponds to a tropical savanna climate (as tropical wet and dry or savanna climate after Köppen-Geiger) and tropical monsoon climate (Am) around the Rwenzori Mountain ranges (Peel et al., 2007). A spatially sharp variation in rainfall amounts occurs, with the Rift Valley and low-lying landscape of Semliki catchment receiving annual average rainfall amounts of 875 mm, while the elevated mountain ranges of Mt. Rwenzori and Mpanga catchment receive an annual average rainfall of 2500 mm (NEMA, 2010).

The average monthly temperature varies between 27 °C and 31 °C, average monthly humidity between 60–80%; due to high evaporation, rates locally negative water balance appears (NEMA, 2009b). The land cover consists of well-stocked and low-stocked areas, including forests, bushlands, open waters, aquatic, afro-alpine vegetation, and grasslands and woodlands (NEMA, 2009b; Plumptre et al., 2007; Winterbottom and Eilu, 2006). The major land uses include the protected areas (national parks, wildlife reserves and forest reserves), agriculture (crops and livestock) and human settlements (NEMA, 2009b). The Albert basin faces several water resources management challenges, especially the increasing water and land demand due to population growth increasing water resources encroachment and land-use changes (NEMA, 2010).

The study population was drawn from primary beneficiaries and participants in the integrated water resources management projects areas of Bukuku-Karangura (upstream), Fort-portal

urban area (midstream) and Nyabani-Ntara sub-counties (downstream) in river Mpanga Sub catchment. The river Mpanga (figure 4.1) delineated to an area of 5203.2 km^2 sub-catchment flows from Mt. Rwenzori ranges and discharges into Lake George. The integrated water resources management projects were implemented in the sub-catchment starting in 2006 by the Directorate of Water Resources Management of the Ministry of Water and Environment and stakeholders. A range of catchment interventions implemented included research, advocacy, service delivery, information, and capacity development (Butsel et al., 2017; NEMA, 2000a, 2000b; Reinhardt et al., 2018; Taylor et al., 2015).

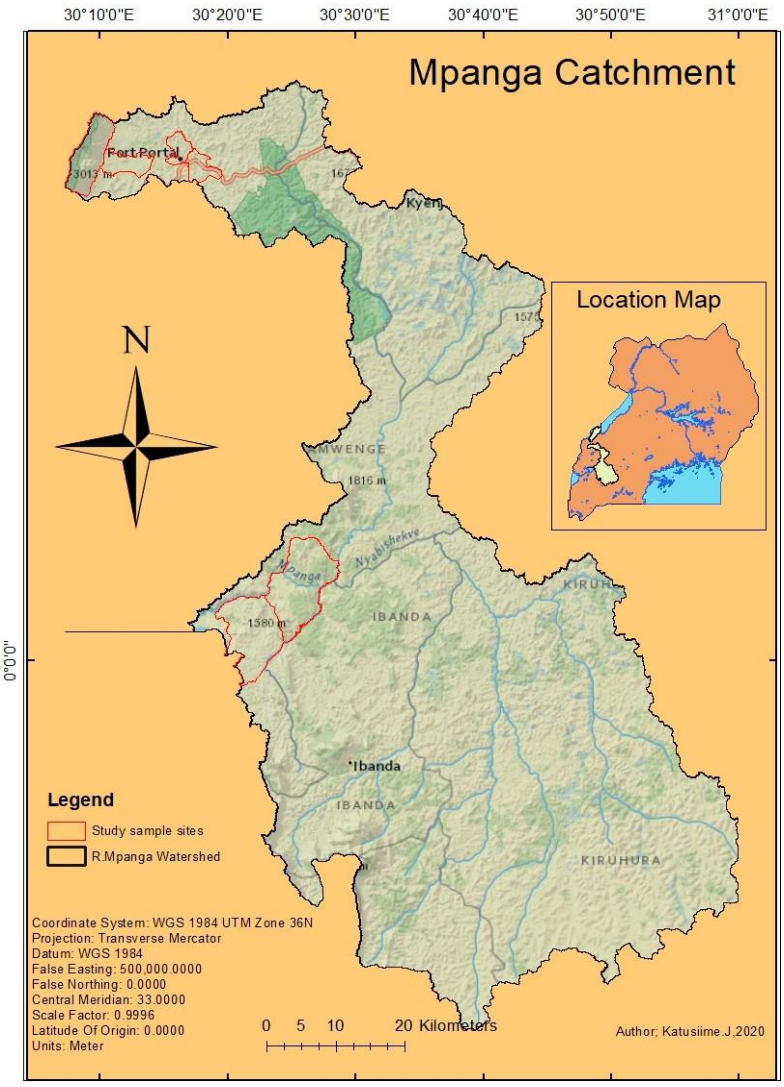

Figure 4.1: The study catchment of Mpanga, highlighting the sample study sites (red).

The catchment is exposed to integrated water resources management projects and measures. The study control site of the river Semliki (figure 4.2) is a transboundary catchment located between Uganda and the Democratic Republic of Congo. The river Semliki flows from Lake Edward through the rift valley floor into the Democratic Republic of Congo west of Mt. Rwenzori, having the character of a border river along the international boundary between Uganda and the Democratic Republic of Congo before pouring into Lake Albert. The estimated size of the entire catchment is 8213 km^2 and it is transboundary. However, for purposes of this study, the part more exclusive to Uganda is delineated and estimated at 833.59 square kilometres, where the study population was drawn from the areas of Rwebisengo, Kanara and Bweramule towards Lake Albert in Ntoroko District.

The river Semliki sub-catchment is predominantly known for protected areas like the Tooro-Semliki game reserve, a relatively flat landscape that is rich in biodiversity. Although facilitating agriculture, agro-pastoralism, fishing and small-scale border trading, the Semliki sub-catchment is threatened by deforestation, overgrazing, flooding and deteriorating quality and quantity of water (MWE and DWRM, 2013; NEMA, 2010, 2009a, 2000a; Winterbottom and Eilu, 2006). Watersheds are known to be hydrologically unique elements, so the Mpanga and Semliki relate basing on the interconnected hydrological system, common socio-economic practices that include agriculture, pastoralism, fisheries, tourism, peri-urbanism, cultural system and thus, shared water interests.

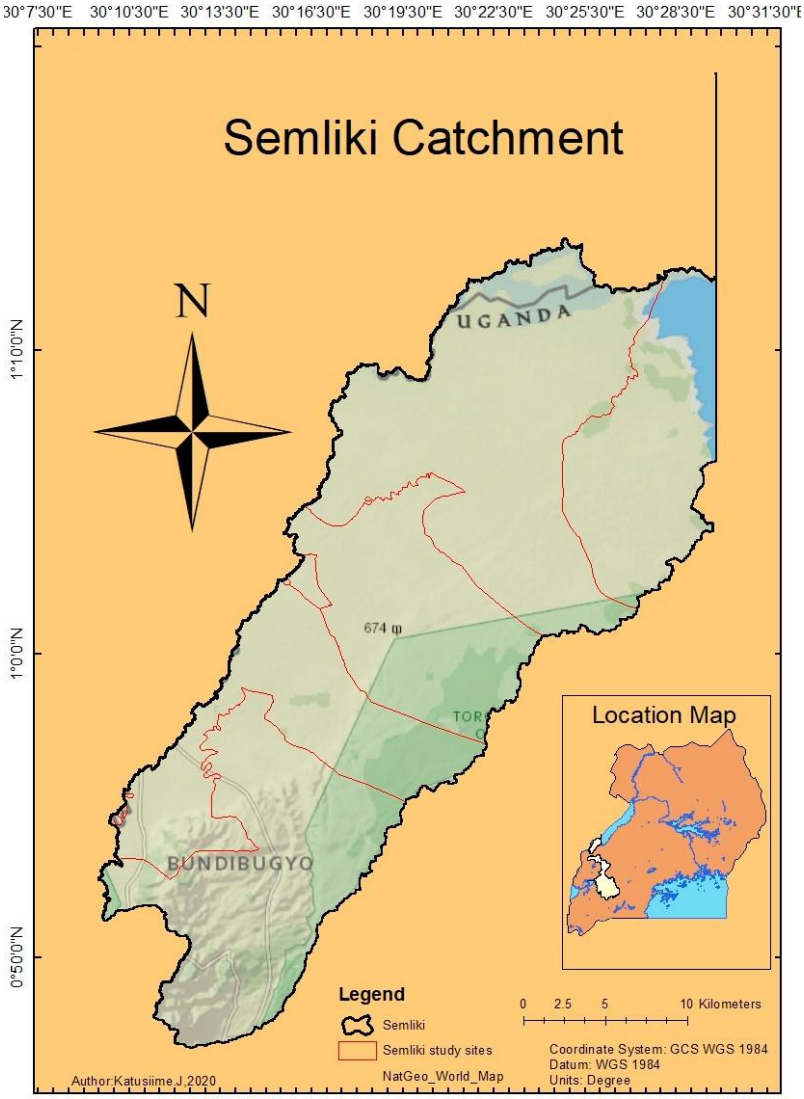

Figure 4.2 A section of the river Semliki catchment indicating the sample study site's (red) relief topography and a portion of the Uganda-Congo (DRC) boarder.

4.2 Materials and methods

Survey research was conducted to compare the water governance situation in the two purposively selected study catchments. Aware of the limitations when comparing less homogeneous catchments, the Semliki catchment was preferred as the control or base site, given its proximity to the Mpanga catchment, which had been exposed to integrated water resources management projects. The catchment also shares a related hydrological, social-

cultural, economic, water administration system, leading to anticipation of a close water resources governance performance. To consistently compare the two catchments, the indicators and characters measured focused on respondent knowledge and capacity, water resources governance styles, the presence and functionality of water resources governance systems, performance of good governance principles, and water resources management effectiveness (Rogers et al., 2003; UNDP, 1997).

The assessment was further guided by the water governance definitions and the user's guide for assessing water governance of the United Nations Development Program (2013), which emphasizes actors and institutions, governance principles, and performance as a basic framework for assessing water governance (Jacobson et al., 2013). The estimated sample size of 383 refers to the procedure suggested by Krejcie and Morgan (Krejcie and Morgan, 1970) , though only 342 questionnaires of the 383 received were fully completed, with 156 questionnaires responding from the Mpanga river catchment and 186 questionnaires responding from the Semliki River catchment. The sample size was drawn from the population data on a sub-county level provided by the government in the study areas, estimated at 139,583 (Mpanga 117,774 residents, Semliki 21,809 residents according to the (Uganda Bureau of Statistics, 2016), and was proportionately distributed between the two study catchments. A simple random sampling of households using target village records as primary respondents to the research questionnaires was performed. Sampling using village-level data increased data collection feasibility and reduced the possibility of bias. The population sampling and selection of target villages targeted the project intervention sites which themselves mainly targeted communities near the main water resources at the upper (hilly or undulating landscape), middle (mostly peri-urban), and lower (relatively flat landscape and some fishing communities) segments of the catchments in Mpanga. A similar arrangement was assumed in Semliki catchment.

The survey questionnaire with both open and close-ended questions was used as the main data collection tool, targeting households. The focus group discussions (FGD), key informants guide, and transect walk checklist were used as complimentary data. The data collection exercise took place in July 2015 involving field household interviews, physical and telephone key informant interviews with 15 sector stakeholders (political leaders, cultural leaders, technical resources managers, policymakers, Water User Committee leader, and Civil Society Organisation members). Additionally, six focus group discussions (FGDs), each composed of 10–25 gender-equitable participants, were organised considering upstream, midstream, and downstream catchment zones as much as possible. During transect walks in the catchment, we rapidly evaluated the physical characteristics and validated some of the respondents' information. The focus group discussions and key informant interviews provided information considering issues at community and large spatial scale. The approach involving "multiple-levels and respondents checked for consistency as learned from validation methods relating to environmental governance (O'Neill et al., 2013). Secondary data and information were derived from government reports, plans, strategic papers, and policies. The methodology providing both qualitative and quantitative data from various sources, enabled in-depth exploration of issues while allowing credibility testing of the research findings as the case in other studies (Barabas and Jerit, 2010; Gable, 1994; Kayser et al., 2015; Pahl-Wostl et al., 2012).

Qualitative data were numerically coded to allow tabulation and computation of descriptive statistics using the STATA statistical package (StataCorp LLC: College Station, TX, USA). During analysis, the neutral responses were controlled (out) as per variable attributes scale of measurements to generate the site-specific means and t-statistics. Data from Semliki River as the base study catchment was coded zero (0), while data from the Mpanga river catchment affected by integrated water resources management measures was coded one (1).

A two paired t-test on the mean proportions (%) from the descriptive statistics was carried out, the interpretation of which made it possible to establish the water resources governance status and whether a significant difference in water resources governance existed between Mpanga and Semliki River catchments. Qualitative data from observation checklists, interviews and focus group discussions notes were analysed, applying content analysis techniques (Onwuegbuzie et al., 2009).

The catchments maps (figures 4.1 and 4.2) were delineated based on a Digital Elevation Model (DEM) based on Shutter Rudder Topography Mission (STRM) with 30 × 30 m resolution (Earth Science Data Systems, 2022). DEM data were processed applying QGIS 3.12.2 and Arc Map10.7 (ESRI, Redlands, CA, USA). Additional spatial datasets used were acquired from arc GIS base maps by National Geographic and Esri, World Resources Institute (WRI, 2016) and the United Nations OCHA Humanitarian Data Exchange database (OCHA, 2022a). We present the study results in an order that reveals the respondents' knowledge and capacity regarding the research theme, the respective evaluation of the governance situation and resource management effectiveness outcome. We later discuss the findings, offering more information on the studied variables and local context.

4.3 Results

4.3.1 Respondents' water resources governance knowledge and capacity

Catchment stakeholder's knowledge and capacity are important aspects of integrated water resources management. Therefore, based on the possible implementation of the capacity development strategy of the water and environment sector (MWE, 2012), we evaluated respondents' knowledge and capacity. Variables examined included knowledge of basic water sector issues like the relevant actors and institutions, water resources governance elements like water rights and legislations, individuals' community capacity to contribute to improved water resources management and governance in the community and access to capacity development opportunities.

The results show a statistically significant difference in knowledge and capacity between the respondents of the Mpanga river catchment, which was influenced by integrated water resources management projects, and the respondents of the Semliki catchment, which was without any influence of integrated water resources management projects. For instance, the Mpanga catchment respondents' knowledge of the relevant institutions and actors was significantly different ($\alpha < 0.05$), and the same applies to water resources governance issues ($\alpha < 0.01$) and the individuals' community resource management capacity ($\alpha < 0.01$) (table 4.3).

4.3.2 Water resources governance in the catchments

Water sector reforms and the adoption of the integrated water resources management approach promise to transform the water resources systems to those coherent with good water management and governance principles. The water resources systems of governance, also

known as styles, are characteristically defined by decision-making procedures and approaches at the local level. The characteristic features were categorised as collaborative, polycentric, new public management (NPM), traditional or customary, and conventional systems. The results indicate the prevalence of the conventional governance system, following the percentage of observations in both catchments, in comparison with other systems of governance (table 4.2). Efforts to engage stakeholders through collaborative means like signed Memoranda of Understanding (MOU) while implementing integrated water resources management were observed in the Mpanga catchment.

Table 4.2: Water resource systems of governance.

System of Governance	Semliki Catchment % Of the Total Observations	Mpanga Catchment % Of the Total Observations
Conventional	30	28
NPM	24	17
Collaborative	22	23
Polycentrism	7	18
Traditional	17	14

Water governance, defined as a range of political, social, economic, and administrative systems present for managing water resources and subsequent services, is explored. Guided by contextual examples, the results indicate the Mpanga river catchment area, which has been affected by integrated water resources management projects, has markedly more socio-economic, political, and administrative structures than the base catchment of Semliki River. Descriptive statistics of the occurrence of water governance components comparing the two catchments show that the presence of political systems supporting water resource systems occurs significantly more frequent in Mpanga river catchment than in Semliki River catchment ($\alpha < 0.01$). Correspondingly, economic systems present in both catchment areas strongly differ, and are more advance in the Mpanga river catchment than in the Semliki river catchment ($\alpha < 0.01$).

In contrast, the locally established administrative systems, as well as traditional resource management systems, do not significantly differ ($\alpha > 0.05$). The political systems and structures were widely reported in both catchments. However, the traditional systems were less engaged, the administrative systems exhibited enforcement challenges, and multi-stakeholder financing was the prevalent economic system (table 4.3).

Table 4.3: Water resources governance character comparison in Mpanga (n = 156) and Semliki catchments (n = 186).

Variable	Semliki catchment		Mpanga Catchment		Both Catchments		t-Statistics
	Mean	Std	Mean	Std	Mean	Std	
Knowledge and capacity							
Knowledge of water resources stakeholders, institutions	1.432	0.497	1.577	0.496	1.498	0.501	−2.679*
Capacity building opportunities accessed	2.211	0.409	2.380	0.487	2.287	0.453	−3.423*
Individual knowledge	1.092	0.339	1.368	0.484	1.227	0.438	−5.279*
Community resource user' capacity	−0.398	2.091	0.234	2.263	−0.114	2.189	−2.531**
Water resources governance							
Political systems presence	2.135	0.343	2.618	0.487	2.374	0.485	−10.052*
Traditional systems presence	2.068	0.254	2.164	0.372	2.110	0.314	−2.665**
Economic systems presence	2.000	0.000	2.191	0.395	2.085	0.279	−6.435*
Administrative systems presence	2.989	0.756	3.205	0.649	3.088	0.717	−2.801**
Functionality of systems							
Systems to report concerns and handle disputes	2.531	0.500	2.600	0.491	2.563	0.496	−1.242
Systems enabling water legal rights	2.150	0.358	2.322	0.468	2.228	0.421	−3.702*
Systems enabling obligations	2.068	0.253	2.285	0.453	2.175	0.380	−5.286*

Systems for resource management (Water Committees)	2.367	0.483	2.454	0.501	2.396	0.490	−1.3683
Water resources management							
Water resources management effectiveness	1.622	1.221	2.473	1.506	2.008	1.419	−4.9038*

Note: ** = Significant at 5%, * = Significant at 1%: Neutral responses were controlled during analysis. The negative means realised at with bi-polar Likert scales. The means of 2.0 in Semliki were a result of the same response in negation by all respondents, thus no variation in the mean, after controlling out the 'neutral' responses.

The functionality of the water governance systems is examined from the resource user perspective as a mechanism or institution through which citizens articulate interests, exercise legal rights, meet obligations, and mediate their differences. The resource governance structures at the lower local government level mostly multi-function with the main objective guided by the establishing institution. Therefore, context-specific system functionality was analysed with respect to practical aspects of handling concerns, mediating conflicts, invoking social obligations, fulfilling water legal rights and local resources management. The functionality of systems differed statistically ($\alpha < 0.01$) between the two catchments, with the realisation of water rights and obligations being more supported in the Mpanga catchment, influenced by integrated water resources management projects. However, systems for handling water-related concerns were rarely present in either catchment, or the occurrence of its components like users' associations was not statistically different ($\alpha < 0.05$). Similarly, the local resources management committees, which included the water user committees, beach management units and environmental committees' functionality, was not significantly different between Mpanga and Semliki catchments ($\alpha < 0.05$) (table 4.3).

