Mainstreaming Indigenous Knowledge Systems in Integrated Catchment Management in the Kingdom of Lesotho

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Mainstreaming Indigenous Knowledge Systems in Integrated Catchment Management in the Kingdom of Lesotho

A report by the Southern African Development Community (SADC)
and Southern African Research and Documentation Centre (SARDC)
in collaboration with the National University of Lesotho (NUL)

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Southern African Research and Documentation Centre

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Foreword by the National ICM Coordinator

The Kingdom of Lesotho is a country of legendary beauty and rich culture and tradition. Our country is rich in water resources and green pastures with high potential for livestock grazing and agriculture. Water is life, essential to us for our daily needs but it is also the motor of livelihood and economic prosperity. The founding of our nation itself is linked to the country's water resources.

Basotho are traditionally herders and farmers; herding and initiation schools are a crucial part of our upbringing and a formative experience. It is through herding that our people come in contact with our natural landscape and rich biodiversity. Through the centuries, we as Basotho have sustained ourselves through farming and have developed a rich panacea of traditional knowledge.

Today, land degradation and water insecurity threaten the prosperity of our people. They are caused by the overuse of our water and land, uncontrolled grazing, abandonment of agricultural terraces and the degradation of wetland ecosystems. Meanwhile, we are also confronting external threats like the increasing droughts and floods that are brought about by changing climate.

Indigenous knowledge, the knowledge of our people, is a precious resource for the conservation of natural resources and holds the answers to some of the problems that Basotho are facing today. This knowledge forms the basis of our engagement with our communities and a starting point towards a more sustainable path to manage our natural resources. Farmers and herders as custodians of our land have tremendous potential in leading the way to ecosystem rehabilitation by championing traditional conservation methods.

To be sustainable, change has to come from within our country and its people. Therefore, I am appreciative of this study that highlights the potential for the use of indigenous knowledge within the implementation of integrated catchment management approaches. This study comes at a critical moment, as Lesotho aims to reverse environmental degradation in line with the UN Decade of Ecosystem Restoration. To reimagine, recreate, and restore our ecosystems, nature-based solutions and indigenous knowledge systems are central. A good understanding of indigenous knowledge and the effective practices of communities will enable policy planners, climate specialists, and indigenous knowledge holders to create collaborative initiatives between indigenous knowledge systems and scientific knowledge.

With ReNOKA as a citizen movement for integrated catchment management, we have a real chance to revisit our traditional knowledge and embed it into training and formal education. This knowledge can then be applied in integrated catchment planning and the rehabilitation of lands by our communities.

Makomoreng Fanana
National ICM Coordinator
Ministry of Water

Preface

The Kingdom of Lesotho is becoming more vulnerable to climate change, as are the other 15 Member States of the Southern African Development Community (SADC), particularly as a result of recurrent droughts, land degradation, inequitable land distribution, deforestation and overgrazing. In response to climate change and emerging challenges, it is essential for decision-makers to formulate policies based on the best available knowledge. The knowledge of local people known as Indigenous Knowledge is increasingly recognised as an important source of knowledge for conservation of natural resources and ecosystems, and for resilience strategies. The tradition of African people is to live in harmony with nature, through sustainable use of the resources within their localities.

Indigenous knowledge is therefore a precious resource that must be preserved, not only as a component of cultural identity, but to meet the challenges of modern life. The use of indigenous knowledge can contribute to the increased efficiency, effectiveness and sustainability of environmental conservation among rural communities in Lesotho and elsewhere in Southern Africa. This knowledge forms the basis for community-level decisions pertaining to sustainable land management, livestock rearing, food security, human and animal health, and the management of natural resources and ecosystems.

Yet despite this critical situation, the practice of indigenous knowledge is still being marginalized among communities in Lesotho and neighbouring countries. It is apparent that there is need to look more closely at the role played by indigenous knowledge in protecting and sustaining the biophysical environment, and to review the integration of effective practices with appropriate modern methods and technologies.

The broader understanding of the value of indigenous knowledge coincides with a period of increasing loss of knowledge about the methods and approaches, with the exception of some rural areas where indigenous knowledge is shared mainly orally. Some practitioners have written about the methods and impacts, and there have been some scientific studies that revealed the importance of specific practices for sustainable rural development, but these studies are often put on shelves and the local knowledge is being lost. The need for documentation is apparent so as to continue to generate solutions appropriate to the local conditions.