4.3.3 Water resources governance principles

The good water governance principles offered governance quality assessment indicators. Analysis of selected good water resources governance principles indicated a statistically significant difference between integrated water resources management projects catchment and the base catchment ($\alpha < 0.01$), including the principles of participation, responsiveness, equity and inclusion, effectiveness, rule of law, and transparency. However, aspects of integrity and anti-corruption did not show a significant difference ($\alpha < 0.05$; see table 4.4). The governance effectiveness principle also showed a significant difference ($\alpha < 0.01$). Integrated water resource management projects established multi-stakeholder forums for participation, local multipurpose water user committees and associations (WUC/A), organised dialogue meetings, facilitated capacity building, carried out policy dissemination, and projects also offered physical solutions to catchment challenges. In return, the differences in water resources governance effectiveness (table 4.4) and management effectiveness (see last section of table 4.3) were statistically significant between the two catchments analysed ($\alpha < 0.01$).

The results, therefore, point to the possible relationship between water resources governance quality or status and resource management effectiveness.

Table 4.4: Water governance principles significance tests results of Mpanga and Semliki River catchments.

	Mpanga Catchment (IWRM Pilot Projects Site)		Semliki Catchment (No IWRM Pilot Projects Site)		Both Catchments		
Principles	mean	std.dev.	mean	std.dev.	mean	std.dev.	t-statistics
Participation	1.127	1.109	−0.051	1.295	0.472	1.349	−8.103*
Accountability	−0.509	1.759	−1.392	1.330	−1.107	1.533	−3.502*
Equity & Inclusion	0.789	1.309	−0.564	1.302	−0.050	1.458	−7.123*
Transparency	0.308	1.281	−0.681	1.502	−0.268	1.492	−4.809*
Rule of law	−0.282	1.495	−100	1.316	−0.723	1.427	−3.418*
Integrity & anti-corruption	−0.572	1.806	−0.935	1.682	−0.813	1.728	−1.439
Responsiveness	0.910	1.538	−1.020	1.545	−0.169	1.813	−8.266*
Effectiveness (governance)	0.207	1.507	−1.430	1.046	−0.801	1.474	−7.869*

Note: * = Significant at 1%: Neutral responses were controlled during analysis.
The negative means realised are due to bi-polar Likert scales. The means of 2.0 in Semliki were a result of the same response in negation by all respondents after controlling out the 'neutral' responses.

Overall, the t-test results comparing the water resources governance characters of Mpanga catchment and Semliki River catchments are compiled in tables 4.3 and 4.4; statistics indicate a significant difference in water resources governance between the two study catchments for most variables at least a 5% level ($\alpha < 0.05$). The results hence indicate a significant difference in water resources governance and management effectiveness between areas affected by integrated water resources management projects and areas without integrated water resources management measures.

4.4 Discussion

4.4.1 Observations of respondent's knowledge and capacity

Survey responses and findings are dependent on several factors to be aware of, including respondents' knowledge, ignorance, mood, the sensitivity of the matter, opinion, surrounding circumstances, anticipated rewards, and methods (Ferber, 1956; Helgeson et al., 2002; Morten

and Kjell, 1991; Sauer et al., 2014). Integrated water resources management and water governance are relatively new and complex concepts among natural resources practitioners and local resource users. Therefore, respondents' basic knowledge about water resources governance and management, relevant sector stakeholders and institutions are important hints for effective participation in water resources management and participatory assessments thereof. Notably, integrated water resources management approaches are characterised by knowledge development, sharing, learning and transfer, including through online toolboxes and sites (Global Water Partnership, 2015b; Schulte et al., 2018). Implementing partners are, thereafter, expected to apply the knowledge through policies and practice. Such policies and mechanisms include the Uganda Water and Environment Sector Capacity Development Strategy (MWE, 2012).

Capacity may be defined as the capability of a society or a community to identify and understand its development issues, to act and address them, learn from experience, and accumulate knowledge for the future. Knowledge, on the other hand, can be viewed as awareness, acquaintance, skill, and familiarity with the facts surrounding water resources management issues and information. However, knowledge can both be input into capacity development and a product (Alaerts and Dickinson, 2008; Alaerts and Kaspersma, 2019). Depending on interests, knowledge and capacity, measurements tend to take diverse approaches (Alaerts and Kaspersma, 2019). Measuring individuals' basic knowledge of aspects relating to water resources management and governance in the country, actors and institutions were of interest for this study. Respondents' knowledge and capacity regarding water resources governance were more limited in the base catchment than in the catchment influenced by integrated water resources management projects. In addition to the difference in knowledge and capacity-building opportunities, other dynamics such as stakeholder involvement, structuring

and related institutional power dynamics are documented (Yinusa and Wehn, 2016). Stakeholders' knowledge and capacity compliments water and related resources management in practice, the participatory monitoring and learning in integrated approaches, as well as ensuring adequate survey evaluations (Ferber, 1956; Helgeson et al., 2002; Olsson and Folke, 2001; Vargas et al., 2019; Wagenet et al., 1999). Community water resource users may have both traditional and conventional knowledge about water resources governance and management and can access adequate information with the advancement in network technologies and multi-stakeholder collaborations to compel action. However, the flow of knowledge and information is patchy and disconnected at the local levels to effectively impact decision making and action (Pedregal et al., 2015; Schiffer et al., 2008). As such, water governance and water management knowledge monitoring, organisation and accommodation in integrated water resources management approaches are crucial (Buuren, 2013).

4.4.2 Catchments' water resources governance

The study examines the water resources systems of governance defined as an agreed relational and engagement mechanism of the various stakeholders in a defined framework (Pahl-Wostl, 2017, 2015). The stakeholders include the government, civil society organisations, resource users and markets (private sector). The 'top-down' governance style dominated in both catchments, and some cases of collaboration and intent to allow multi-stakeholder participation. Despite the top-down mechanism, also known as the conventional governance style, resource users reported holding informal power and decisions about water resources within their community jurisdictions and land. However, informal power dispersal is less harnessed in existing centralised governance legislation and approaches. Other system de-linkages exhibit when conventional water management systems tend to prioritise professional

and scientific "expert" knowledge and views more than indigenous experiences and knowledge (Bucknall, 2006). Remediation to informal power and knowledge exclusion includes good governance processes recognising formal and informal power decision-making actors and networks while demanding less centralised systems to accommodate 'down-up' stakeholder-driven interests and approaches (Bucknall, 2006). Examples of Stakeholder driven governance styles designed include collaboration among multiple stakeholders and public agencies without necessarily creating independence (Ansell and Gash, 2007).

Other models such as the public-private partnerships leverage financial resources, the polycentric systems allow issue-based independence and power clusters, while catchments with customary systems present equally use indigenous norms, practices, and knowledge. Water resources systems or styles of governance in Uganda (table 4.3) mostly bear characteristics of a centralized system. However, the results pointing to multiple governance styles affirm the argument that resource governance systems need to be designed while considering interests, biophysical resource scale and function levels (Mwangi and Wardell, 2012; Nunan, 2018; Termeer et al., 2010; Valk and Keenan, 2011). For instance, a transboundary resources governance system and integrated water resources management actions befit the Semliki catchment. Actions would include transboundary local water committees with participation from Uganda and the Democratic Republic of Congo. The inter-state transboundary catchment committee would enhance the regional Cooperative Framework Agreement (CFA) and the Nile Basin Initiative Act (2002) coordinated by the Nile Basin Initiative (NBI) among other international water instruments aimed at controlling state behaviour and promote cooperation (Brels et al., 2008). Governance of transboundary catchment aquifers is also critical, because over-abstraction, contamination and degradation of recharge areas threaten the sustainability of aquifers worldwide according to the

International Groundwater Resource Assessment Centre (Conti and Gupta, 2016; Villholth et al., 2018).

The water resources governance process includes establishing and making functional a range of socio-economic, political, and administrative systems to develop and manage water resources, and the delivery of water services (Jacobson et al., 2013; Rogers et al., 2003; United Nations, 1977). Using the integrated water resources management approach pillars for system examples, the social dimensions pillar focuses on equity of access to and use of water resources, equitable distribution of water resources and services among various social and economic groups. The economic dimensions pillar highlights efficiency in water allocation and uses, while the political dimensions pillar focuses on providing stakeholders with equal rights and opportunities to take part in various decision-making processes. The environmental dimensions pillar emphasizes the sustainable use of water and related ecosystem services (Allan and Rieu-Clarke, 2010; Lautze et al., 2011; Rogers et al., 2003). The conventional political systems could include a set of legal institutions that constitute either "government", "state", or a set of "processes "or interactions with other non-political sub-systems (Heslop, 2019). Thus, the different pillars offer a basis to define what constitutes the socio-economic, political, and administrative context of each system.

A range of examples of political, administrative, and socio-economic systems in the national context were used to guide system presence identification. For example, the elective and non-elective political appointees composed the range of political systems. The relevant state agencies and instruments, like water taxes, permits and fees, policies, bylaws, Acts of Parliament, guidelines, procedures, all mainly administered by a central or local government formed the administrative system. The range of socio-economic systems identified included Payment for Ecosystems Services (PES) schemes like the REDD+(Reducing Emissions from

Deforestation and Forest Degradation) program, water, or environmental funds. Other market and non-market schemes like mineral, oil and gas royalties, industrial and domestic water user fees, water extraction and effluent discharge permit fees as well as related project grants were also included. The traditional systems of water resources governance identified with social norms, practices, and cultural leadership involvement. Systems examples were mostly aligned according to the main objective for the establishment to avoid double reporting.

The occurrence of water governance systems was more pronounced in the Mpanga catchment, influenced by integrated water resources management projects. However, political systems and structures prevailed more than the administrative, economic, and traditional systems in both study catchments, in addition to multi-purposing especially at the lower administration level. The involvement of political systems in natural resources development and management in developing countries, including Uganda is, however, to be regarded with caution, given the possibility of political sabotage from interests and power surpassing scientific knowledge and effective resources management (Collier, 2010; Muhereza, 2006; Saito, 2007). The identified socio-economic-political and administrative water systems need to be capable of serving different purposes. While there are possible variations in the measurement of functionality, the study related functionality to the presence of governance systems as compositions of mechanisms, processes and institutions through which citizens and civic groups articulate their interests, exercise their legal rights, meet their obligations, and mediate their differences (Grigg, 2011; Jacobson et al., 2013; Rogers et al., 2003; UNDP, 1997). We regard the functionality of systems significantly different with respect to the realisation of water resources use rights and the facilitation of user obligations and exclusive conflict management. Possible reasons observed for limited functionality include the prevalence of a 'top-down' style of governance, the limited reach and scale of projects, and the absence of competent local

resources committees in most areas. The findings are related to previously observed gaps in governance systems and challenges during the implementation of policies and enforcement of legislation in the water and environment sector in Uganda (Akello, 2007; Global Water Partnership, 2015b; Muhereza, 2006; Naiga et al., 2015; Saito, 2007; Songa et al., 2015).

Water governance principles are key measurement indicators of water governance quality. The quality of water resources governance, as indicated by the water governance principles, was significantly different between the two study sites, as was the anti-corruption principle (Table4). Stakeholders' participation was enhanced, according to the results, while the perceived deficiencies in integrity and fighting graft concurred with earlier studies on transparency, integrity and accountability in the water and sanitation sector in Uganda (Jacobson et al., 2010). The results indicate that the integrated water resources management approach has a high potential to ensure good water governance; this finding is consistent with chances of success documented elsewhere, like the case of Zambia (Lenton and Muller, 2009; Uhlendahl et al., 2011).

Water challenges persist to varying degrees in both study catchments, independent from already practised integrated water management approaches and the national policy direction. The mixture of successes and challenges observed is to some extent consistent with the successful evidence and approach limitations documented elsewhere (Allan and Rieu-Clarke, 2010; Biswas, 2008; Global Water Partnership, 2015b; Uhlendahl et al., 2011; United Nations et al., 2012), including the view of Integrated Water Resources Management as a fixed concept rather than understanding it as a flexible and adaptive concept with the capacity to accommodate alternative resource management approaches (Giordano and Shah, 2014).

The results also point to the possible mutuality in ensuring successful implementation of the integrated water resources management approaches and improving water resources

governance. Thus, there is an absence of a very defined linear order of 'horse before the cart' (Lautze et al., 2011). Ineffective water resources governance stifles water resources management effectiveness, as observed in the Semliki catchment, which was unaffected by integrated water resources management projects (Bucknall, 2006; UNDP, 1997; UNESCO and World Water Assessment Programme (United Nations), 2006).

The shortfalls observed in water resources governance in this study equate to policy failure, a possibility also observed in managing interconnected and complex natural systems using approaches incompatible with the broader approaches to governance and public management (Lenton and Muller, 2009) . It is argued that policy failure (fully or to some degree) is a normal element of natural resources governance, including water resource governance; however, public policymakers fail to contemplate and manage this contingency (Castro, 2007; Martin and Williams, 2013). Policy failure as a constituent of governance failure may be due to the insensitivity of water management institutional (instruments and agencies) and decision-making processes to stakeholder needs at all levels. In consequence, this leads to failure in administration, technical services delivery, financial and economic management and political oversight in the water and related resources sector (Bakker et al., 2008). Other documented reasons for governance failure are related to state and market failure, given the involvement of the state and the private sector in water resources management and development. The state induced failures might result from over- and or under-regulation, ill-defined rights, nonfulfillment of set resources management goals, corruption, poor leadership, inadequate policy, and legislative responses. The co-existence of formal and informal power structures characterised by political sabotage, power struggles and withholding of useful resources also affects good governance efforts (Pahl-Wostl et al., 2013); strategies to overcome policy failure include appropriate instruments to improve institutional credibility and efficiency where markets and regulatory instruments require efficient legal and administrative systems

trusted by the community (Martin and Williams, 2013). Additional strategies could include the development of more effective water governance and related land governance regimes designed to overcome government failure, market failure and system failure or a combination of the three (Rogers et al., 2003). Importantly, water governance regimes are expected to be cognizant of the Dublin water principles and related management approach principles (Solanes and Gonzalez-Villarreal, 1999).

The implementation of the integrated water resources management approach in selected watersheds drew lessons about the costs of work at varying scales conducted by multiple stakeholders and institutions (MWE, 2018, 2013). As study results indicate the likely effect of unmatched financing for water resources management and governance of catchments, a case in literature demonstrates how the integrated management approach comes with an increase in governance costs, but a drop in infrastructural costs (figure 4.3).

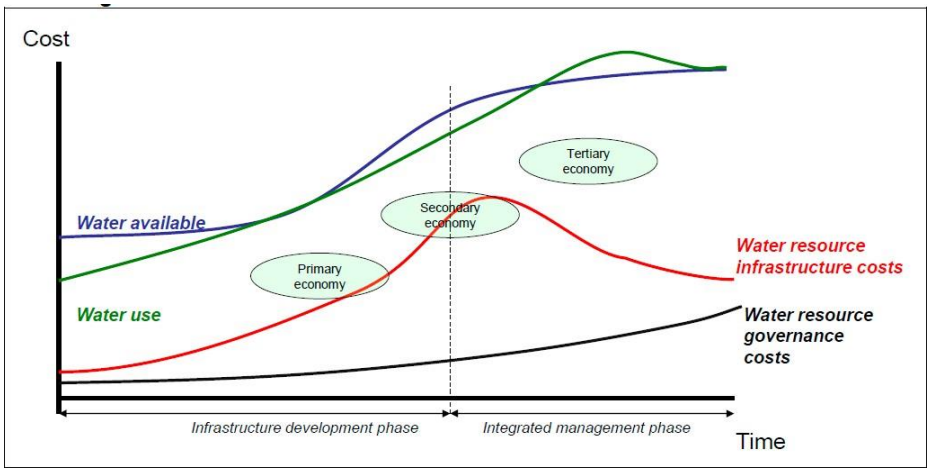

Figure 4.3: Costs dynamics of water resource governance (black line), water resource infrastructure (red line) and XYZ (green line) as a function of time and related to infrastructure development and implementation of integrated water resource management (graph adapted from EU Water Initiative—Finance Working Group (EUWI-FWG), Report of 2012 on Financing Water Resources Management/Experiences from Sub-Saharan Africa (Winpenny et al., 2012).

4.5 Conclusions

The water crisis can alternatively be called a water governance crisis. Thus, integrated water resources management approaches and concepts for alleviating both crises have evolved since the 1990s. This study contributes to the increasing consensus regarding the interconnectivity of resources, systems, and sustainable development, viewing the integrated water resources management approaches as a key block to successful land and water resources management and governance (Jiménez et al., 2020). The case of the integrated water resources management (IWRM) approach relies on the three cornerstones of establishing an enabling environment, institutional framework, and management instruments. The existing literature indicates the possibility of success or failure of this approach in attaining the desired goals. The adoption of integrated water resources management in Uganda has included water sector reforms and experimental projects implemented in selected catchments since 2006. In this study, the water resources governance situation of two catchments compared. Both located in the Albert Water Management Zone of the Lake Albert Basin, the river Mpanga catchment has been influenced by the implementation of integrated water resource management projects and was evaluated and compared with a base-catchment that has been unaffected by integrated water resource management projects, that is, the river Semliki catchment (focusing on the Ugandan side). The results show the water resources governance situation to be significantly different between the two catchments under the same water administration. Recognising integrated water resources management as a nationally agreed water management strategy in the water policy, the study findings further demonstrate the effects of differentiated policy translation. Statistical differences in the characteristics of water resources governance and the resulting management effectiveness were highlighted, clearly showing the impact of integrated water resources management on improving water resources governance in the Mpanga river catchment, while

water resources governance was largely poor in the Semliki River catchment. Thus, integrated water resources management improves water resources governance and management effectiveness. We observe the integrated water resources management concept to embody both water management and governance tenets; thus, it is double-pronged, ensuring mutual effectiveness. The comparison between both catchments additionally indicates the necessity of including various aspects such as spatial scale, level of action, policy, and institutionalisation for the successful implementation of the integrated water resources management approach.

Persistent challenges observed in both study catchments include the increasing demand for arable land, leading to riverbank encroachment, catchment deforestation and degradation, in conflict with natural resource rights and land tenure. These challenges, coupled with limited enforcement of legislation, threaten resource sustainability and related management objectives in both Semliki and Mpanga catchments. We,thus, recommend an appreciation of the integrated water resource management approach that is highly cognizant of the local context at the time, to improve water resources governance. The aspirations of the approach include holistic management of land and water resources, which implies future research to consider the examination of water and land resources governance for a holistic view.

4.6 Chapter linking with other chapters

The paper is an output of objective one seeking to establish the state of integrated watershed management in a dynamic land tenure context. The case study orientation builds on the state-of-the-art debates regarding the functionality of integrated watershed management approaches. The case study shows, integrated water resources management approaches improve water resources governance. However, land tenure issues arise in due process as some of the local limiting factors to integrated watershed management potential.

Katusiime J, Schütt B. Linking Land Tenure, and Integrated Watershed Management—A Review. *Sustainability*. 2020; 12(4):1667. https://doi.org/10.3390/su12041667

CHAPTER 5: LINKING LAND TENURE AND INTEGRATED WATERSHED MANAGEMENT—A REVIEW

Abstract

Land tenure is given attention in the general discussions on conservation and management of natural resources, but the necessary holistic approach to understand the linkages is less considered. Thus, we considered a watershed as a unit of reference and Integrated Watershed Management as a holistic land and water resources management approach with various roles and touchpoints with land tenure issues. To examine the role of land tenure on the management of natural resources in watersheds, we reviewed and compiled literature that captures watershed issues, integrating aspects of land tenure, and aiming to identify the key land tenure roles, dynamics, and its influences on integrated watershed management. Land tenure is observed playing various roles in watersheds and, thus, also on integrated watershed management as an approach as a driver of change, influence for investment decisions, an incentive for adoption of practices, and leading to sustainability. Land tenure dynamics range from land tenure security, land tenure forms, land access and acquisition modalities, and how these aspects of land tenure relate with integrated watershed management.