The current crisis with global warming is a catalyst for the mobilization of all knowledge and possible solutions for analysis and implementation planning. A good understanding of indigenous knowledge and the effective practices of communities will enable policy planners, climate specialists, and indigenous knowledge holders to create collaborative initiatives between indigenous knowledge systems and scientific knowledge.

This publication on *Mainstreaming Indigenous Knowledge in Integrated Catchment Management in the Kingdom of Lesotho* marks a firm step towards documenting the evidence of indigenous knowledge practices related to Integrated Catchment Management in Lesotho as a pilot study to be shared and studied elsewhere in the SADC region. The report highlights selected case studies that assess the use of indigenous knowledge in Integrated Catchment Management, analyse its importance, give reasons and provide options for integration.

This report can help to build and strengthen collaboration between policy makers and communities in promoting sustainable utilization of natural resources for the benefit of all

stakeholders. The opportunities, challenges and lessons learnt presented in this report should continue to inspire all stakeholders to do more in managing the natural resources in the region.

The book supports the Indigenous Peoples Kyoto Water Declaration of 2003, which states that:

"*We, the indigenous people from all parts of the world reaffirm our relationship with our lands, territories and water as the fundamental physical cultural and spiritual basis for our existence. The relationship to our Mother Earth requires us to conserve our freshwaters and oceans for the survival of present and future generations. We assert our roles as caretakers with rights and responsibilities to defend and ensure the protection, availability, and purity of water. We stand united to follow and implement our knowledge and traditional laws and exercise our right of self-determination to preserve natural resources and life*[1]."

This study comes at a critical moment when the next decade from 2021-2030 has been dedicated as the UN Decade of Ecosystems Restoration. To successfully reimagine, recreate, and restore the ecosystems, nature-based solutions and indigenous knowledge systems are central.

SADC produced the first environmental study of the region based on ecosystems in 1994, providing a baseline and some insights into indigenous knowledge and community-based initiatives, in collaboration with SARDC and the IUCN-The World Conservation Union. The book was awarded a special commendation that described it as "an important and timely state-of-the-art report in an area of crucial significance... presenting issues in a way that challenges decision-makers to act."

In his Foreword to that book, *State of the Environment in Southern Africa*, Sir Ketumile Quett Joni Masire, then President of Botswana and Chairman of SADC, said, "In this region, we have a long history of traditional conservation methods that allowed us to live in harmony with our natural environment. We the people of southern Africa have the future in our hands." (SADC, SARDC, IUCN 1994).

The National University of Lesotho and the Southern African Research and Documentation Centre, through its environment, climate and water institute and the I. Musokotwane Environment Resource Centre for Southern Africa (IMERCSA), are pleased to present this publication on *Mainstreaming Indigenous Knowledge Systems in Integrated Catchment Management in Lesotho.*

1 Indigenous Peoples Kyoto Water Declaration presented at the 3rd World Water Forum in Kyoto, Japan, 2003


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Contents

Selected Maps and Figures

List of Tables

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The production of this report would not have been possible without the considerable support and valuable input from the communities in Lesotho. The information they provided through questionnaires and interviews forms the foundation of this report on the need for integrating indigenous knowledge in Integrated Catchment Management. The stakeholders consulted were mainly from Community Councils, Chiefs and their advisers, village headmen, elders, farmers, women groups, herdsmen, young men and women, and NGOs working in related fields in Lesotho. Ministry officials consulted include Agriculture, Range Management, Forestry, Wetlands, Tourism, Environment, Rural Water Supply, Department of Water Affairs, and the Lesotho Highlands Development Authority (LHDA).

Site visits were made to six Priority Sub-Catchment areas of the Integrated Catchment Management project in Lesotho, and we want to thank the district officials, community representatives and the communities for taking time to discuss issues of indigenous knowledge in natural resources management. Special mention must be made of the Catchment Managers -- Matseko Rankhasa (Khubelu); Matsoere Sebutsoe (Maletsunyane); Motseko Mots'ets'e (Senqunyane); Motlalepula Rasekoele (Makhalaneng); Phomolo Khonthu (Hlotse); and Sebabatso Selia (Likhetla) for their welcoming spirit as well as their knowledge on how resources in these sub-catchments have degraded and the contributions that mainstreaming indigenous knowledge in natural resources management can play in reviving these resources.