Keywords: Land resources, Conservation, Holistic approach

5.1 Introduction

The United Nations Agenda 21 for sustainable development recommends the integrated management of land resources. The agenda broadly includes soils, minerals, water, and biota in subsection 10, while subsection 13 acknowledges mountain watersheds protection (United Nations Sustainable Development, 1992). The recommendation enhances the watershed approach from the initial focus on forestry and forestry hydrology to include the complex actions, resources, and stakeholders in a proposed hydrological system area (FAO et al., 2006). Consequently, applying the watershed approach for land resources management uses the watershed as a spatial unit of analysis and as an evolving practice for the management of land, water, biota, humans, and other resources in a defined area for ecological, social, and economic purposes (Wang et al., 2016).

Land resources immensely promote rural livelihoods, especially in developing countries. In Africa, an estimated 70% of the population directly depends on the land and natural resources for food security and sustainable development (Economic Commission for Africa, 2012). The relationship, whether legally or customarily defined, among people, as individuals or groups, concerning land refers to land tenure. Therefore, as a determinant of ownership, use, influence, and decision making, land tenure is a key factor in resources management and resource degradation (FAO, 2002a). Land tenure significance is also demonstrated by research exploring household land-use decisions at micro-levels that indicate the need for physical capital to span economic growth and land governance systems (Hettig et al., 2016). Land uses can both harm or enhance the environment as determined by existing rules of land acquisition and access (FAO, 2002a). Possible land ownership insecurity issues frequently lead to poor use of resources because it influences practices, abilities, and choices in line with adoption,

sustainability, effectiveness, and efficiency among others (FAO, 2002a).

In this way, land tenure insecurity also affects the effectivity of integrated watershed management (Kumar et al., 2009).

Multiple empirical studies available about land tenure and resources management in watersheds, mostly focus on fragmented research problems, watershed components, geographical locations, and methodologies. In this review paper, we compile information related to land tenure and resources management in the watershed in a multi-perspective approach. The focus of the review is on (a) to examine the role of land tenure in integrated watershed management, (b) to identify key land tenure dynamics (issues), and (c) to identify areas for further research about land tenure and integrated watershed management.

5.1.1 Integrated watershed management concept

The approach of integrated watershed management has evolved in terms of definition, scope, and application in water and land resources management since at least 200 BC and gained increasing attention in the late 20th century (Abeywardana et al., 2018; Bebermeier et al., 2017; Roth et al., 2016; Wang et al., 2016). Integrated watershed management is defined as the process of formulating and implementing a course of action involving natural and human resources in a drainage basin, taking into account the social, political, economic, and institutional factors operating within the drainage basin, the superordinate river basin, and other relevant regions to achieve specific social objectives (Dixon and Easter, 1991). Because land resources and other resources systems interconnect in a drainage basin, the need for joint actions and responses between the various stakeholders through integrated management is emphasized (Tennyson, 2005). The linkages between upstream, midstream, and downstream drainage basin areas

fulfil the idea of trans-media environmental management, using the "ecosystem" as the concept, born out of the experience that single–medium or sectoral management was less successful (Heathcote W, 2009). Applying the holistic approach of integrated watershed management enables different actors to protect and restore the physical, chemical, and biological integrity of ecosystems and human health and to preserve the base for sustainable economic growth (National Research Council, 1999). Watershed interventions include land use planning; controlling erosion and sedimentation potential; managing streamflow patterns; ensuring soil, water, and forest conservation; and enhancing food production, security, and livelihoods (Biswas, 1990). The indicators relating to the quality and quantity of water resources, land cover, ecosystem health, legislations, livelihood improvement, knowledge generation, and research apply when measuring the effectiveness of integrated watershed management and interventions (Heathcote W, 2009; Wang et al., 2016).

5.1.2 Land tenure concept

Land tenure is normally categorized into four different types (Kasimbazi, 2017):

- Nationalized tenure, where the state has full ownership rights;
- Freehold tenure, where individuals envisage absolute rights;
- Leasehold tenure, where land is held based on contract or agreement for a specific time;
- Customary tenure, with land administered through and by indigenous customs.

The different land tenure systems and formations occur globally due to historical and social controlled parameters including legislation, cultural traditions, global trends, political situations, and social classes (Kasimbazi, 2017). In Sub-Saharan Africa for example, next to freehold; leasehold; state, public, and cases of crown land; land tenure systems; and arrangements, customary and native land tenure systems predominate (Economic Commission

for Africa, 2012; Kasimbazi, 2017). Customary land tenure is found to differ in the degree of individualization (the extent of rights held by families as opposed to the state or communal authorities), exclusivity, and property inheritance patterns (Place and Otsuka, 2000; Somarriba-Chang, 1997).

Land tenure is argued to be a derivative of the concept of natural resources tenure, though "tenure" is largely a social construct (Economic Commission for Africa, 2012, 2004). Tenure is a possible instrument for conservation since tenure defines the relationships and rules between people, land, and related resources. The rules define property rights of use, transfer, and control through statutory or non-statutory laws (Kasimbazi, 2017).

5.2 Role of land tenure in integrated watershed management

Land tenure plays various roles in watersheds and related management, including;

- Land tenure as a driver of land use and land cover changes but also subsequently affecting hydrological, climatological, geomorphological, infrastructural, and developmental changes in watersheds (Borrelli et al., 2017; Fox, 2002; Kakembo, 2001; Kleemann et al., 2017; Mwangi et al., 2017; Petchprayoon et al., 2010; Place and Otsuka, 2000; Somarriba-Chang, 1997; Turner et al., 1996).
- Land tenure as an influencer of (human) actions and decisions (Bebermeier et al., 2017; Johnson et al., 2002; Liu et al., 2018; Price, 2007; Vargas et al., 2019; Zizinga et al., 2017).
- Land tenure as a determinant for land use, plans, and arrangements (Fox, 2002; Mwangi et al., 2017; Place and Otsuka, 2000; Stanfield et al., 2002; Turner et al., 1996; Wannasai and Shrestha, 2008).
- Land tenure as a tool for controlling access, ownership, and disposal of land resources (FAO,

2002a; Hettig et al., 2016; Kasimbazi, 2017; Kumar et al., 2009; Mwangi et al., 2017).

- Land tenure as a basis for other resources tenures such as forest and tree tenures (Holland et al., 2014; Naughton-Treves and Day, 2012; Parker et al., 2007; Robinson and Naughton-Treves L., 2011; Wannasai and Shrestha, 2008).

Land tenure drives land-use and land-cover change in watersheds. Pieces of evidence recorded include the changes in vegetation cover and the spatial distribution of species measured against population, land tenure, and climatic factors pointing to the effects of long-term human activities, with differences in land management practices that vary with land-tenure systems as the main controlling factor (Kakembo, 2001). Land tenure is also cited in land cover conversions and changes as a means by which people and companies acquire and own land informally, strengthen tenure security, and alternate land use, as observed in the Mara River basin in East Africa (Mwangi et al., 2017). Land tenure underlies some of the gradual land use and covers change processes by farmers converting forests to areas first used for annual crops and thereafter used for perennial crops (Wannasai and Shrestha, 2008).

Land tenure–driven land cover changes manifest variably, responding to spatial diversity and patterns according to a study done in Oregon state watersheds in the US. These patterns exhibited by distinguishable forest cover corresponded to the diverse state, federal, and private land ownership types, where private lands carried few forests and low forest diversity (Stanfield et al., 2002; Turner et al., 1996). Tenure diversity is also observed in customary land tenure systems, resulting in varying effects on watersheds and management practices such as tree cover and community tree management according to case studies from Uganda and Malawi (Place and Otsuka, 2000) and riparian vegetation and stream bank erosion according to a case study in South Africa (Kakembo, 2001).

The effects of land tenure on land-use changes in drainage basins have globally resulted in hydrological changes and increased soil erosion risks (Borrelli et al., 2017; Petchprayoon et al., 2010). At a local watershed scale, soil erosion costs can be economically estimated, as a case study from Malawi shows, indicating 20% maize yield loss and 8% long-term soil productivity loss (Lovo, 2016). Consolidating land tenure mitigates some economic losses and costs due to land degradation (Nkonya et al., 2016). Soil erosion risks and patterns have been linked to land use and related land tenure practices such as land fragmentation, especially in agrarian communities. A case study from Nicaragua documents increased soil erosion rates at farming units of less than four hectares in size, characterized by high land-use intensity and land fragmentation among smallholders (Somarriba-Chang, 1997).

Land fragmentation mostly results from land-use policies and reforms that promote individualization rather than communal land ownership arrangements, as observed in Cambodia (Fox, 2002). Other risks associated with land fragmentation include the intensive use of land resources, increased costs of extension services to individuals, the complexity of large scale planning, and land use and land cover patchiness (Fox, 2002; Mwanjalolo et al., 2018; Somarriba-Chang, 1997). Despite the likely negative outcomes from land fragmentation, arguments to support fragmented and mixed land tenure systems advance the likely benefits of land fragmentation to an ecosystem and biodiversity in landscapes (Stanfield et al., 2002).

The role of land tenure is both indirect and complementary to other factors driving changes in watersheds. These factors, for instance, include demographic factors (population, gender, migration, employment), agricultural expansion, infrastructural development, climate conditions, and watershed resources management approaches (Kakembo, 2001; Kleemann et al., 2017; Place and Otsuka, 2000). For instance, gender, marriage, and migration differently influence

environmental actions under matrilocal and patrilocal land ownership and inheritance systems among the Chewa and Yao community in Malawi. The Yao patrilocal communities were less affected by migration, norm changes and less destructive environmental practices than the Chewa matrilocal communities (Place and Otsuka, 2000). Unemployment among the local population results in unsustainable watershed use and livelihood options like fuelwood trading. Poverty and unemployment persisted with the lack of land or possession of small plots of land in some Zambian communities. Therefore, there is a link between unemployment, unsustainable livelihood options, and land ownership. The smaller the piece of land owned, the higher the probability that the smallholder and his family participate in fuelwood collection and marketing and, thus, trigger local deforestation as pointed out in a case study from Zambia (Mulenga et al., 2015).

Adequate knowledge about watershed issues and the capacity of resource users contribute to effective participation and decision making in watershed management (Johnson et al., 2002; Olsson and Folke, 2001; Vargas et al., 2019; Wagenet et al., 1999). However, a study conducted in the Philippines indicates land tenure arrangements rather than inadequate knowledge constrained farmers' engagement in soil erosion management (Price, 2007). Land tenure, therefore, also plays a complementary role in functionalizing community capacity and other resources use.

Considering land tenure while practicing integrated watershed management is imperative because beneficiaries might be operating in a land tenure system that restricts their decision-making capacity and participation. Thus, in the past watershed planners frequently fixated on the infrastructural, economic, and biophysical attributes of integrated watershed management while neglecting land tenure social elements risked-limiting local participation (Parker et al., 2007).

Integrated watershed management includes natural and societal components of human resource development, water and soil use, and the promotion of wise resource use with each type of land use in a drainage basin as competing interests (Schütt and Förch, 2004). However, several factors influence the effective integration, promotion and adoption of wise use practices, including land tenure (Knowler and Bradshaw, 2007; Kumar et al., 2009; Liu et al., 2018; Zizinga et al., 2017). Some communities have complex land tenure systems, characterized by both formal and informal rights on shared resources and fragmented land resources governance. In such cases, discrepancies exist between the "would-be right" technical solutions and socially or legally accepted interventions on various lands (Kumar et al., 2009).

Globally, watersheds currently experience increased land and water demand for agricultural expansion and other uses (FAO, 2017; Mwangi et al., 2017; Mwanjalolo et al., 2018). Agricultural water use alone is estimated at 70% globally and 95% in developing countries and is expected to increase because of an increasing number of irrigation projects (FAO, 2017). Large scale agricultural investments, and especially agricultural irrigation projects planning, and design are rarely void of land tenure issues arising from access, people displacement and resettlement repeatedly (Tiffen, 1985). Increased resources demand and competing interests in watersheds led to the need for incentive-based models in resources use. Incentive-based approaches, including Reducing Emissions from Deforestation and Degradation (REDD+) and other Payment for Ecosystem Services (PES), aim mainly at protecting and promoting sustainable use of shared natural goods and ecosystems services while engaging relevant stakeholders in beneficial partnerships (Holland et al., 2014; Naughton-Treves and Day, 2012). The approaches slightly engage in defining resource use relationships, benefits, obligations, and property rights of forestry or tree tenures, use of water, carbon, mineral credits, and permits (Holland et al., 2014; Naughton-Treves and Day, 2012; Robinson et al., 2014). Thus, the requirement to understand prevailing property rights and land tenure as a

prerequisite to participation in incentive-based projects. One of the aims is to avoid potential limitations from state incompetence, conflicts from competing and overlapping interests from indigenous dwellers and other users, land-tree tenure, and carbon rights (Naughton-Treves and Day, 2012; Robinson et al., 2014).

5.3 Land tenure dynamics in integrated watershed management

The term dynamics denotes a discourse marked with assertions, suppositions, questions, and sequences of statements in importance (Muskens et al., 2011). However, land tenure studies have interpreted dynamics in the direction of changes. For instance, the demonstration that land tenure in Africa evolved along with socio-economic and technological changes, and overtime getting simplified and individualized rights (Bruce and Migot-Adholla, 1994), and the account of land tenure changes in East Africa (Otto et al., 2019). We employ both interpretations of dynamics as a change and as a discourse to offer a holistic discussion of key land tenure dynamics in the context of integrated watershed management. We categorized three key land tenure dynamics discussed in the following section.

5.3.1 Land succession and gender dynamics

Land ownership changes with time, thus requiring a lifelong ritual of inter-generational access and acquisition through succession and inheriting for instance. Evidence from the literature indicates a positive association between secure land ownership with a succession plan and an emphasis on conservation because the reasons for ensuring environmental quality include the assured possibility of future productivity (Parker et al., 2007). The land succession discourse includes a focus on gender disparities, where women and other marginalized groups miss out

or rather access land rights mainly through their male kin (FAO, 2002a, 2002b; Kasimbazi, 2017). Concerning gender and sustainable land-use practice decisions, studies have examined whether the gender of the head of the family influences pro-conservation land-use decisions (Lovo, 2016). One such case study from Malawi indicates that male decision makers are more likely to invest in soil conservation measures than the female decision makers in a patriarchal inheritance system. This finding did not hold for female decision makers in a matriarchy inheritance system; however, male decision makers preferred to invest in soil conservation measures in that second case (Lovo, 2016).

5.3.2 Land tenure system dynamics

Land tenure systems, forms and classes refer to categorizations of land tenure practices, defined bundles of rights and means of administration (see Section 5.2), held by the state, other public institutions, and private entities or individuals. Public land tenures such as protected natural resources reserves show more land management and conservation results, biodiversity, species richness, land cover, and a conservation dividend than on private land tenures. Possible reasons for the variability include the land management and incentive measures that occur on the various land tenure arrangements (Kutt and Gordon, 2012; Woinarski et al., 2013). Effects of differentiated resource management models captured in a case study on community tree cover on Mailo land tenure, a semi-customary land tenure system in central Uganda characterized by land custodianship because of absentee landlords and land squatters, crown landownership, and individual Mailo landowners (Place and Otsuka, 2000). Tree cover observed among resident Mailo owners was higher than on absentee Mailo owners land with squatters and on public lands including the commons. Additionally, possible reasons for the tree cover difference included the highly individualized rights among Mailo

landowners for long-term land and trees conservation investments compared to public land (Place and Otsuka, 2000).

While studies associate higher losses of watershed resources like forests with private land ownerships (Paneque-Gálvez et al., 2013; Robinson et al., 2014), the contribution of private lands to landscape biodiversity and conservation is reported (Woinarski et al., 2013). Private land ownership contribution to landscape biodiversity value suggests the need to integrate into national conservation frameworks, especially in the developing countries where degradation on both state and private land tenure systems is high (Bruce and Migot-Adholla, 1994; Robinson et al., 2018). However, in Ethiopia, government-financed watershed programs targeting private land for adoption and scale-up of soil and water conservation techniques document the potential challenges that result from mixing public interests and private land ownership. Observed challenges of integrating privately owned land for public resources conservation practices include limited adoption and scale-up possibly due to community members' unwillingness to invest private finances into shared resources conservation work, and costly technologies (Gebremedhin and Swinton, 2003) . The example from Ethiopia is not isolated, other programs about public and private sustainable development financing have encountered related challenges with land tenure systems (Emerton, 2006; FAO, 2015; Girling and Bauch, 2017; Lambooy and Levashova, 2011).

5.3.3 Land tenure security dynamics

Land tenure security refers to the assurance that land-based property rights remain upheld by society or institutions. The rights may be held by individuals, governments, groups, or communities (Kasimbazi, 2017; Robinson and Naughton-Treves L., 2011). Land tenure

security characteristics include full land ownership rights, predictable and long-term occupancy, and proof of ownership. Land tenure insecurity relates to short term land tenancy contracts, unpredictable occupancy periods, unprotected or defined rights and lack of ownership evidence. Land tenure security, however, is also likely perceptional, attainable formally and informally, with the possibility of status change (Bruce and Migot-Adholla, 1994; Kasimbazi, 2017; Wannasai and Shrestha, 2008). While land tenure security or insecurity is a status, either situation is possibly a result of social and economic processes and changes. Informally initiated land tenure security processes include the case of farmers converting natural forests to croplands and subsequently claiming ownership of the land (Johnson et al., 2002); farmers investing in long-term watershed measures like tree planting to mark ownership, boundaries, and secure the land (Neef et al., 2000); and other processes of formal institutional measures like obtaining formal land documents such as land titles (Blackman et al., 2017a; Buntaine et al., 2014; Robinson et al., 2018). Land tenure reform processes in various African countries, for instance, have formalized land tenure systems and land tenure titling to centrally secure land (Bruce and Migot-Adholla, 1994). A study comparing the land tenure security situation among formal and informal land tenure systems landholders in the Prasea watershed in Thailand found cases where both formal and informal land tenure holders were reportedly secure. The confidence exhibited in either formal and informal land ownership security by the Prasea watershed communities was attributed to the likelihood of land tenure homogeneousness and occupation by indigenous owners with given land rights even without formal registration and land titles (Wannasai and Shrestha, 2008). Still, land tenure security motivates most transitions from traditional undocumented to documented land tenure systems (Robinson et al., 2014).

Land tenure security may have both positive and negative effects on watershed use and watershed management. The literature focusing on forestry protection mainly associates protected areas as a form of land tenure with positive conservation outcomes. In addition to the presumed land tenure security through protected areas, land tenure security is also associated with less deforestation regardless of land tenure form, accounting of potential variations in assessment approach, location, and other factors (Robinson et al., 2014). Land tenure security contributes to land conservation through influencing soil and water conservation actions in watersheds by enhancing household willingness to invest in high-cost and long-term conservation practices like stone bunds, as documented in a case study from Ethiopia (Gebremedhin and Swinton, 2003). Land tenure security additionally enhances the intensity of investments into watershed protection measures and the likelihood of the adoption of good watershed use practices compared to village institutions, market access, and population density development domains, as shown in a case study from Kenya (Kabubo-Mariara et al., 2010).

Land titling is one of the mechanisms sought for land tenure security. Advocates of land titling argue that it spells out land rights, builds confidence into long-term conservation-friendly investment benefits, and the ability to exclude destructive users or competition (Bruce and Migot-Adholla, 1994; Deininger et al., 2008; Kasimbazi, 2017; Robinson et al., 2014; Wannasai and Shrestha, 2008). Therefore, land titling is claimed to protect indigenous communities' forests in the Peruvian Amazon (Blackman et al., 2017a), a finding that is appreciated, but we must be cautious not to extrapolate without rigorous location and methodological consideration (Blackman et al., 2017b; Robinson et al., 2017). A case study from Ecuador comparing titled and untitled land tenure types of impact on forestry and forest cover changes noted the statistically indistinguishable and insignificant impact of land titling to slow down the negative trends of deforestation (Buntaine et al., 2014).

Land tenure security exhibits time and space dynamics in watersheds as observed around Mount Elgon watershed in Uganda, where land tenure security varied spatially among communities (Robinson and Naughton-Treves L., 2011). Communities close to the Mount Elgon National Park and natural protected reserves reported very limited land rights of transferability, exclusivity, enforceability, and alienability compared to those distant from the protected areas who claimed to be land tenure secure (Mugagga and Buyinza, 2013). As a result, adoption of watershed conservation techniques was poor in the land insecure communities, while in contrast predominantly land secure communities invested in long-term soil conservation measures (Mugagga and Buyinza, 2013).

The temporal aspect of land tenure security is reflected by changing practices and rights with time. These changes largely relate to social changes including gender perspectives or tenure reforms that form land tenure systems and ownership modalities. In the US, "full landowners" adopted conservation tillage practices more frequently than other "cash renters" and "share renters," documenting the immediate effect of the different land rights on land conservation behavior (Soule et al., 2000). Land leaseholders hold land rights for a defined time (Soule et al., 2000). A related case about land tenure systems and investment decisions in sustainable agricultural practices in Pakistan shows "full" landowners investing more into soil improvement measures than "lease contract" land ownership holders (Akram et al., 2019). In contrast, findings from another study conducted in Iowa, USA show that land "leaseholders" were more likely to practice conservation tillage than "full landowners," indicating possible behavioral changes with time (Varble et al., 2016). A case study from Ghana relates land tenure forms with productivity considering technical efficiency and effectiveness in the rice industry: rice production on "owned" land reduced productivity inefficiencies and thus, higher technical efficiency than on "rented" and "shared cropping with fixed rent" land (Donkor and Owusu, 2014).

To a large extent, recent research demonstrates a positive link between land tenure security and general land management improvement, consideration of long-term investments, land rights optimization, and improvement in socio-economic outcomes given the reduced uncertainty. Nevertheless, cases of land tenure security resulting in externalities and unpredictable effects on sustainable land management exist (Neef et al., 2000; Niyuo Vengkumwini, 2016). In case studies from Vietnam and Thailand, evidence shows long-term conservation investments occurring in land tenure insecure areas, though going along with the hope of attaining tenure security from the investments (Neef et al., 2000). A related scenario in Ghana shows farmers who neither felt land tenure insecure nor fully participated in the conservation activities of forestry plantations (Niyuo Vengkumwini, 2016). Therefore, assessing the relationship between land tenure security and land conservation requires a multi-directional view while considering the value of alternative land uses(Neef et al., 2000; Niyuo Vengkumwini, 2016; Robinson et al., 2018). The land tenure security discourse includes probing the dependence of individuals and institutions on land titling as a mechanism to guarantee tenure security and facilitate good-land-use decisions. The probing connects with institutional limitations, resource competition, rent markets, tenure system reforms, customary gender-biased inheritance systems and modern land resources management approaches and governance issues (Lovo, 2016; Robinson et al., 2017).

5.4 Conclusions

Integrated watershed management puts the "human–land–water" resources interactions in a central position, making the need to characterize the related land resources rights of land tenure significant. The approach ensures a coordinated process approach of managing all resources and interests in a drainage basin for socio-economic and environmental purposes.

We, therefore, reviewed the available literature on land tenure and natural resource management in watersheds, integrating case studies from around the world, which are mostly focusing on developing countries. On this basis, we demonstrated the role of land tenure in watersheds and on the implementation of integrated watershed management, identifying and linking the key land tenure dynamics to offer a holistic view. We observe that empirical studies about land tenure and natural resources conservation issues are repeatedly component of studies, independent from the disciplinary focus of the review. However, a dependency between the diverse role of land tenure and land tenure dynamics in watersheds can be observed. Land tenure is mainly an indirect factor driving land management behavior. The watershed changes including land cover and land use changes result mainly from the need to own land, land ownership insecurity, land fragmentation, and land-use practices. We also point out how the different land tenure systems affect the physical, ecological, and socio-economic situation of a watershed and the possible differences in resources, biodiversity, species distribution and soil loss spatial distribution patterns, legislative, institutional, and resources management aspects of integrated watershed management. Prevailing land tenure conditions enhance integrated watershed management objectives through influencing resource users' decisions to participate, adopt and invest in conservation practices. Land tenure conclusively plays a significant role in planning the management of a watershed and conducting watershed management; however, awareness of other surrounding physical and ecological conditions, population parameters, cultures, and administrative practices factors is indispensable.

We further point out that land tenure security is positively considered for sustainable watershed practices and that land tenure insecurity is frequently associated with poor adoption of acceptable watershed protection measures and the eventual soil and land cover losses.

Concerns recorded include the possible negative impact of land tenure security, land fragmentation,

and individualization of land rights in protecting natural capital, especially where shared ecosystems and resources occur and conflict with socio-economic interests (Robinson et al., 2014). The literature reviewed sufficiently informs certain decisions about natural resources management in watersheds and demonstrates the varied linkages of land tenure and integrated watershed management. However, the literature lacks the full capacity to inform the holistic principle of integrated watershed management approaches that can enable a direct measure and conclusion on the level of significance of the identified roles. Thus, more research is necessary. Additional questions for further research surround the understanding of watershed management changes along the historical continuum of land reforms and other major factors such as wars, land tenure insecurity and instabilities, new policies, technologies, and climate change. Therefore, acknowledging the significant and dynamic role of land tenure in integrated watershed management requires continuous research.

5.5 Chapter linking to other chapters

The chapter is an output of research objective two and establishes a state of the art of land tenure dynamics and integrated watershed management. The review establishes the various roles land tenure plays and some critical variables for and against integrated watershed management, offers a tentative holistic view and identifies relevant research gaps for chapters 6 and 7.

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CHAPTER 6: THE RELATIONSHIP OF LAND TENURE AND LAND USE LAND COVER CHANGES IN LAKE VICTORIA BASIN

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CHAPTER 7: TOWARDS LEGISLATION RESPONSIVE TO INTEGRATED WATERSHED MANAGEMENT APPROACHES AND LAND TENURE

Abstract:

Land tenure affects integrated watershed management approaches in various ways, such as influencing land use and investment in sustainability practices and decisions. However, some land tenure and integrated watershed management relations need more examination, including how the prevailing relevant legislation responds and the needed course of action. In this paper, we provide relevant evidence to support a shift to responsive actions and legislation through (a) examining land tenure scenarios affecting integrated watershed management, including the public–private land tenure co-existence from a watershed perspective; (b) the responsiveness of the prevailing relevant legislation to integrated watershed management and the land tenure scenarios and (c) identifying legislative remedies recommendable for responsiveness. We use qualitative methods to review secondary data sources, including four legislations, and complement them with field survey data. Field experiences are from three sub-catchments in the Lake Victoria basin, each representing a different land tenure system, as case studies. Land tenure links with integrated watershed management in various ways, such as influencing land use decisions. However, underscoring the relationship from the perspective of private and public land tenure also indicates a complex and tense spatial relationship. As such, it likely limits adopting sustainable land use and management practices in watersheds as a case. Regardless, the perceptions from the study area indicate that land tenure systems and forms enable sustainable choices and decisions, despite limitations such as tenure insecurity. The disconnect between integrated watershed management aspirations of ensuring sustainability, the land tenure abilities and the subsequent human practices is mainly institutional, with the relevant legislation indicating a low to moderate level of responsiveness to integrated watershed management approaches and land tenure, thus, abating effectiveness. Therefore, we suggest a shift towards responsive programming and legislation and the adoption of model legislation to support responsiveness replication. We also recommend further studies to assess the legal gaps and feasibility thereof.

Keywords: Legislation, Environmental law, Holistic, Land rights, Catchments, Private property

7.1 Introduction

Responding to nature-human needs and relationships in an integrated and sustainable way has gained momentum since the 1992 Rio de Janeiro Conference on Environment and Development (United Nations, 1992). Integrated watershed management, in this paper, refers to a process and act of holistically managing the environment in a given delineated spatial unit, considering both upstream and downstream systems connectivity, for social and ecological systems sustainability. Integrated watershed management incorporates several implementation approaches, including integrated water resources management (IWRM). At least 186 member states of the United Nations have subscribed to some form of integrated watershed management approach and land tenure issues through Sustainable Development Goals 6.5 and 1, mainly. Despite the wide adoption of integrated watershed management approaches, approximately 58% of the member countries, most of which are in the global south, need to be on track to achieving integration and its aspirations based on the targets set out in the sustainable development goals framework (UNEP, 2021, p. 2).

The objective of integrated watershed management approaches includes controlling land use and cover changes, erosion control, improving water and other resources governance, facilitating carbon storage and ameliorating the weak sustainability of measures, among others (Gebregergs et al., 2022; Gessesse et al., 2020; Katusiime and Schütt, 2020b; Teka et al., 2020). There are multiple limitations to implementing integrated watershed management, especially the land tenure factor at the catchment level and the legislation factor at the 'integration' process level (FAO et al., 2006; GWP, 2022b; Katusiime and Schütt, 2020a). Despite the challenge of implementing integrated watershed management, institutions and land tenure

systems are still changing to afford sustainable development (Chigbu et al., 2019; Chimhowu, 2019; Holland et al., 2022; Otto et al., 2019).

Land tenure is a crucial factor observed to influence variations in landscape structure (Stanfield et al., 2002), including land use and land cover change, the adoption of sustainable land practices, and investment and conservation decisions (Akram et al., 2019; Chidumayo, 2002; Robinson et al., 2018, 2014), among other roles we compiled in a review article linking land tenure and integrated watershed management (Katusiime and Schütt, 2020a). Attention to the prevailing land tenure systems increases because land tenure refers to a defined relation between individuals or groups with the land, customarily or legally, people's rights, restrictions, and responsibilities on the land (and property) (Chigbu et al., 2017, p. 20; FAO, 2002a). As such, the human influence, especially the private tenure influence on the land use decision, drivers and thus, resultant land cover change is increasing (Lambin and Meyfroidt, 2011). A land supply constraint challenges human and ecosystem need, constraints adaptation and mitigation actions to climate and hydrological changes, and fails to achieve integration (Hyandye et al., 2018; Marhaento et al., 2018; Patz and Olson, 2006; Tanaka et al., 2021; UNEP, 2021).

While the land tenure factor is prominent during catchment-level actions, an enabling environment characterized by institutional and legal frameworks is one of the tenants to effect integrated watershed management approaches actions (Bandaragoda and Babel, 2010; Gibbs, 1991; GWP, 2022b). The approaches continuously depend on a collection of fragmented sectoral legislation and conventional institutional and normally sectoral legislation frameworks (Allan and Rieu-Clarke, 2010; Bandaragoda and Babel, 2010; Capocaccia, 2020; Sokile et al., 2003; Songa et al., 2015). As such, the dependence on these primarily public environmental laws encounters weaknesses, such as the complexity of supervising, enforcing, and dealing with diffuse issues and rights (De Vries-Stotijn et al., 2019).

Notwithstanding, environmental legislation has historically depended on the changes around public values, private rights, and the possible limits envisioned for resources, such as water, thus, the possibility of reforms (Sax, 1989).

Against this background, this paper examines some of the land tenure and integrated watershed management scenarios and the legislative responsiveness as a process to inform reforms. Notably, we answer three questions: (a) What land tenure scenarios affect integrated watershed management? Which scenarios are less understood but essential? (b) How responsive is the prevailing and relevant legislation to integrated watershed management and the land tenure scenario? (c) What legislative remedies are recommendable for responsive legislation? The research focus presumes to ameliorate limitations to integrated approaches' effectiveness through integrated watershed approaches and land tenure responsive legislation. We draw a case study area from the global South, exemplarily from the Lake Victoria Basin, as it offers comparative land tenure systems- at a watershed scale, reports of integrated watershed management applications with successes and pending challenges, and a legislative framework with legislation due for reformation.

Our approach to the research questions is two-fold, but they are interconnected. The first part of the paper consists of literature in section 7.2. The literature surveys integrated watershed management approaches, their relationship with land tenure and implementation framework in the context of legislation. As a result, additional knowledge gaps in integrated watershed management are identified, such as about the situation and co-existence of private and public land tenures in catchments. In addition, we generate field-based observations relating to land tenure and integrated watershed management scenarios, mainly synthesising the relationship between private and public land resources tenure co-existence and sharing the results in subsections 7.4. In the second part, we additionally assess the responsiveness of the prevailing relevant legislation to integrated watershed management approaches amidst the land tenure

dynamic in sub-sections 7.4 and utilize the findings to suggest a responsive mode of legislation in sub-section 7.5.

7.2 State of the literature

7.2.1 The concept and progress of integrated watershed management approaches

Managing human relations and nature in a coordinated way dates to 2000 BC, following an appreciation of environmental interconnectedness. The approach further appreciated the role of water and related processes in shaping many other processes in a given setting, thus, the watershed case (Biswas, 1990; Heathcote W, 2009; Wang et al., 2016). Along the times, the role of humans gained attention in the watershed management processes, and so did the need to consider every other issue likely to affect the intended outcomes (Förch and Schütt, 2022). One of the main reasons for integrating approaches involves building the capability to manage resources such as water and land in a cross-cutting way to meet different demands and ensure environmental sustainability (UNEP, 2021). Other reasons include imparting a way of thinking shaped by multidisciplinary information for application (Mcdonnell, 2008; Mukhtarov and Gerlak, 2014), as a joint consideration of interacting, yet sometimes distinct, issues to achieve balanced health (Capocaccia, 2020; Ruiz-Aravena et al., 2022; Zhang et al., 2022), or mostly a coordinated process to resource management and development (Global Water Partnership, 2000). Furthermore, the integrated approaches continue to relate to a specific space and time in the context of both the natural and human systems (Jønch-Clausen and Fugl, 2001).

Integrated watershed management approaches can ameliorate the likely adverse land and water changes through:

a) improving water resources governance (Katusiime and Schütt, 2020b);

b) controlling land-use impacts such as non-point pollution and runoff, soil erosion, improving water availability, crop production and household income (Haregeweyn et al., 2012; Rajaei et al., 2021; Teka et al., 2020);

c) supporting carbon stocking in the soil and above ground (Gessesse et al., 2020);

d) supporting tourism development (Dodds, 2020) and improved public health indicators (Nerkar et al., 2016, 2015);

e) improving the comprehension of the linkages between the dynamic land tenure and other watershed issues, and thus,designing appropriate actions (Katusiime and Schütt, 2020a).

Generally, integrated approaches record multiple impacts given the holistic intention in design (Pathak et al., 2013). The positive contribution of integrated approaches continues to record an initiation of more issue-based integrated approaches, a case of the United Nations Agency' 'one health approach' following incidences of 'animal-human-environmental ecosystem' public health concerns, such as the outbreak and spread of coronaviruses (Azuma et al., 2020; Capocaccia, 2020; Chen et al., 2021; Ruiz-Aravena et al., 2022; Zhang et al., 2022). Other approaches include the Integrated Watershed Management (IWM), Integrated Water Resources Management (IWRM), Collaborative Forestry Management (CFM), Integrated Soil Fertility Management (ISFM), and Integrated Disaster Risk Reduction (IDRR), among others.

Various definitions exist for a given approach; for instance, watershed management relates to organizing and guiding land, water, and other natural resources used to provide the appropriate goods and services while mitigating the impacts on the watershed resources. The process also

involves socio-economic, institutional, and biophysical inter-relationships and a connection between upland and downstream areas (Wang et al., 2016). The integrates water resources management refers to a process that promotes the coordinated development and management of water, land, and related resources to maximise the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems (Global Water Partnership, 2000). Observably, the definitions and, thus, approaches relate to some degree. Therefore, we are collectively referring to related approaches as "integrated watershed management approaches in this paper going forward. Our working definition for integrated watershed management approaches recognises that certain integrated approaches' spatial and thematic focus may vary. However, such an approach considers all relevant resources and issues during resource management and governance to achieve physical, environmental, health and socio-economic goals at a given time and space. Such integrated approaches dwell on a scientific acknowledgement of the interconnectedness of earth resources and issues and the needed management and governance. In that regard, working within defined scales, preferably physical land hydrological units such as basins and watersheds, are applied to targeting multidisciplinary and multi-institutional connections (Gibbs, 1991; Wang et al., 2016).

However, gaps exist with integrated approaches application, given a continuously changing environment, linked global actions and impacts landscape, multi-sectoral actions needed (Alden Wily, 2018; Borrelli et al., 2017; Lambin and Geist, 2006; Winkler et al., 2021). In consequence, the operations of integrated watershed management are not only multi-disciplinary but also multi-level. At the watershed level, some challenges included the sustainability of the measures post the intensive project implementation phases (Gebregergs et al., 2022). Furthermore, integrated approaches also fail to ensure a balanced trade-off between conservation and development as the stakeholders perceive conservation as a costly choice with limited tangible returns in a short time or costly to maintain compared to other social-economic

investments (Sandker et al., 2009). Contracted debates emerge, especially regarding the fixation on the terminologies and the limited accommodation of contextual innovations.

The points of discussion or concern might differ between the natural, social, political, and institutional environmental disciplinary groups (García, 2008; Grigg, 2008). Depending on when one interacts with the terminologies and approaches for the first time, the questions of whether the approaches work surfaces (FAO, 2022a), given the relatively large spatial distribution of all land and water resources to consider in each hydrological unit (Biswas, 1990; Dixon and Easter, 1991; Förch and Schütt, 2022). As such, debates arise as to whether the approaches suit only institutional and associative levels that create an enabling environment and not operational levels that emphasize resource management outcomes, thus more about governance than management. In addition, a debate suggests that to achieve effective integrated watershed management, catchment-level management activities and issues, as well as institutional processes and issues at the legislation level, need to be addressed simultaneously and holistically.

Accordingly, integrated approaches improvements are continuous, with suggestions of integrating biophysical and socio-economic data for decisions making (Pirani and Mousavi, 2016). Other suggestions include examining the legal frameworks (Allan and Rieu-Clarke, 2010), the approaches in the larger frame of resources management and governance (Lautze et al., 2011) and clarification of conceptual definitions and views (Grigg, 2008).

7.2.2 Integrated watershed management and land tenure relation scenarios

The land is a medium of integrated watershed management, and thus the relationship defined as land tenure gains attention as a conservation factor (Holland et al., 2022; Neef et al., 2000; Robinson et al., 2018). Land tenure relates to integrated watershed management by driving

changes through influencing decisions, and an incentive to sustainable land management practices adoption. We document many of these scenarios in a review article (Katusiime and Schütt, 2020a). The significance of land tenure lies in it being an institution of ''rules invented by societies to regulate behavior. Rules of tenure define how property rights to land occur within societies. They (the rules) define how access is granted to rights to use, control, and transfer land and associated responsibilities and restraints. In simple terms, land tenure systems determine who can use what resources for how long and under what conditions, according to the Food and Agricultural Organisation of the United Nations (FAO, 2022a). These systems occur as nationalized, customary, leasehold, and freehold systems in some places, and are an essential factor and tool for sustainability, degradation neutrality and responsive resource distribution and planning (Chigbu et al., 2017; Haregeweyn et al., 2012; Unruh et al., 2019).