NUL and SARDC utilized its team of well-trained researchers who have been involved in similar work for an extended period. The SARDC research team was comprised of water resources management specialists, gender experts and environmental experts, among others. We particularly thank Egline Tauya, Admire Ndhlovu, and Neto Nengomasha for their expertise in compiling this report. The NUL research team comprising of Dr Makoae Masopha (Team Leader), Dr Khahliso Leketa, Dr Mamohau Thamae, Joalane Marunye, and Pokane Masotsa, we greatly value your contribution that led to the success of this initiative.

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SARDC

Acronyms

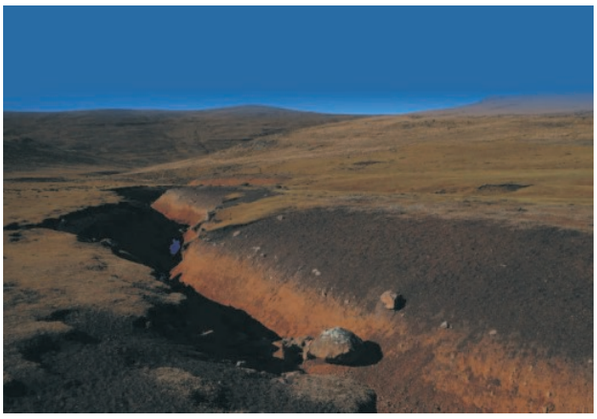
ACs	Area Chiefs
CCs	Council Committees
CCS	Community Council Secretary
DA	District Administrator
DCs	District Committees
DCS	District Council Secretary
DRWS	Department of Rural Water Supply
DWA	Department of Water Affairs
FGD	Focus Group Discussion
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IMERCSA	I Musokotwane Environment Resource Centre for Southern Africa
IWRM	Integrated Water Resources Management
L-BWT	Lesotho-Botswana Water Transfer
LHDA	Lesotho Highlands Development Authority
MAFS	Ministry of Agriculture and Food Security
MFRSC	Ministry of Forest Range and Soil Conservation
MTEC	Ministry of Tourism, Environment and Culture
NUL	National University of Lesotho
ORASECOM	Orange-Senqu River Commission
PCs	Principal Chiefs
RSAP IV	Regional Strategic Action Plan Phase IV
SADC	Southern African Development Community
SARDC	Southern African Research and Documentation Centre
SDG	Sustainable Development Goals
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme

CHAPTER 1

Introduction

1.1 Background

Catchments in Lesotho are degrading at an alarming rate. It is estimated that every hour, Lesotho loses about 4,500 tonnes of fertile topsoil (up to 300 lorry loads), carried away in rivers flowing into South Africa (ORASECOM and Lesotho Department of Water Affairs, 2018). As a result, gullies at numerous hillsides are widened during each rainy season and farmland continues to disappear.



Gullies in Khubelu Catchment. (Credit: ORASECOM)

The main drivers of this change include population pressure, especially in marginal areas, coupled with overgrazing, encroachment of invasive alien plants, as well as unsustainable agricultural and livestock production practices which tend to exacerbate environmental degradation.

Studies show that the increased rate of land degradation in Lesotho and the rest of the Orange-Senqu basin is to a large extent attributable to the abandonment of indigenous knowledge systems as a key strategy in resource management (Orange-Senqu River Commission 15 Years, 2000–2015).

Southern African communities have built their own body of knowledge and beliefs which have been handed down for generations through oral traditions. This knowledge touches on the relationship between living beings and their environment, encapsulating a system of organisation, a set of empirical observations about the local environment, and a system of self-management that governs resource use (SARDC, 2005).

Although local communities have successfully utilised their traditional knowledge in climate forecasting and land rehabilitation, these practices are fast disappearing.

It is against this background that research was carried out to contribute to the reduction of catchment degradation in Lesotho through reviving and mainstreaming indigenous knowledge in integrated catchment management programmes. It is expected that the study will contribute to the body of knowledge on why indigenous knowledge systems are disappearing and what mechanisms could be put in place to revive them.