Integrated watershed management approaches and actions targeting water catchments deal with land tenure and related rights in general but categorically private and public property regimes and rights. Private lands usually are the majority compared to public lands in most countries (Drescher and Brenner, 2018). Therefore, sustainability and equity involve mobilizing private and public property rights regimes to enhance public tenure protection and conservation and is a significant part of environmental legislation (Drescher and Brenner, 2018; Lähteenmäki-Uutela et al., 2021; Lange, 2017; Moon et al., 2021; Sax, 1989; Tarlock, 2000). However, the process of mobilizing private land tenure for the public good and services faces challenges regarding effectiveness, accountability and 'green grabbing', among others (Gooden and 't Sas-Rolfes, 2020). There is substantial coverage of the public–private land tenure relationship in the literature on property regimes and rights. Particularly examining the common property, also known as government, state or no private claim property and private property (Ostrom, 1999; Schlager and Ostrom, 1992). Notably, the discussion signifies the complexity of private and

public property rights when attempting to achieve ecological goals, thus demanding matching institutional and policy coherence (Gerber et al., 2009). The discussion also extends into the definition of property regimes, rules, duties, rights, recommended theories and institutional approaches, and the disputing the state-led approach to property rights as a better custodian compared to communal and private regimes (Alden Wily, 2021, 2018; De Vos and Cumming, 2019). Adding to the complex situation is the growing scarcity of resources, while others are expensive for private affordability; as such, the need for private and shared property institutions and organizations to ensure equity is inevitable (Slaev, 2020). Overall, blending private and public property regimes and frameworks for conservation, equity, and sustainability is a continuous challenge (De Vries-Stotijn et al., 2019; Drescher and Brenner, 2018; Lähteenmäki-Uutela et al., 2021; Sax, 1989).

Experiences drawn from integrated watershed management applications indicate the significance of property rights in land, with the: a) distribution of resource rights affecting the distribution of costs and subsequent monitoring needs; b) rights administration and regulatory remedies tend to restrict certain aspects of watershed use, affecting user groups either positively or negatively leading to resentment and assertion of rights by the affected groups in unintended ways such as encroachment; c), integrated approaches benefit landowners more than groups with limited land rights; d) thus leading to inequity during the distribution of benefits, especially the socio-economic benefits of integrated watershed approaches, and leaving several stakeholders satisfaction (Ratna Reddy et al., 2017).

Catchments, therefore, may compose an amalgamation of property rights in water (Bosch et al., 2021), land and related resources (Feder and Feeny, 1991; Moon et al., 2021), fisheries and other natural resources, among others (Schlager and Ostrom, 1992), in categories of private, public and other tenure systems (Ostrom, 1999; Slaev, 2020), and a spatial distribution and co-existence situation differing from one place to another. In this case, the situation is less understood in the Lake Victoria basin of East Africa, especially, how it affects integrated watershed management.

7.2.3 Prevailing considerations for integrated watershed management responsive legislation

Integrated approaches seek to achieve integration of human and natural systems (Global Water Partnership, 2000), to vision and ably manage resources in a cross-cutting way, meet different demands and ensure environmental sustainability. Integrated watershed management approaches also desire and aim to contribute to resource frameworks enabling; a) collaboration and coordination; b) stakeholder participation; c) innovation experimentation; d) recognition of multiple scales of action (Huitema et al., 2009), to understand the stakeholders' roles, obligations, rights, and legitimacies (Gibbs, 1991). Integration aims to achieve other objectives, including social and ecological justice, which is a vital component of the legislative agenda and the acceptability of sustainability actions (Lähteenmäki-Uutela et al., 2021). However, limited integration occurs, leading to ineffective approaches, according to a United Nations report evaluating IWRM progress as a case (UNEP, 2021). The limited occurrence of 'integration' may be due to various factors, such as conventional institutional setups, integration costs, weak governance, and varying conceptualizations of the approaches (Fischhendler and Heikkila, 2010; Lautze et al., 2011; Uhlendahl et al., 2011).

Nonetheless, the very integrated approaches bear a related responsibility of constructing the needed institutional framework and enabling environment. Respectively, processes devised earlier by creating catchment or basin management and governance boards and multiple interest committees indicate organizational and institutional decentralizations as incapacitated with limited power and control over resources (Luoga et al., 2005; Robins, 2007). In other cases, we observe integrated approaches improving governance (Katusiime and Schütt, 2020b), and in other cases, integrated watershed management approaches and interventions are achieved with conventional institutional and legislative frameworks, occasionally supplemented by moderate institutional modifications, high supervision, more financial resources, decentralization, and a strong will to learn and succeed in delivering the intended outcome. In effect, contrasting results exhibit at large or state-wide scale applications.

Continuing with integrated approaches means navigating new demands, such as land tenure and governance factors decisively through legislation. Responsive legislation to integrated watershed management approaches ought to accommodate the character of integrated watershed management approaches which tend to be prescriptive, thus, with pre-set guidelines, discursive as a power and values point of reference, and practical with management measures that encounter land tenure dynamics (Mukhtarov and Gerlak, 2014). Integrated watershed management approaches success also depends on institutional arrangements and strength (Matondo, 2002).

The pursuit of a legal regime accommodative of integrated watershed management approaches, however, also raises some questions, such as the degree of desirable and feasible integration and the extent to which conventional laws need altering. Other challenges of taking a legislative track relate to consolidating and coordinating the issues for which legislation is due (Howarth, 2018). Suggestions for reviews fit for sustainability guide reformations to serve heterogenous groups, including small-scale landowners, firms, corporations, governments, private property

rights, differentiated interests, variable power, and rights and responsibilities to cause sustainability transformations (Lähteenmäki-Uutela et al., 2021). Legislative reforms must also ensure that anthropocentric and ecocentric rights are balanced to holistically address the earth's challenges in this Anthropocene age (Baumann, 2021). Particularly, legislation responsive to integrated watershed management approaches must ably mobilize private tenure into public sustainability framework equitably (De Vries-Stotijn et al., 2019). The legislative shift also recognizes the application of international and cross-border treaties, conventions, and legislation for land tenure, environmental resources, issues management and governance (Altvater et al., 2015; Bosch et al., 2021; Brels et al., 2008; De Vries-Stotijn et al., 2019), which tend to produce varying outcomes as affected by local context and effects, some relating to land tenure (Dieterle, 2022). Furthermore, tenure responsiveness is essential in catchment management measures such as land use planning and landscape restoration initiatives. The view majorly appreciates land tenure responsiveness to improve land tenure security, which is a critical factor in achieving various socioeconomic and environmental sustainability goals (Chigbu et al., 2017; McLain et al., 2021).

However, land tenure is dynamic involving tenure systems, form, security, and institutional framework (FAO, 2002a; Kasimbazi, 2017). The dynamics result in diverse property rights, regimes, and strengths (Luoga et al., 2005), notably a legislative challenge during catchment environmental management. The diverse tenure regime situation also turns legally complex within the sustainability transition discourses (Lähteenmäki-Uutela et al., 2021; Muller-Landau, 2009). Secure tenure rights, such as perpetual land ownership rights, tend to limit legislative enforcement of conservation-related easements. As such, reconciling eco-justice and equality, especially intergenerational equity, which is linked to sustainability (Allan and Rieu-Clarke, 2010), requires a more efficient approach with a coherent enabling environment. As the debates continue, additional contextual information is essential to achieve the desired

enabling environment. In this case, relating to the distribution and co-existence relationship of private and public land tenure and other land tenure scenarios in the catchments and the level of responsiveness of the prevailing legislation to integrated watershed management approaches amidst land tenure issues.

7.3 Materials and Methods

7.3.1 Approach to the study

We apply a case study approach, purposively selecting Uganda and the country section of the Lake Victoria basin. The decision is, among other reasons, informed by the possibility of examining three sub-catchments bearing individual land tenure systems: Customary, Freehold and Mailo tenure at scale, in proximity, and exposed to integrated approaches and shared legislation. Moreover, the case study approach can contextually examine unique environmental and socio-economic relations and aspects at a given place, say catchment, that is scalable (Bartlett and Vavrus, 2017; Kaarbo and Beasley, 1999; Knight, 2015). As such, we find the approach appropriate to a paper that examines local cases and informs the broader appreciation of integrated approaches and related legislative responsiveness.

7.3.2 Data acquisition and processing

The study applies data from secondary and primary sources. The primary data collected from three purposively selected sample sub-catchments in 2020 answers questions about land tenure scenarios affecting integrated watershed management, such as the private–public land tenure co-existence and adopting sustainable land use practices. We apply survey techniques of

participatory mapping of catchment physical environmental conditions, especially the land use and land cover, through observations supported by a checklist and household snowball sampling supported with a questionnaire. The questionnaire and checklists content includes the sustainable land use practice adapted from the Uganda strategic investment framework for sustainable land management 2010–2020 and the land use and land covers classes in Mwanjalolo, M. et al. 2018, which locates the some private (outside protected areas) and public (protected areas) tenures (Mwanjalolo et al., 2018; UNDP, 2010). The target sample population and area are in villages exposed to integrated watershed management activities and near public and private land tenure-sensitive areas, such as wetlands, lakes and riverbanks, forests, and hilly regions.

The data analysis takes on both qualitative and descriptive statistical formats involving the responses of 152 households considered complete. The sub-catchments include the river Rwizi (Native freehold land tenure system and n = 61), the lake Wamala sub-catchment (Mailo land tenure system and n = 44) and the Upper Victoria catchment (Customary land tenure system and n = 47). The sample size is considered statistically viable for small sample analyses. The focus area's spatial extent and land tenure systems as independent variables also played a role in this decision. We answer the questions about the responsiveness of the prevailing relevant legislation to integrated watershed management and land tenure scenarios. After that, we identify legislative remedies recommendable for a legislative shift and improvement based on secondary data. We source the relevant documents from online databases from the Food and Agriculture Organisation of the United (FAO, 2022c, 2022d), and the Uganda Legal Information Institute sites (ULII and Judiciary of Uganda, 2022). The collection is typically considered the relevant framework or integrated watershed management in Uganda (Kakuru and Sekyana, 2009; MWE and DWRM, 2019; Songa et al., 2015). The final sample considers four Acts of Parliament as the most relevant: the National Environment Act 2019, the Water

Act 1997, the Land Act 1998, and the Forestry and Tree Planting Act 2003. Geographical Information System data layers applied for the study area map are sourced from open access data bases and Uganda institutions (OCHA, 2022b, 2022a).

7.3.3 Study area

The study area includes Uganda country and three sub-catchments selected as a case study for tenure in the Ugandan sector of the Lake Victoria Basin. The total area of Uganda is estimated at 241,550.7 km², with 41,027.4 km² (17%) of water and wetland areas — in consequence, the relevance of integrated water resources management approaches becomes obvious. The climate in the study areas is humid tropical, with annual temperatures ranging between 15 °C to 30 °C and annual rainfall between 750 mm and 2100 mm; substantial variation of average climate data relates to a varying topographic gradient**.** However, 90% of the area experiences an average potential evaporation rate exceeding the respective annual rainfall besides the areas around the Lake Victoria basin and the mountainous landscape sections of the Rwenzori, Elgon and Kabale. Moreover, due to the character of Uganda as a landlocked country, 69% of the surface waters are transboundary (Mwanjalolo et al., 2018; Obua et al., 2010; Uganda Bureau of Statistics, 2016). The regional economy is predominantly agro-based, characterized by small-scale agricultural holdings, rain-fed agriculture and most habitants engaged in primary resource value chain activities (Mwanjalolo et al., 2018; Obua et al., 2010; Uganda Bureau of Statistics, 2016).

The case study areas are multi-ethnic and multi-customary institutional by character, resulting in diverse socio-cultural practices concerning land resources at the various sub-catchments. However, collectively, land tenure practices are legally classified into four land tenure systems: Customary, Freehold, Mailo, and Leasehold, but this study focuses on three systems leaving

out Leasehold, given their spatial spread to catchment scale. The land tenure systems vary due to historical, cultural, and political administration conditions (Kasimbazi, 2017; Okuku, 2006). Thus, formal, and informal land tenure classes, such as 'official' and 'native' freeholds and leaseholds, essentially superimpose or accommodate customary practices and systems.

Land and integrated watershed management relevant legislations in Uganda mostly date to the early 1990s, including the Country's constitution declaring that land belongs to the citizens. At the same time, water resources and protected areas are a public resource under state stewardship (Uganda Law Commission, 1998, 1995). As such, both private and public tenures co-exist and form the background of this study. One of the significant changes is the county's demography, with a current growth rate of the population of 3.0 –3.3%, documented impressively by an increase of total population of 2,466,325 in 1911 within a century to 34,634,650 in 2014 (The World Bank, 2021; Uganda Bureau of Statistics, 2016). The collective characteristics in the area significantly influence regional land use and cover, management approaches, and effectiveness.

In the study area (figure 7.1), private tenure spatially co-exists with public tenure and rights. The public land and water resources, translating as public tenure and property rights, including mostly rivers, lakes, streams, wells, wetlands, national forests or game reserves and parks, and other declared land and water resources for public protection interest. However, managing and governing the co-existing tenures faces persistent challenges, some due to gaps between legislative aspirations and the practice, enforcement of due measures, attention to social impacts as to the physical environmental impacts, and tackling power imbalances and conflicts between the socio-political and technical administrative arms (Akello, 2007; Edema et al., 2020; Kahangirwe and Vanclay, 2022; Oosterveer and Van Vliet, 2010; Rwakakamba, 2009).

Since the very legislations are considered for integrated management of the resources in the area (Songa et al., 2015), we can confirm that challenges exist, and reforms are due.

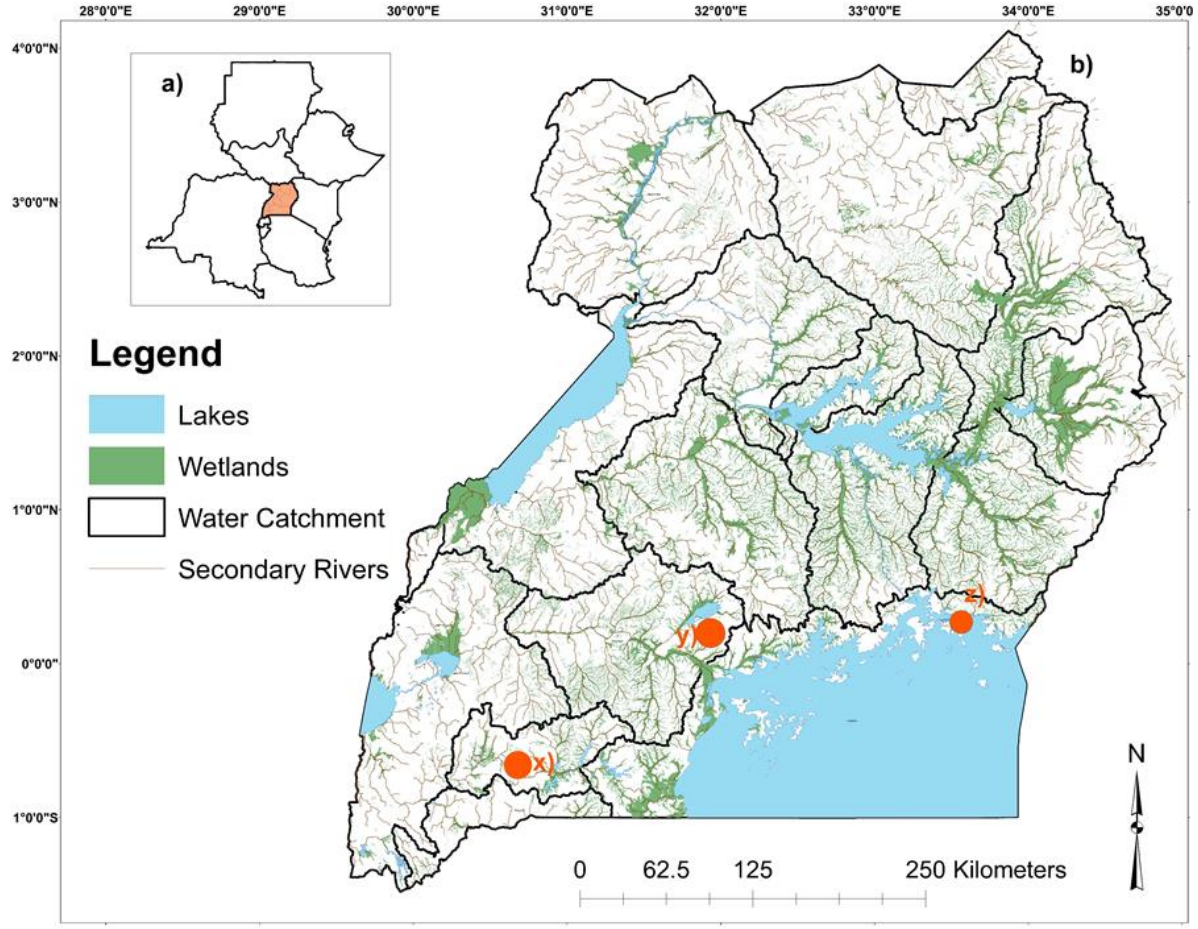

Figure 7.1: A catchment-based location map of Uganda, Eastern Africa (**a**). The main map (**b**) shows the distribution of selected water resources such as rivers, lakes, and wetlands; these are also considered as public tenure and rights resources. The resources transverses land which belongs to the citizens according to the prevailing legislation, exceptional cases of the land are public tenure such as parks, forest reserves among others. The orange dots indicate the catchments sampled for land tenure system-specific assessments with River Rwizi being Native freehold (x) for Lake Wamala being Mailo tenure (y) and Upper Victoria for Customary land tenure systems (z).

7.4 Results and Discussion

7.4.1 Characterisation of the private and public land tenure co-existence in watersheds

Our characterization of the private–public land tenure relation builds on previous pieces of evidence relating land tenure in general to integrated watershed management (Katusiime and Schütt, 2020a), but lacking a perspective of how the relations happen under different land tenure systems, multiple land property regimes driven processes, and catchments. The participatory mapping engages sample households of the land use and land cover the situation in their immediate surroundings. The characterisation and interpretation of the public–private land tenure co-existence according to the land use and the land cover situation.

Very discrete private and public land tenure data in the studied areas' unavailability persist for several reasons, including limited land registration to show the distribution of the public and private tenure in each setting as desired. As such, the description of the public–private tenure co-existence using a qualitative method is tentative in indicating which catchment land use and cover classes are particularly experiencing pressure and changes.

To interpret the co-existence, we enlist at least five public and private land tenure co-existence dimensions observed in the studied area. The resources include lands and related resources pronounced under state and community custodianship for the public good traversing private lands.

a) Transboundary dimension: for land uses and land cover such as wetlands traversing private and public land tenures.

b) Proximity dimension: for land uses and land cover cases where defined boundaries exist that separate private and public land tenures (including protected areas such as game or forest reserves and parks).

c) Temporal use dimension: private land rights temporarily occur on public land and vice versa. For instance, collecting fuelwood, growing seasonal crops, and granting leases and easements.

d) The land surface–subsurface dimension: for land use cases where private land tenure and public land tenure concurrently exist, for instance, land on the surface could be private tenure, but the sub-surface content such as minerals, oil, and gas and groundwater are public resources.

e) Legal dimension: where any land is considerable for public land tenure as and when the need arises, and the reverse possibly according to law. Instances include easements, reserve declarations, and other public works deemed needed.

f) The above-ground tenures dimension: for land use cases of resources other than land that bear either private or public tenure, such as forestry resources.