Indigenous knowledge has been designated as a system because it was a constant practice that yielded positive results. The research verifies its continued relevance within the current socio-economic context in Lesotho, as well as to the youth. Research has also revealed that the benefits of integrating indigenous knowledge into modern ways of managing natural resources far outweigh the benefits of modern science alone. The knowledge developed over generations of interaction between people and ecosystems can make a substantial contribution to ecological restoration.

> ***"Indigenous knowledge has been designated as a system because it was a constant practice that yielded positive results"***

The main objective of the research is to contribute to improved livelihoods and restoration of degraded lands through mainstreaming indigenous knowledge in integrated catchment management. It is intended to support the understanding of indigenous knowledge and its status in natural resources management in Lesotho, and to widen the base of knowledge on effective practices from indigenous knowledge and its integration with other innovative practices.

1.2 Justification of the research

The project contributes to ongoing initiatives aimed at enhancing sustainable land management practices in Lesotho, in particular the national programme for Integrated Catchment Management. Its aim is to rehabilitate degraded watersheds across the country and to put in place prevention measures that will halt the further degradation of Lesotho's catchment areas. The research on mainstreaming indigenous knowledge in integrated catchment management in Lesotho contributes to Output 5 of the programme, which states the need to *conduct applied operational research on integrated catchment management.* The recommendations from the research inform the ongoing policy harmonisation process under Output 2 of the Integrated Catchment Management programme, as well as the development of a compendium.

The research contributes to the achievement of sustainable land management policies and strategies in Lesotho, with results feeding into the basin, regional and global goals.

At national level, the project is in line with the sustainable management principles of the Lesotho Environmental Act of (Act 10 of 2008). Specifically, the research addresses subsection 3(2)(e) which states the need to *reclaim lost ecosystems where possible, and reverse the degradation of natural resources,* and Subsection 66 (1)(b)(iv) which states the need to *integrate traditional knowledge for the conservation of biological diversity with mainstream scientific knowledge.*

At basin level, the research contributes to the focus areas towards the Strategic Action Programme for the Orange–Senqu River basin's Priority 4 on Land Degradation, with its objective focusing on reducing the adverse effects of catchment degradation and improving the sustainability of land use management. Part of the actions and targets listed under this objective include the need for the rehabilitation of degraded rangelands and wetlands, as well as strengthening of institutional frameworks for effective catchment management.

The research supports the implementation of the Integrated Water Resources Management Plan (IWRM) for the Orange-Senqu River basin, 2015–2024. It contributes specifically to the achievement of the IWRM Plan's Central Strategic Objective 3, which states the need to *ensure that the adverse effects of catchment degradation are reduced, and the sustainability of resource use is improved.*

At regional level, the research contributes to the SADC Regional Strategic Action Plan 4 (RSAP IV) Programme 7 on climate change and variability. By assessing the role of indigenous knowledge, the research responds to specific interventions of programme 7.1.1 and 7.1.2, which seek to enhance resilience of SADC Member States to the impact of challenges related to water resources through assessment and dissemination of local indigenous knowledge and practices. The research is expected to be a pilot study that can be widened to other sectors in Lesotho and replicated in other countries in the SADC region.

At continental and global level, the research contributes to the achievement of the African Union Agenda 2063, the Paris Agreement and the Post-2015 Global Development Agenda, where climate change remains a key issue for sustainable development. The research specifically addresses Sustainable Development Goal (SDG) 15, which states the need to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss. The research also addresses SDG 13, which states the need to take urgent action to combat climate change and its impacts.

The valuable contribution of indigenous knowledge to environmental management is reflected in Agenda 21 of the UN Conference on Environment and Development held in 1992. The agenda emphasises that governments and intergovernmental organisations should respect, record, and work toward incorporating indigenous knowledge systems into research and development programmess for the conservation of biodiversity and sustainability of agricultural and natural resource management systems (UNEP, 2008).

Due to the mounting global climate crisis, ecosystem restoration has become a priority mandate for policymakers around the world, ultimately leading to the declaration of the United Nations Decade of Ecosystem Restoration, 2021-2030.

"Agenda 21 emphasises that governments and intergovernmental organisations should respect, record, and work toward incorporating indigenous knowledge systems into research and development programmes for the conservation of biodiversity and sustainability of agricultural and natural resource management systems"

1.3 Methodology and approach

SARDC has partnered with the National University of Lesotho (NUL) to conduct the research on *Mainstreaming indigenous knowledge in integrated catchment management in Lesotho*. The research leveraged on the ongoing Integrated Catchment Management project, and used existing networks for stakeholder consultations.