The above-highlighted dimensions mainly occur randomly, signifying a complex character to be observed in the private and public land tenure and rights co-existence. As a result, the possibility of tenure encroachment in the catchments is high, and we interpret the use of public land tenures for private tenure activities as encroachment. We observe tenure encroachment affecting mainly wetland areas and forest reserve lands for livestock and crop growing, among other activities. In principle, wetlands are primarily public land tenure, with most human uses subject to regulation according to prevailing legislation. Nevertheless, there is reported use,

both regulated and unregulated, in the studied catchments. Exceptional cases where sections of public land tenure existed on privately registered land before the coming into force of Uganda's 1995 constitutional declarations exist, especially in the Mailo tenure sub-catchment. However, using such private lands is also subject to agency regulations according to the current legislation.

Furthermore, the trajectory of tenure encroachment likely continues if the dominant factors continue, primarily relating to agricultural land use, subsistence and commercial farming arrangements and climate change affecting rainfall patterns and distribution over land. Encroachment practices occur for both small-scale and large-scale practices. Individual, smallholder, corporate, and government power relations occur in the catchments. For instance, although agriculture was an essential practice defining the private–public tenure co-existence, it varied, with commercial agriculture mainly sugarcane *(species- Saccharum officinarum)* and rice (*species- Oryza sativa*) and performed on an out-grower farmer-company contract basis occurring in the customary land tenure (upper Victoria) catchments, unlike other sub-catchments of the Native freehold and Mailo tenure system. Any agricultural practices have implications on the local land use and tenure dynamics, especially where binding contracts are signed in respect.

In most cases, the demarcations between private and land tenures are unclear and not permanent due to land and related resources legislative ambiguities and changes, human manoeuvres, insufficient mapping information and the changing land use and cover. In this sense, the Mailo sub-catchment exhibits a more dynamic and complex public–private land tenure co-existence relationship, followed by the Customary sub-catchment (upper Victoria area) and the Native freehold sub-catchment (River Rwizi area).

7.4.2 Land tenure effect on integrated watershed management

In this sub-section, we examine the effect of the catchment public–private land tenure co-existence within the context of varying land tenure systems, namely the Customary, Mailo, and Native freehold tenure systems and land tenure forms. We define *land tenure form* as the defined bundle of land rights given to an individual, group, or entity under any given land tenure system. The land tenure forms include full land ownership or co-ownership, tenancy, custodianship, and short-term leases or use contracts. The land tenure systems considered are constitutionally defined due to the region's historical, colonial, and cultural influences. Both private and public tenure occur on any other land tenure systems.

The results show how private land rights holders in areas where some integrated watershed management approaches and practices occur ensure sustainable land use and practices as they co-exist with the public tenures. The process identifies with 20 sustainable land use management practices from the Uganda Strategic Investment Framework for Sustainable Land Management 2010 –2020. The practices include those aiming to improve soil and water conservation, restore and maintain soil fertility, harvest water for production and domestic water use, and practices to increase forest cover or reduce pressure on forests and alternative livelihoods. The practices include conservation farming, afforestation and reforestation, integrated soil nutrient management, agroforestry, crop fallows, water and runoff harvesting, energy-saving stoves and kilns, controlled grazing, small-scale irrigation, and community watershed management.

Generally, every household applies some practices considered under the sustainable land management framework. However, no clear pattern is visible among the reporting household's choice of sustainable land management practices (SLMP) to indicate consistency, strategic or systematic remediation of an identified challenge at scale, implying randomness. Respectively, more sustainable land management practices are compiled in the Wamala sub-catchment (Mailo land tenure system area), Upper Victoria (customary land tenure system area), and lastly, the Rwizi catchment (Native Freehold land tenure system).

Regarding whether the land tenure system and form affect the adoption of sustainable land use and management practice, the results in (figure 7.2) are based on the land tenure system character of enabling (a) possession of full land rights, (b) gender biases in land inheritance and ownership norms, (c) land transfer or sale, and (d) investment in long-term sustainable land-use practices. A total of 72% of respondents have full land rights under the native freehold land tenure system (Rwizi sub-catchment), 81% have full land rights under the customary land tenure system (Upper Victoria sub-catchment), and 47% have full land rights under the Mailo land tenure system (Wamala sub-catchment). On the other hand, the land tenure systems variably disable long-term investments in sustainable management practices, with interest to invest in long-term practices limited in the Mailo tenure sub-catchment at 19%, compared to 10% and 8% in the Customary and Native freehold sub-catchments, respectively. Furthermore, gender-biased cultural norms relating to land tenure persist across all three study areas independent from the land tenure system.

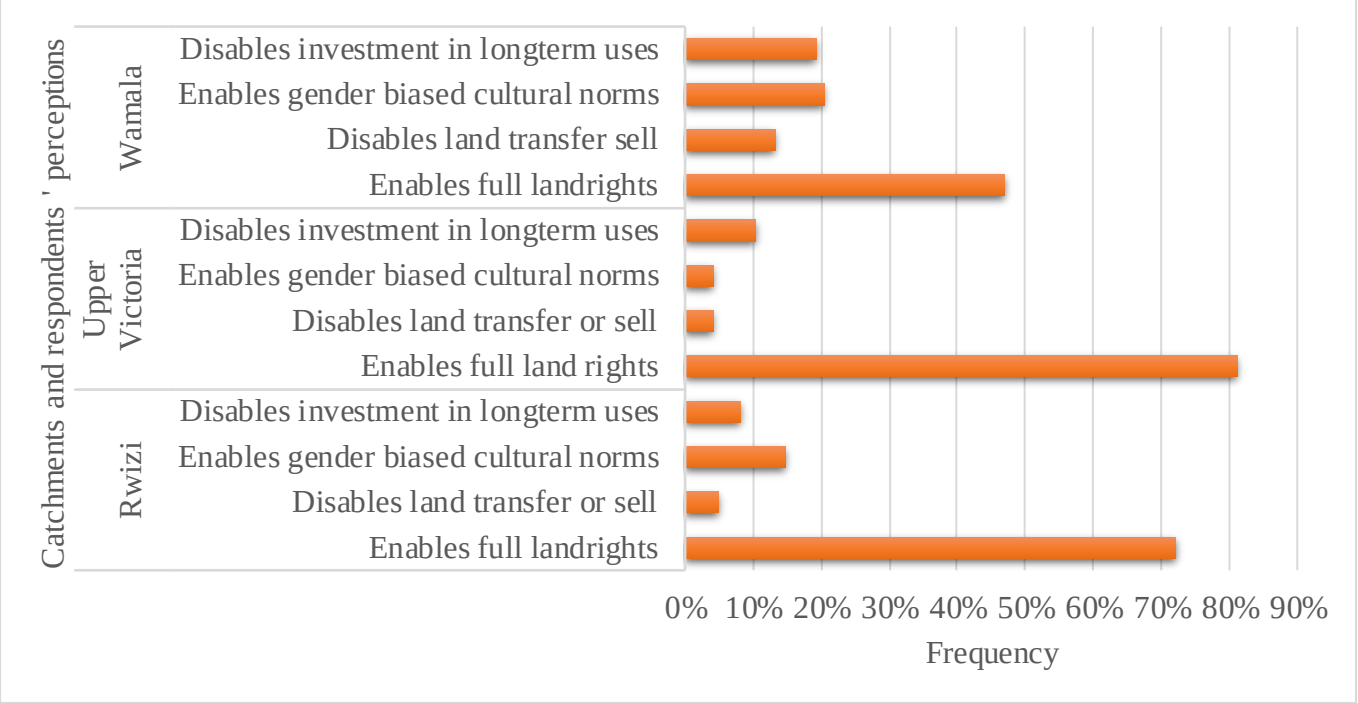

Figure 7.2: Respondents' perceptions regarding the effect of land tenure systems on select land use and management decisions and practices differentiated for the three study areas tenure systems that is Native Freehold (n = 61), Customary (n = 41) and Mailo Tenure (n = 44).

The land tenure form (figure 7.3) character relates to enabling the households; a) to adopt some or all recommended sustainable land management practices, b) enable multiple land uses, and c) enable massive land cover conversions. For example, in the native freehold land tenure (Rwizi sub-catchment), more than 80% of the respondents perceive the tenure form held enables the adoption of all sustainable land management practices. In comparison, 64% and 21% hold a similar perception of the Customary tenure (Upper Victoria sub-catchment) and the Mailo land tenure (Wamala sub-catchment). However, only 16% of the respondents of the same group in the native freehold land tenure, 5% in customary land tenure and 17% in Mailo land tenure agree that multiple land uses are possible at a given interval.

The perception about the current land tenure form enabling massive land cover conversions is limited, with the highest response being 17% of the respondents in the Mailo tenure area.

Overall, the land tenure forms held according to the respondents enable (a) multiple land uses but at varying intervals, (b) the adoption of all or some of the sustainable land management practices (c) essentially disables massive land cover conversion.

Although the land tenure form is similar by title, marginal differences occur per land tenure system. For example, a landowner's rights under the Mailo system might differ from those of a landowner under the customary system and native freehold system.

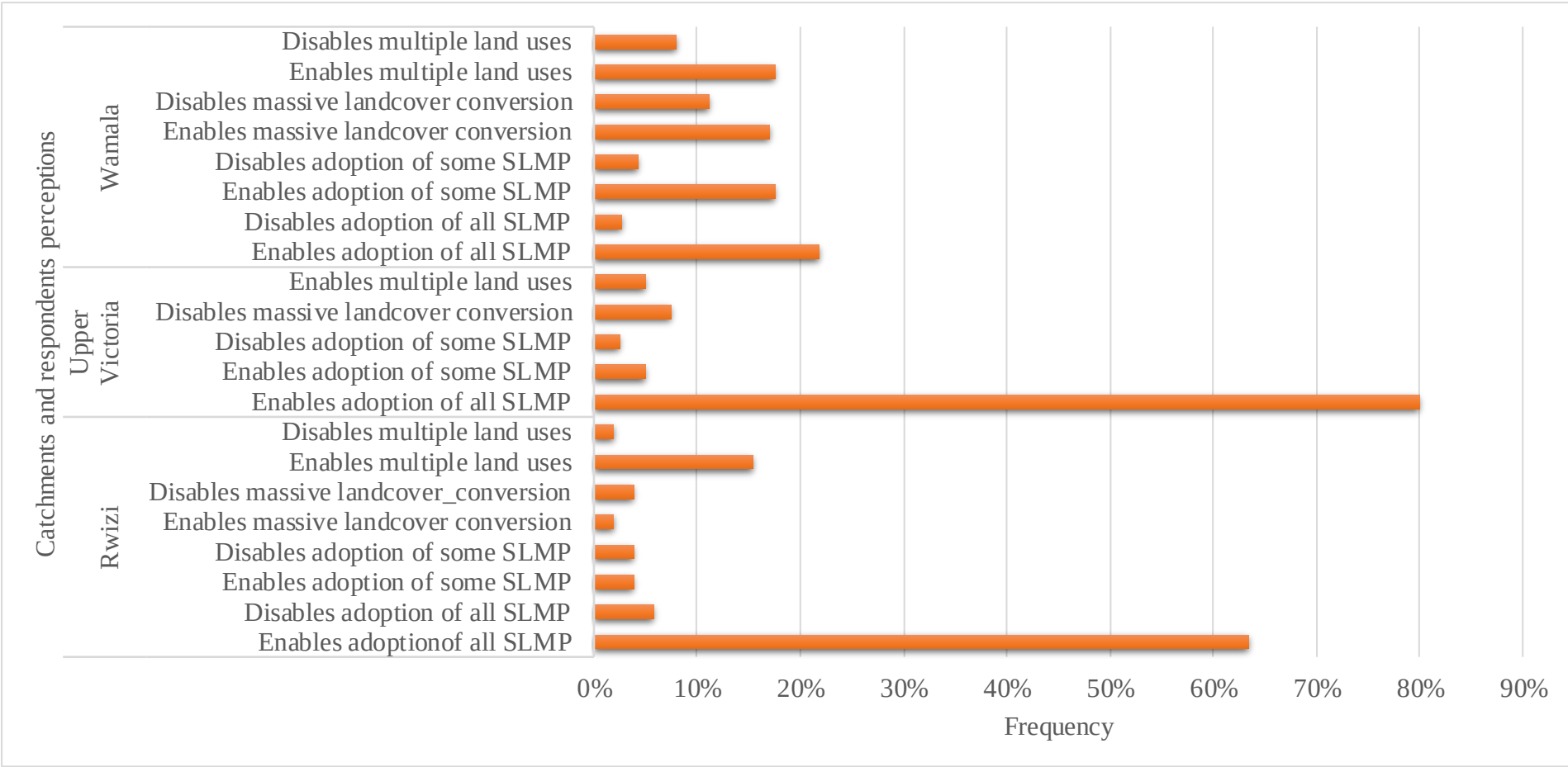

Figure 7.3: Respondents' perceptions regarding the effect of land tenure form on select sustainable land management practices (SLMP) decisions and practices differentiated for the three study areas under Native Freehold in Rwizi Sub-catchment (n = 61), Customary tenure in Victoria Sub-catchment (n = 41) and Mailo in Wamala Sub-catchment (n = 44).

7.4.3 Implications of the land tenure scenarios to integrated watershed management approaches

The two scenarios of private–public land tenure co-existence situation and the respective possibilities under the varying land tenure (systems and forms) have implications for integrated watershed management.

7.4.3.1 Implications of the public–private tenure co-existence in integrated watershed management

The general view on the public–private land tenure relationship in the case study indicates a complex co-existence, with increasing pressure against public tenures, especially wetlands. With such vulnerability, an occasion of turning sections of public land tenure to private tenure or private land acquisitions for public land needs is foreseeable. Both scenarios likely cause tension, conflict, and violation of rights, and incur high resource management and governance costs, characterizing the integrated watershed management processes in the study areas.

There is significant private land tenure in Uganda, where an estimated 85% of forests and woodlands exist under private tenure and customary practices. In comparison, only 5.6% occur under forest reserves and 9% in Uganda's National Parks and Wildlife reserve management systems (Obua et al., 2010). Adding to the situation, most public land in the form of wetlands, grasslands, and waters also transverse or occur in areas outside physically 'protected' spaces, surrounded by private and mostly informal tenure systems. As such, extensive losses of forests and woodlands occur (Mwanjalolo et al., 2018; Obua et al., 2010), despite a relevant legislative frame for controls present (Akello, 2007; Kakuru and Sekyana, 2009). Indeed, the legislation framework struggles to manage the co-existence of tenure arrangements as it is characterized by tension, conflict, violation of rights, and high management costs (Akello, 2007; Oosterveer

and Van Vliet, 2010; Were et al., 2013). The increased vulnerability and susceptibility of the public–private land tenure co-existence is due to annexation and conversion of public lands to private interest, private land acquisitions for public land needs such as restoration and maintenance of subsequent environmental rights, and frictions in the land regime. In effect, multiple land and resources administration interests and lines of governance exist due to the fragmented land uses. Land fragmentation, for instance, results from land divisions to meet individual land needs and the acquisition of property rights, registering limiting and positive effects on land use, investment decisions and administration as observed elsewhere (Lee et al., 2021; Zang et al., 2019).

Co-existence is a term commonly used but variably interpreted among various disciplines and probably still shrives on contexts for meaning (Knox et al., 2021). We derive our applicable meaning from the ecological and environmental co-exitance studies where co-existence refers to the long-term co-persistence of different species in a given niche (Hawlena, 2022); in this case, the study considers the public–private land tenure regimes as niched in a watershed. The co-existence of species situation is equally related to what with observed with the land tenure situation amidst global changes, where the relationship depicts competition, facilitation, and invasion as some of the descriptive characteristics of co-existence (Valladares et al., 2015). Co-existing systems occasionally result in the thriving or collapse of ecosystems, learning from instances of humans and wildlife co-existing as private lands nearing public land tenures in the form of game reserves and other protected areas (Carter et al., 2012).

Techniques to ensure harmonious co-existence of the private and public tenures include creating protected areas. However, challenges and limitations occur due to increased social and land-related needs pressure, changing perceptions, and valuing of such protected areas (Feng et al., 2021; Geldmann et al., 2019; MacKenzie et al., 2017). For instance, protected areas ensure biodiversity protection, deforestation avoidance, and livelihood support, among other

advantages (Baldwin and Fouch, 2018; Naughton-Treves et al., 2005; Pfaff et al., 2014), but fall short in ensuring financial efficiency, management effectiveness, carbon and other emissions storage, and avoidance of land grabbing (Elleason et al., 2021; Geldmann et al., 2019; Gizachew et al., 2018; Holmes, 2014). Therefore, managing the various human-led drivers of land use changes and the insufficiency of protected areas to attain conservation goals requires attention to private land tenure. Indeed, processes to expand protected areas and strengthen private tenure for conservation are ongoing, albeit susceptible to socio-ecological malpractices such as land grabbing and dispossession of indigenous community's land (Busscher et al., 2018; Holmes, 2014). Nevertheless, private lands are needed to complement the sustainability drive and state-protected public lands, which are considered insufficient (De Vries-Stotijn et al., 2019; Gooden and 't Sas-Rolfes, 2020).

Considering the public–private co-existence adds a dynamic to consider for the effective adoption of sustainable land management practices during integrated watershed management. Importantly, the process supports understanding the multiple dimensions of land tenure and how it relates to conservation behaviours and measurement limitations that tend to render the discussion inconclusive (Ranjan et al., 2022). Many such land tenure dimensions and behaviours relate to private property rights, which tend to fail the functionality of the public interests, especially those related to ecosystems (Moon et al., 2021). Catchments with private and public land tenures exhibit a mixture of willingness and unwillingness to cooperate and residents' interests, priorities, and financial capacities. Such areas are also politically sensitive in case of land appropriation for conservation or other attempts at engaging with private lands (Ryan and Hartter, 2012). Owing to the possibility of needing more land for public tenure and services or vice versa, the claiming or reclaiming of either public or private lands, compensations are costly, and incentives are perverse (Paulich, 2010). Additional threats to

considering private lands for public sustainability include effectiveness, inefficacy, and value conflict-related concerns (Gooden and ‘t Sas-Rolfes, 2020).

The private–public tenure scenario leads to multiple legislative dimensions, as land is a multidimensional use resource, but also as the dimensions we mapped in the catchment indicate. Thus, the possibility of legal overlaps and power plays in certain catchments (De Vries-Stotijn et al., 2019; Lähteenmäki-Uutela et al., 2021). As such, blending private and public tenures in conservation demands legislative transitions and reforms (Drescher and Brenner, 2018; Lähteenmäki-Uutela et al., 2021). The latter is especially true in the studied catchments and elsewhere, as we learn that as the land changes hands, differences also exist among subsequent landowner interests, the land size reduces and occasionally, the chances of land conflicts increase. Thus, considering private and public land tenures while applying integrated management approaches and related legal administrations is timely.

7.4.3.2 Implications of the prevailing land tenure systems and forms to integrated watershed management approaches

In an area with de jure and de facto land governance and administration systems, private land tenure practices tend to differ according to the tenure system, affecting the public–private land tenure relations in catchments. In this case, Customary, Mailo, and Native freehold tenure systems are dominant in Uganda. The three land tenure systems slightly differ in the title, background history, and rights framework. Results indicate that the perceptions about the prevailing land tenure are variable but oriented towards enabling integrated watershed management actions such as sustainable land use practices. However, sustainable land use and management practices adoption patterns still need to be more strategic and sufficient as desired

under the Uganda Strategic Investment Framework for Sustainable Land Management 2010–2020 and other relevant policies and programs.

Although the perceptions about the role of tenure and ensuring integrated watershed management are generally positive, gaps exist, such as tenure insecurity. Land tenure security influences the adoption of sustainable land use measures (Gebremedhin and Swinton, 2003; Neef et al., 2000; Robinson et al., 2018), and is a significant variable for favorable decision making in conservation and sustainable land use, though not exclusive (Akram et al., 2019; Holland et al., 2022).

It is also common for land tenure security assurance to be associated with various land tenure forms and subsequent documentation (Atwood, 1990; Blackman et al., 2017a; Holland et al., 2022). Compared to the Native freehold (easily registrable to freehold title, perpetuity) and Mailo land tenure systems (mostly registered with title), we observed some perspectives contrary to the notion when respondents in the Customary land tenure system (mostly unregistered) expressed a positive perception of the tenure system's ability to facilitate sustainable land management practices. Furthermore, more respondents reported attaining full land rights in the customary tenure catchment than in the Native freehold and Mailo land tenure-dominated study catchments.

Despite some opposing views in the available literature, most of the literature tends to see customary land tenure negatively influencing conservation and land productivity. As a result, the preference for registered lands over customary tenure systems (Amone and Lakwo, 2014; Atwood, 1990; Chimhowu, 2019; Peters and Kambewa, 2007). Among our study catchments, the Mailo land tenure system characterizes land titling and registration since the 1900s. Nevertheless, some tenure holders reported limitations associated with land rights due to gender biases, inability to enjoy full land rights, and unwillingness to invest in long-term

sustainable land use (see figure 7.2). In other 'formalized' land tenure systems in the global south, findings not directly linking land titling to mostly positive outcomes persist (Blackman et al., 2017a; Buntaine et al., 2014; Robinson et al., 2017, 2014). This follows a disconnect between the conceptualized results expected from land formalization and effective catchment management outcomes owing to the relatively patchy, slow, and sometimes contested land reforms (Green, 2006; Okuku, 2006; Peters and Kambewa, 2007). Additional limitations are likely due to numerous reports of persistent gender biases, limited land transferability and commitment to long-term investments in sustainable land use and management practices, and unmatched policy implementation persisting.

7.4.4 Assessing the legislative responsiveness to the integrated watershed management approaches and land tenure

The previous section of the paper provides evidence of the land tenure and integrated watershed management relationship and situation as background information for legislation. In this paper's third section, we assess select legislation's relevant responsiveness to the integrated watershed management approaches amidst the land tenure and related dynamics. Land tenure is also an institution of rules invented by society to regulate behaviour and property rights to land allocation (Lähteenmäki-Uutela et al., 2021), while integrated watershed management seeks an enabling environment as one of the pillars and instruments for success (Bandaragoda and Babel, 2010; GWP, 2022b, 2022a). As such, legislation is a cornerstone for land reforms and integrated watershed management improvements.

In assessing whether the prevailing legislations in the study area are at par with the needs, an assessment criterion of selected indicators is applied when reviewing the documents. First, we score the results qualitatively using a four point Linkert scale and a scoring matrix where; Low

(the idea/indicator is traceable, but abstract >25), Moderate (the idea/indicator is traceable, clear, but partial to presentation expectation >50), High (the idea/indicator is traceable, clear, satisfactory to presentation expectation >75), and Undetected (the idea/indicator is not traceable or very abstract for basic articulation =0. The indicators are according to the responsiveness on thematic areas of integrated approaches, land tenure, and holistic land tenure and integrated approaches (see table 7.1). The legislations mainly considered are four Acts of Parliament: The National Environment Act 2019, the Water Act 1995, the Land Act 1998, and the Forestry and Tree planting Act 2003. In addition, complimentary cross-reviews include the Water Regulations 1997 and National Water Policy 1999, The National Environment (Hilly and Mountainous Area Management) Regulations 2000, The National Wetlands, Riverbanks and Lake Shores Regulations 2000, the National Agricultural Advisory Services Act 2001, the Uganda Constitution 1995, Local Government Act 1997, Land Acquisition Act 1965, and the Climate Change Act 2021.

7.4.4.1 Responsiveness to integrated watershed management approaches

There are differences in the responsiveness of the four Acts for water, forestry and tree planting, environment, and land to integrated watershed management approaches. Accordingly, using the thematic measurement indicators in Table 1, the Land 1998, Water 1997, Trees, and Forest Acts 2000 score a low remark. In contrast, the Environment Act 2019 is moderately responsive, signaling the likelihood of conceiving new legislative needs correlating with the time of enaction. The performance of the indicators measured against the score matrix indicates:

a. All the Acts include the legal provision for cross-referencing or consultation across relevant Acts, thereby legally providing for interconnecting to a wide range of watershed issues.

The requirement to cross-consult can also indicate acknowledging the interconnectedness of resources and issues in integrated watershed management approaches.

b. All the Acts include the principles associated with integrated watershed management approaches, such as sustainability, economic efficiency, equity, participation, and the recognition of the role of women.

c. All the Acts also include provisions for institutional collaboration.

d. To a reasonable degree, all the Acts provide for access to non-confidential data and information.

Table 7.1: Results of the legislative responsiveness score of the four Acts.

Thematic Area		**Water Act**	**Forestry & Trees Act**	**Land Act**	**Environment Act**
	Indicators	Score	Score	Score	Score
Responsiveness to Integrated watershed management approaches	Acknowledgement of resource interconnectedness and so, the management and governance.	U	M	M	M
	Recognition of integrated approaches' common principles pillars such as equity, economic efficiency, and environmental sustainability.	M	M	L	H
	Requirements for relevant institutional collaboration and hierarchy of the organisation.	M	M	M	M
	Recognition of the various land-based physical scales and transboundary nature of resources and management requirements.	U	L	L	L
	Defines and requires multi-stakeholder actions and participation, including the role of women.	L	L	L	H
	Provides conceptual examples or definitions of integrated approaches	U	U	U	U
Responsiveness to Land tenure	Recognises and provides for the various land tenure systems.	U	L	H	U
	Recognises and provides for the various land tenure dynamics such as tenure form, tenure rights, security, land access modalities and the possible means of assurance or administration.	L	L	M	L
	Provides for current and projected land demands.	L	M	M	M
	Cognizant of the private and public land tenure rights and trends, co-existence challenges and provides for remedies.	L	L	L	M
	Provides for relational cognisance between land tenure and other socio-economic and ecological goals and requirements.	U	U	L	U
	Provides for accommodating and enabling updated land tenure and rights demands such as information access, digitalisation, women, and other gender rights.	L	M	M	M

Responsiveness to holistic integrated watershed management and land tenure	Recognises the role of land tenure in integrated watershed management (approaches).	M	M	M	M
	Provides for land tenure terms and responsibilities in the framework of integrated watershed management.	U	L	U	L
	Underscores the role of the land legislation in improving integrated watershed management.	U	L	U	L
	Underscores the role of other resource-relevant legislations to improve land tenure characteristics such as tenure security, equity among others.	U	U	U	U
	Provides for spatial and temporal variabilities of catchments and land tenure system.	U	U	U	U
	Provide for conditions of legislative review, monitoring, and evaluation.	H	H	H	H

However, there are observable limitations and gaps in the laws regarding integrated watershed management, and some are within the articles. The limitations include;

a. All Acts are considerably sectoral despite cross-referencing and an average score on the inclusion of relevant issues in the Environment Act.
b. The Acts do not explicitly acknowledge the interconnectedness of watershed resources, issues, and related management governance.
c. The Acts are considerably less precise in several provisions.
d. The Acts do not provide definitions for integrated watershed management approaches, watersheds, or other physically delineated hydrological concepts.
e. The Acts identify ministerial arrangements, institutional collaborations, processes, procedures, and stakeholders at higher institutional levels, leaving out the local community levels.
f. Additionally, the intermittent attention to scale as a spatial factor is of concern. Integrated watershed management approaches aim for multiple scales and levels; the Acts reviewed mainly align with the country's administrative scales. Instances of perceiving and providing for the transboundary nature of resources and ideologies, other catchment-based scales and possibly the respective management and governance relate to international water laws and other cross-border treaties in some legislation.
g. The National Environment Act 2019 has a legal provision guiding and requiring adherence to the environmental action plans by other sector agencies whenever dealing with matters

related to the environment as defined by the Act. However, despite the individual action plans, similar legal guidance is lacking in the Water Act, Land Act, and Forestry and Tree Planting Act.

7.4.4.2 Responsiveness to land tenure and related dynamics

While the Land Act scores moderately, the Water, Environment, Forestry and Tree Planting Acts bear a low consideration of land tenure, despite a very high indication of current and future land needs. Specifically, the Acts include provisions to require, access, and establish specific actions on any land through easements and acquisitions, especially for public work and authority. As such, all four Acts include provisions linking private tenure to public tenure objectives such as conservation, including the prospects of land acquisition from private tenure holders through the Land Acquisition Act of 1965, a law that spells out the land compensation procedures to date. The Land Act 1998 has a moderate coverage of land tenure issues, despite some gaps and limitations in accommodating the complexity of the related changes since its enaction in 1998.

Generally observed in all the four Acts assessed is the indication of land as a centre of the action. The diverse interests and power over the same land contribute to the complex private and public land tenure coexistence situation and the likely conflicts the legislation should manage. The legislation needs to explicitly outline how particular land tenure dynamics may affect the enforcement of each Act, including how the diverse institutional priorities may proceed. Furthermore, while the Land Act contains most of the institutional arrangements relating to land, the Water, Forestry and Trees, and Environment Acts also introduce respective institutional arrangements, with multi-sectoral efforts reflected at Ministerial Committees and District Committees.

Nonetheless, conflicting institutional and legal impasses are present. For instance, the Water Act empowers the responsible officers to negotiate and award easements on any land without consulting with land lead agencies or institutions. Furthermore, the reliance on the 1965 Act on land acquisitions and compensation, yet several other Acts, including the constitution, are enacted post the 1990s, signalling potential legislative pitfalls.

Any considerations of land tenure in the Acts are still plot-oriented in perspective, with a limited conceptualisation of the possibility of tenure as a spatial and temporal resource. The plot-based view of land needs by each law leads to the possibility of overlapping rights and interests on certain lands, yet without apparent legal hierarchy's provision.

7.4.4.3 Responsiveness to holistic integrated approaches and land tenure

A shift towards integrated and tenure responsiveness requires legislation to be cognizant of individual and interconnected issues. In this case, the assessed Acts variably respond to integrated watershed management approaches and land tenure responsiveness, but also sections of the Land, Water, and Environment Act require land 'ownership' to be respectful to the land use plans, environmental requirements, and water protection. There are more land tenure forms than 'ownership'. Additional gaps include the absence of provisions demonstrating knowledge and acknowledgement of integrated watershed management approaches and land tenure in ensuring successful resources administration and sustainability as a concurrent act.

Management actions related to environmental or other resources are not required to ensure tenure issues responsiveness, nor are courses on land administration required to ensure environmental sustainability explicitly. As such, implementing one Act threatens or limits the success of another Act. Integrated approaches thrive on orderliness, in this case, clear

legislative hierarchy and precedence, which are largely absent from the Acts, except for the Environment Act, which assumes and indicates legal superiority on environmental matters.

7.4.5 Implications of the legislative responsiveness to land tenure and integrated approaches findings

The Environment Act, Water Act, Forestry and Tree Planting Act and Land Acts' responsiveness is according to the pre-set thematic indicators, the score, and thus, varying observations. Therefore, the Environment, Forestry and Tree Planting Acts are moderate regarding integrated watershed management approaches responsiveness. Selective pointers to the rating decision regarding integrated approaches responsiveness include the observed inclusion and provision of most of the integrated approaches principles and goals in all assessed Acts. In addition, the legislation provides institutional collaboration, participation, information access, and possibilities for review, updating, and reform. The higher score is unattained due to the need for vivid definitions, citations, or recommendations of the integrated watershed management approaches, complementary provisions, and sufficient provision for institutional coordination and power hierarchies. The Land Act is moderate in land tenure responsiveness, while the water law is of low responsiveness in all three thematic categories of indicators. All four Acts are abstract about the holistic indicators regarding land tenure and integrated watershed management, especially the Water and Land Act.

Although the Water Act, Forestry and Tree Planting Act, and Environment Act rate low on land tenure responsiveness, we confirm a significant need and dependence on the land. The Acts also consider private land tenures, thus, providing for land acquisition, including compulsory land acquisition using the Land Acquisition Act of 1965. However, the planned reliance on compulsory land acquisition to extend public tenure is likely an action perpetuating

land tenure insecurity (real and perceived), mass acquisitions and speculations, displacements, and incidental costs, among other land tenure challenges. In addition, some of the available compensatory remedies have so far indicated difficulties when using the land acquisition law of 1965, equally past due reformation. Additional procedures exist among practitioners' such as ensuring the Principles of Free Prior and Informed Consent (FPIC) in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Voluntary Guidelines on the Governance of Tenure of Land, Fisheries and Forests (VGGT) encounter legal limitations (FAO, 2022b; United Nations, 2007). As such, the prevailing legislations are insufficient for the desired outputs of integrated watershed management.

Legislative reforms are due to allow a move from the low or moderate responsiveness of the prevailing legislation and the dependence on policy statements for integrated watershed management. For instance, attempts at integrated watershed management in the study area are primarily a policy action of the Uganda water policy of 1999, whose results based on land use and cover changes in the regions catchments confirm the possible level of integrated watershed management effectiveness (Broek, 2019; Mugo et al., 2020; Mwanjalolo et al., 2018).
Land use and cover changes pause a legislative challenge as legal evidence is more likely lost to claim ecological sensitivity and other decision-influencing indicators. Relevant agencies must thus utilise coherent environmental history legal provisions empowering decision-making to overcome contracted legal proceedings. The catchment changes also affect legal restoration benchmarks that characterise environmental impact assessments. The successes and challenges encountered in integrated watershed management indicate that the current sectoral legislations usually wound into a framework are failing to effect intended changes (Blomquist and Schlager, 2005; Muhereza, 2006; Rwakakamba, 2009; Songa et al., 2015).

The Acts contain provisions for multi-sectoral ministerial and district-level committees, institutional collaborations, processes, procedures, and stakeholders, but little show at the local community levels. Achieving institutional improvements in structure and, consequently, the actions depend on the prevailing legislation. Some institutional gaps are due to the existing legislation needing more precision and clarity. Clarity, precision, and as much certainty as possible are due qualities of effective legislation. Legal precision and clarity become more critical in multidisciplinary and interdisciplinary fields of action, research, and dependence on social learning, such as integrated management approaches (Coleman, 1998; Majambere, 2011). According to our hypothesis, the limited responsiveness of the legislation has led to the limited adoption and effectiveness of integrated watershed management approaches. As a result, catchments with dynamic tenure miss an opportunity for integrated watershed management actions to improve land tenure responsiveness in plans and actions (Chigbu et al., 2017; FAO, 2022b; FAO et al., 2006; McLain et al., 2021; Wolter and FAO, 2017). Property rights are linked to watersheds, and so the management (Lange, 2017; Schlager and Ostrom, 1992; Tarlock, 2000). Therefore, equally important is recognising the role of land tenure, especially private land tenure practices, with more individualised but unequal resource power and rights and insufficient public land tenure to maintain and supply sustainability goals, among other characteristics defining the public–private land tenure and property coexistence, as essential for holistic and responsive legislation.

7.5 Conceptualizing for a responsive legislation to integrated watershed management amidst land tenure dynamics

In this sub-section, we respond to the third research question identifying legislative remedies recommendable for responsive legislation.

Overall, an integrated watershed management and land tenure-responsive legislation would handle the complex integrated watershed management approaches. However, at the catchment levels, responsiveness pays attention to the public and private land tenure co-existence, complexities, and other distinct land tenure system dynamics. Some foreseen complexities relate to mobilising, legislating, and administering private land tenures for ecocentric values, costly land acquisitions to supply human and nature needs, participatory supervision of public and private tenures, and legislation enforcement. The new legislation must also balance valued goods and services with intangible ones, land rights and responsibilities, and plots and landscape values while considering the physical place, related laws, social norms, and rights (Gooden and ‘t Sas-Rolfes, 2020; Ostrom, 1999; Schlager and Ostrom, 1992).

Therefore, an appropriate legislative framework is due, with at least a three-pronged effect, as summarised in (figure 7.4). Here we envision the ‘new legislation’ ability to accelerate ‘integration’ and thus approach effectiveness, solve land tenure-related challenges and limitations prevailing, and enact other relevant legislations through monitoring and evaluation.

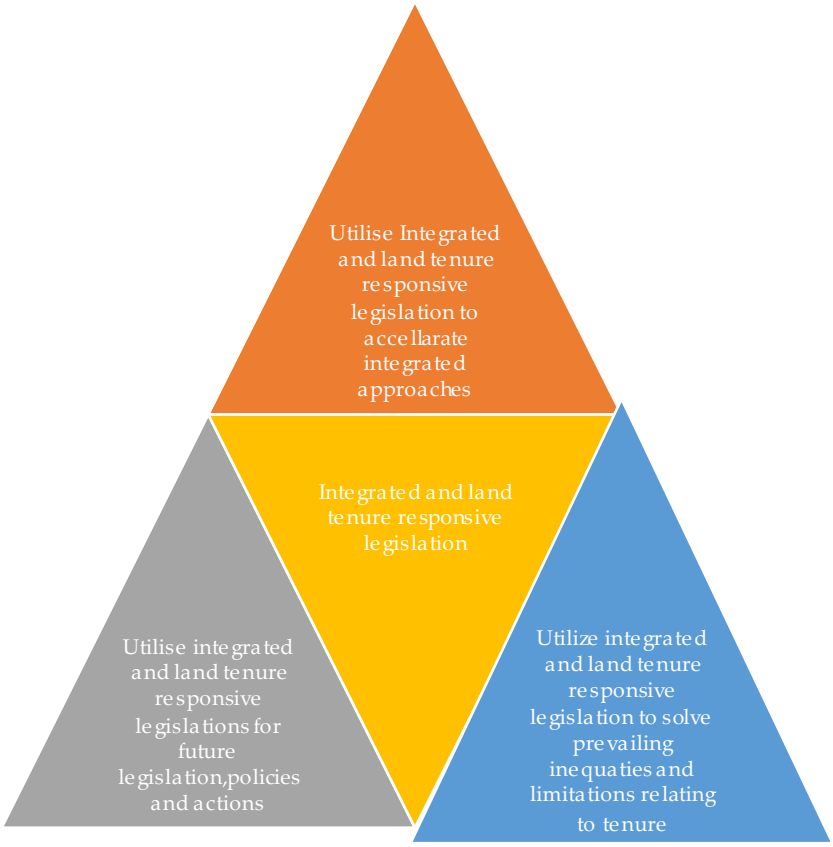

Figure 7.4: Conceptualised application of integrated and land tenure responsive legislation.

One of the ways to initiate a review of existing laws, enact new ones, or influence coherence among prevailing legislations is through the development of Model legislation or provisions. Model legislation would inform some uniformity and consistency necessary following the global adoption of integrated watershed management approaches extent, land tenure, environmental legislation variations and the transboundary and cross-sectoral nature of issues. This paper provides some ideas to inform the model legislation, especially following the indicators we applied in evaluating the prevailing legislation. Emphasis should include providing appropriate definitions, principles, institutional frameworks, and hierarchies. Responsive legislation should recognize the interconnectedness of resources and the issues that enable responsive planning, budgeting, monitoring and evaluation. Catchments bear uniqueness; thus, jurisdictional applications accommodative of catchment uniqueness are essential. In that case, provide for landscape-based-land tenure rights. The aim is to provide for

common but differentiated roles, duties, and benefits in land and other resource administration. For instance, the Uganda Mountains and Hilly Areas Regulations of 2000 contain such thinking. However, it is limited to mountainous and hilly areas and is not equally enforced uniformly in the whole country or enforced at most. To succeed at ensuring varied roles, tenure but common goals, elaborate assessment process, information management and decision making.

7.6 Conclusions

Integrated watershed management approaches to ensure sustainable resources management and governance, especially on a defined spatial scale, informally date back centuries but formally to at least four decades ago. Concept refinement continues through criticism, research, and practice. Experiences drawn from implementing integrated watershed approaches draw our attention to the role of land tenure and institutional dynamics as some of the limiting factors to the possibility of achieving integrated watershed management goals. This paper answers the three research questions approaching them in two parts. First, by providing comprehensive coverage of the land tenure and integrated watershed management linkage from literature and complementary field experiences of topics, we need to understand better, such as public–private land tenure co-existence in catchments and the prevailing land tenure effect on integrated watershed management approaches. Second, the section provides a knowledge basis for a move towards integrated and responsive legislation. Third, the significance of understanding the land tenure dynamics provides information about needed modifications in mobilizing private lands and consolidating strategies for private voluntary actions, land acquisitions, restrictions, incentives, and other measures for sustainability through integrated watershed management (Buntaine et al., 2014). The second part of the paper also evaluates the

responsiveness of relevant legislation in the context of dynamic land tenure to integrated watershed management approaches. The results indicate a low to moderate responsiveness by the prevailing legislation to integrated watershed management amidst the dynamic land tenure. As such, achieving a resources management system that respects land tenure rights while serving both human and environmental goals equitably across landscapes, a move beyond policy statements and sectoral legislation lacking in responsiveness is due. The suggestion applies to the case study areas where integrated watershed management approaches are a policy statement and action decades past and dependent on a sectoral legislative framework. Moreover, according to the UN report of 2021, several other regions in the global south need to improve on integrating and implementing integrated watershed management approaches (Gebregergs et al., 2022), a situation that would benefit from legislative reform. We suggest a move to integrated watershed management and tenure-responsive legislation. However, we are limited in elaborating in a detailed manner the significance of such legislation as such future research could explore the legal significance and feasibility of our recommendation for integrated watershed management approaches and land tenure responsive legislation.

7.7 Chapter linking to other chapters

Based on results from objectives 1 and 2, this chapter consolidates more evidence to propose reforms set under objective 3. The process includes consolidating the land tenure relationship in the catchments into two significant categories of property rights and regimes: the public and private land resources tenures and resource rights' and shows how they co-exist and the effects of integrated watershed management. The paper also assesses integrated watershed management relevant legislations of Uganda as a case for land tenure and integrated approaches responsiveness. The paper conceptualises legislation proposals for integrated watershed management responsive reforms.

CHAPTER 8: LAND TENURE DYNAMICS AND INTEGRATED WATERSHED MANAGEMENT - A SYNTHESIS AND CONCLUSION

8.1 Introduction

In this chapter, I summarise the research, highlight some lessons learned, and offer a tentative conclusion. The research broadly inspires to improve the effect of integrated watershed management approaches in contexts with dynamic land tenure. The specific objectives of the research include (a) surveying the state of integrated watershed management in dynamic land and tenure contexts, (b) examining the relationship between land tenure and integrated watershed management, (c) assessing the relevant land and related resources legislation responsiveness to integrated watershed management and conceptualise responsive reforms.

8.2 The state of the progress, effects, and possible limiting factors of integrated watershed management in dynamic land tenure contexts

The history of the integrated watershed management concept and the terminologies varies, with some literature going back to antiquity, and the mid-20th centuries to the present (Wang et al., 2016). However, consistent over the years is the need to improve resource use, development, governance, and management in a given space, preferably watershed approaches. Global instutionalisation and monitoring of integrated management approaches are traceable in the Millennium Development Goals (MDG 2000-2015) that were preceded by the global sustainable development goals (SDG 2015-2030) where each respective Country reports progress (UNEP, 2021; United Nations, 2015b).

8.2.1 Integrated watershed management concept and approaches

Several "integrated" approaches in watershed management exist, some to achieve specific goals, such as water security, and general goals, such as ensuring ecosystem balance and sustainability, human and animal health. Such approaches include the integrated water resources management (IWRM) shared among the water community of researchers and practitioners and the integrated watershed management (IWM) approach common among the soil, land, and agricultural management community. Progressively, either approach is adopted, working with a defined scale to seek functional, societal, and institutional integration.
Several decades of integrated watershed management have come with some modifications in purpose at certain levels. For example, physical management measures for maintaining hydrological conditions, soils, and other biomes, were standard from the beginning (Biswas, 1990; Heathcote , 2009). Progressively, the human factor gained attention, identifying governance as a central challenge, defining crises such as the water crisis, and limiting the effectiveness of physical and infrastructural management measures (UNESCO and World Water Assessment Programme (United Nations), 2006). As such, dating recent years integrated watershed management approaches serve to improve resources governance. The conceptual theory hypothesises that the improvement of resources governance will improve resources management amidst debate.

Some observable character differences among some integrated watershed management approaches in available literature indicate that the integrated watershed management (IWM) approach associated with more physical catchment impact assessments related to erosion and sedimentation control (Bebermeier et al., 2017; Teka et al., 2020), water quantity and quality (Butsel et al., 2017), carbon stock improvements (Gessesse et al., 2020), and land resource

distribution and equity questions (Ratna Reddy et al., 2017). On the other hand, the integrated water resources management (IWRM) approach attracts more conceptual refinement and institutional related debates (Bandaragoda and Babel, 2010; Kumar et al., 2019; Sokile et al., 2003). Notwithstanding, I note that the expandable nature of integrated approaches as they aspire and assume inter-agency interests and cross-jurisdiction. The approaches require multiple tiers of action, with the lower levels often operating under a unified statutory and jurisdictional order. As such, depending on various legislations and ad-hoc consolidation of plans, strategies, and applications (Bucknall, 2006; Grigg, 2011; Lautze et al., 2011; Rogers et al., 2003). The dissertation research, therefore, examines the state of integrated watershed management amidst dynamic social and governance factors and conceptualising a way forward.

In this dissertation therefore, integrated watershed management approaches refer to all approaches or strategies responding to a range of socio-ecological issues involving relevant stakeholders, using delineated units such as water catchments for reference, aiming to achieve socio-ecological results. Integrated watershed management, among several prevailing definitions, is the process of formulating and implementing a course of action involving natural and human resources in a drainage basin, considering the social, political, economic, and institutional factors operating within the drainage basin, the superordinate river basin, and other relevant regions to achieve specific social and ecological objectives (Dixon and Easter, 1991; Schütt and Förch, 2004; Thiemann et al., 2018; Wang et al., 2016).

8.2.2 Integrated watershed management approaches and improving resources governance - as a case

In chapter 4, two sub-catchments are compared, one affected by integrated water resources management interventions, and another not exposed to direct interventions. The results indicate that integrated watershed management application improves water governance through enabling the establishment of systems and structures, respective functionality, 'good' governance principles among other variables desirable to effect water resources governance applied in the assessment. The difference between the two sub-catchments governance situation is statistically significant ($\alpha \leq 0.05$) across over 95% of the variables.

The study also contributes to debates on the potential of integrated watershed management approaches and what makes integrated watershed management approaches successful. At some point, good governance was a prerequisite for integrated watershed management to thrive, leading to debate on what comes first between integrated watershed management approaches and good governance (Lautze et al., 2011; Rogers et al., 2003). The results also complement arguments in favour of improving resources governance, such as water in prospect for improvements in the respective resources management and approach framework (Allan and Rieu-Clarke, 2010; Bucknall, 2006; Uhlendahl et al., 2011). Additionally, the approaches by design orient to improve resource governance through creating an enabling environment, institutional framework and management instruments, and financing is tentatively working according to the results.

The study continues to widen the gap between the number of water-centred governance studies and studies assessing the broader watershed and related governance issues. The gap is due to

the ‘problem-shed’ rather than ‘watershed’ approach, even in the context of integrated watershed management (Woodhouse and Muller, 2017).

Additional observations drawn include;

- A differentiated impact of integrated watershed management approaches adoption at policy and practice level. For instance, both sub-catchments fall within the broader framework of integrated watershed management policy implementation in the country. However, the governance systems remained ‘conventional’ and less effective River Semliki sub-catchment, while improvements were recorded in the river Mpanga sub-catchment.
- Integration ought to be caused and understood at multiple levels, thus, designing appropriate actions.
- Land tenure issues arose at the catchment level during the study, especially when dealing with households during integrated watershed management.
- Although both sub-catchments share a similar land tenure system, the study findings also indicate that the role of land tenure differs according to the governance situation. Thus, different integrated watershed management results are possible.
- The situation implies the interconnectedness of land and water governance issues.

8.3 The relationship between land tenure and integrated watershed management

Land tenure refers to a defined arrangement in which an individual, group of individuals, institution, or state accesses, possesses, controls, and extinguishes land rights. Other prevailing definitions emphasize that land tenure is a relationship, defined formally or informally, between an entity/subject and land (FAO, 2002a).

The chapters 5 and 6 examine the relationship between land tenure and integrated watershed management. Chapter 5 summarises different literature documenting the linkage, mainly regarding land tenure's roles. The chapter also identifies some typical land tenure dynamics. These dynamics include land tenure security, gender and succession, and land tenure systems. The variables are vital in shaping the role of land tenure in watersheds. There are several roles that land tenure plays, including its influence on land use and cover change and, resultingly, hydrological, and geomorphological change. Land tenure also influences human decisions and actions and determines land use and related plans and arrangements. Finally, land tenure is a tool for the control, ownership and exchange of land and related resources. Consequently, land tenure controls and defines other resources' tenure. The mentioned roles are further identifiable in the related literature review. Difficulties and gaps in applying the information persist, despite mapping the multiple linkages of the land tenure role and various aspects of integrated watershed management due to information fragmentation.

The research in chapter 6 provides a holistic examination of the land tenure effect, using catchment as a unit of reference and analysis. It is documented that the extent of changes in land use and land cover, the driving factors, and the adoption of sustainable practices depend on the prevailing tenure . The findings confirm the association of land tenure and integrated watershed management aspects, such as land use and land cover changes in the Lake Victoria basin, like elsewhere, with similar studies. (Chidumayo, 2002; Luoga et al., 2005; Mpanda et al., 2011; Schürmann et al., 2020; Turner et al., 1996).

According to the results, the watershed's land use and the land cover situation in the study areas are rather adverse. The rate of adopting sustainable land use and management practices as a remedy is unmatched, yet the prevailing land tenure, though with limitations, is perceived mainly as less limiting. The gap may be due to various reasons including the prevalence of customary and informal administration practices in the Customary, Mailo and Native freehold

tenure systems. Moreover, the land tenure systems also still bear widespread land tenure insecurity perceptions, gender biases in land rights and succession despite laws demanding otherwise, and other system-specific weaknesses.

Overall, the findings in chapters 5 and 6 tentatively indicate land tenure as a valuable tool for integrated watershed management. However, the studies also emphasise the differences in land tenure effect at household and catchment scales to recognise, thus recommending land tenure responsiveness in integrated watershed management.

8.4 Towards integrated and responsive legislation

In most parts of the world, the legislative framework associated to integrated watershed management approaches still functions in a sectoral way (GWP, 2017). Likewise in the study areas of Uganda, almost three decades of implementing integrated watershed management depend on a policy statement in the 1999 water policy and a sectoral legislative framework. The framework consists of a land law of 1998, a water law of 1995, and a land acquisition Act of 1965. Therefore, the likelihood of failure to respond to new demands in resource governance and management is high. So far, the continuing land use and land cover change over the same period as the prevailing legislations confirm the legislative and approach implementation gaps (Mugo et al., 2020; Mwanjalolo et al., 2018). The prevailing framework has failed to allow effectiveness of the integrated watershed management approaches, mainly due to limited 'integration' according to the recent evaluation report (UNEP, 2021). The later situation encounters a future with an increase of climate change impacts on the watershed systems (Akurut et al., 2014; Gabiri et al., 2020; Nyeko-Ogiramoi et al., 2013), population growth among other social issues (Wafula et al., 2014; World Bank, 2022), and increasing demand for land amidst a changing land tenure (Chimhowu, 2019; Otto et al., 2019).

Against this background, I suggest a move towards integrated watershed management and land tenure-responsive legislation. I arrive at the suggestion after;

- seeking a shared conceptual understanding among integrated watershed management approaches,
- demonstrating the potential of the approaches in ameliorating the ineffectiveness of resources management and management,
- assessing the land tenure effects, including the frame of the private and public tenure coexistence and relationship,
- assessing the level of responsiveness of critical legislation. The legislations assessed are mainly Acts of Parliament and are responsive between low and moderate.

Therefore, current integrated watershed management lacks adequate and coordinated legal force to compel the needed action.

8.5 On the study methods

Generally, the dissertation applies a mixture of qualitative and quantitative methods. The methods include systematic literature review, catchment surveys involving the administration of questionnaires, focus group discussions, interviews, and catchment-wide reconnaissance observations. Complimentary secondary data consists of satellite imagery data and other spatially differentiated data. The data methods support producing maps as well as unit data mostly from households as the primary units of analysis and interaction. The data is managed and analysed using statistical tools. The decision regarding which tools and methods to apply depends on the research questions and the data requirements. Overall, mixing the methods meritorious in several ways, including bridging the gap between spatial evidence and watershed user perceptions.

8.6 Conclusions

The research answers mainly three questions. In the first question, the state of integrated watershed management is explored, explicitly identifying the concepts, and tracing the debates, successes, and challenges. The undertaking facilitates a coherent understanding of multidisciplinary concepts and approaches such as integrated watershed management. In due course, the research direction is established.

At a conceptual level, integrated watershed management is defined as a process and act of holistically managing the environment in delineated spatial units, considering both upstream and downstream systems connectivity for social and ecological sustainability. Integrated watershed management incorporates several implementation approaches, including integrated water resources management.

In literature, the translation from concept to practice shows an integrated approach with the potential for success, failures, and challenges. Therefore, a case study in the lake Albert basin – Uganda segment compares the water resources governance situation in two sub-catchments under the same land tenure system, ascribed as native freehold tenure, but varying exposure to integrated watershed management interventions. The catchment with integrated water resources management catchment interventions shows improvements in water resources governance and management effectiveness. Improvements in governance and water resources management, however, face challenges like land tenure in both sub-catchments. However, the effect is likely disproportionately and affecting measures' adoption and sustainability.

The second research question, dwells on understanding the relationship between land tenure and integrated watershed management. First, the research explores the status through a systematic literature review. The findings indicate land tenure relates to integrated watershed

management variably, such as driving changes, influencing decisions and actions, and incentivising sustainable practices adoption, among others. The second part of the research responds to some of the research gaps identified in the literature review; determining whether land tenure explains land use and land cover changes in catchments in the Lake Victoria basin-Uganda segment. In the process, the significance of the relationship between contextual explanations and factors for and against integrated watershed management are established by considering multiple land tenure systems and examining the private-public land tenure co-existence.

The results from satellite imagery analysis confirms that adverse land use and land cover changes characterise the period between 1985-2014. The watershed users highly perceive agricultural practices, population growth, soil types and fertility, and rainfall variability. As such, the perception of land tenure is low compared to other drivers. However, the association is statistically significant, concerning the influence on the extent of the changes, the other drivers of land use and land cover change, and the adoption of sustainable land use and management practices.

Some contextual explanations for the contribution of land tenure depend on the three land tenure systems of Customary, Mailo and Native freehold character, especially the perceived land tenure insecurities and related causes. Land tenure security affects various sustainable land practices, choices and decisions, such investing in long term solutions (Holland et al., 2022; Robinson et al., 2018).

Land tenure affects many variables, such as tenure systems, form-according to bundle of rights, and administration practices. However, In the context of a catchment, land tenure falls into private or public land (resources) tenure regimes. Public land mainly relates to resources vested in the management of the state for the public, including wetlands and water resources, protected

areas and reserves, among others. The public-private tenure coexisting dimensions mapped show randomness and complexity as a distribution character. The coexistence also indicates an increase in private tenure activities and encroachment on public tenure. The observation implies land tenure-induced complications and complexities in the watershed.

The third broad question focuses on the collective responses and findings from questions one and two and an orientation to seek improvements in integrated watershed management. The supposition is that integrated watershed management and land tenure-responsive legislation will make improvements. However, an assessment of select legislation in Uganda shows low to moderate responsiveness to integrated watershed management and land tenure issues. Thus, a limiting framework exists to enable effective governance and management, despite indications of some degree of land tenure responsiveness. The findings follow a set of qualitative measurement indicators. Consequently, reforms and moving towards integrated and land tenure-responsive legislation is recommended. We include tentative areas and indicators to provisions for such a law are included.

The research supports to understand the relationship between land tenure and integrated watershed management, especially in the global south. Some questions need further research including the potential effects of land tenure registration or delay to catchment sustainability. Arising questions are, (a) Will land tenure registration result in improved tenure security? (b) Will improvements in tenure security result in positive integrated watershed management and conservation outcomes? (c) What land administration and guarantees are needed before reforms and during enforcement to ensure (a) and (b)? These and other questions must add to research assessing the legal possibility and feasibility of integrated watershed management and land tenure responsive legislation.

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APPENDICES

Appendix A: List of assessed and cross-checked acts of parliament and other legislations

Main legislations

Uganda laws. The National Environment Act 2019

Uganda laws. The Water Act 1995

Uganda laws. The Forestry and Tree Planting Act 2003

Uganda laws. The Land Act 1998

Other relevant legislations cross-checked.

Uganda laws. The Constitution 1995

Uganda laws. Local Governments Act 1997 Cap 243

Uganda laws. The Land Acquisition Act, 1965 Cap 226

Uganda laws. The National Climate Change Act,2021

Uganda laws. The National Environment (Hilly and Mountainous Area Management) Regulations, 2000. No.2

Uganda laws. The National Wetlands, Riverbanks and Lake shores regulations No.3 2000

Uganda laws. The National Agricultural Advisory services Act, 2001

Uganda laws. Water Resources Regulations (S.I. No. 33 of 1998).

Uganda laws. Succession Act,2000, and the Succession (Amendment) Bill, 2021

Uganda laws. National Agricultural Advisory Services Act, 2001 Act 10 of 2001

Uganda laws. Mining Act, 2003

Relevant policy

Uganda Policy. The Uganda water policy 1999

Appendix B: Responsiveness Score Matrix

		Water law	Forest law	Land law	Environment law
Indicators					
I.	Resource interconnectedness	U	M	M	M
II.	Principles	M	M	L	H
III.	Institutional collaboration	M	M	M	M
IV.	Physical and transboundary scales	U	L	L	L
V.	Multi-stakeholder actions	L	L	L	H
VI.	Concept, definitions, examples	U	U	U	U
VII.	Land tenure systems	U	L	H	U
VIII.	Land tenure dynamics	L	L	M	L
IX.	Current and projected land demands	L	M	M	M
X.	Private-public tenure co-existence complexities	L	L	L	M
XI.	Land tenure role and other socio-economic and ecological goals	U	U	L	U
XII.	Updatable, progressive, and accommodative	L	M	M	M
XIII.	Role of land tenure in IWM	M	M	M	M
XIV.	Land terms and responsibilities in IWM frame	U	L	U	L
XV.	Land legislation to improve IWM	U	L	U	L
XVI.	Other legislations to improve land tenure characters	U	U	U	U
XVII.	Spatial and temporal differences	U	U	U	U
VIII.	Review, monitoring, and evaluation	H	H	H	H

Code:

L=Low (the idea/indicator is traceable, but abstract >25)

M=Moderate (the idea/indicator is traceable, clear, but partial to presentation expectation >50)

H=High (the idea/indicator is traceable, clear, satisfactory to presentation expectation >75)

U=Undetected (the idea/indicator is not traceable or very abstract for basic articulation=0

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Juliet Katusiime
Berlin, 19. 03.2023

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