Considering that there is limited documentation of indigenous knowledge in integrated catchment management, and that indigenous knowledge is characteristically local, rooted to a particular environment and generated by people living in those environments, and is orally transmitted, the intervention was highly consultative. Qualitative research design in a case study approach and snowballing techniques were used to select participants with in-depth knowledge on traditional beliefs and practices in natural resource management. The qualitative data collection methods included interviews and Focus Group Discussions (FGDs) targeting eminent informants purposively sampled at community level. These included community leaders, village heads and elders, farmers, resource managers, and extension workers.

In group discussions, respondents were able to share their existing ideas as well as provide feedback on new information mentioned by fellow group mates. This was an easy and efficient way to gather more information than through one-on-one interviews. The one-on-one interviews were also important to get in-depth information and clarifications on certain issues which would not have been possible during the group discussions.

Interviews and focus group discussions were complemented by desk study and field observations. An extensive literature review was undertaken to assess the impact of land degradation and analyse the status of indigenous knowledge in natural resource management.

To ensure progress of the research, a reference group consisting of the Integrated Catchment Management Coordinator, sub-catchment managers, research teams from SARDC and NUL, and GIZ advisors, held team meetings every two weeks to provide updates and get direction, especially regarding the logistical arrangements for the fieldwork.

Stakeholder mapping

A stakeholder mapping exercise carried out using information from the main Integrated Catchment Management programme provided guidance on socio-economic and environmental aspects, and was considered in planning the number and categories of people to be consulted. The mapping provided guidance on the methods of data collection and identified environmental features to be observed.

Table 1 gives a summary of the key aspects that include the number of villages and chiefs in each sub-catchment area, as well as other socio-economic and environmental aspects considered when planning for the consultations. The villages are managed by chiefs for administrative purposes. Thus, a sub-catchment may be under the administration of one chief or under several chiefs, each administering a portion of the sub-catchment.

Table 2 summarises the different groups of stakeholders consulted at national, district, sub-catchment and village levels using online and physical interviews and through FGDs. More time was used with traditional authorities and knowledge holders at local level, where indigenous knowledge usually rests.

Table 1.1: Background information on priority sub-catchment areas

Priority sub-catchment/ district	Pop in priority sub-catchment	No. of area chies	Terrain	Main env features
Hlotse/Leribe	Pop-23 208 Villages-109 Male-11 569 Female-11 639	6	Flat lowlands & mountainous foothills	Tšehlanyane National Park
Khubelu/Mokhotlong	Pop-1 104 Villages-9 Male-563 Female-541	1	Highlands	Polihali Dam wetlands, mining grasslands
Likhetla/Mafeteng	Pop-7 908 Villages-35 Male-4 010 Female-3 898	2	Lowlands	Sheet erosion
Makhalaneng/Maseru	Pop-6 928 Villages-50 Male-3 483 Female-3 445	3	Foothills	Grassland
Maletsunyane/Maseru & /Hoek	Pop-6 637 Villages-71 Male-3 456 Female-3 181	3	Foothills	Grassland, Maletsunyane falls
Senqunyane/Thaba-Tseka, Maseru, Berea	Pop-3 554 Villages-31 Male-1 838 Female-1 716	3	Highlands	Grassland, Mohale Dam

Table 1.2: Groups of stakeholders consulted

Key stakeholders and institutions	Why they were consulted
Local Government Authorities (District Councils, Members of Parliament, Urban Municipalities, Traditional Leaders, Village Development Committees), District Administrators (DA), District Council Secretaries (DCS), Community Councils (CC), Community Council Secretaries (CCS), Chiefs, Land and Environment Committees, Social Service Committees, and Sub-Catchment Managers	Custodians of the land and water resources and leaders of the traditional chieftainship system responsible for sustainability were consulted to get their perspective on indigenous knowledge and its importance today.
Village Grazing Schemes and Grazing Associations, Water User Associations	They often contribute to the environmental challenges, but are also negatively affected by the impacts of a degraded environment.
Youth and people of all ages including elders, women, farmers, vulnerable groups; and schools	Custodians, harvesters, users, and traditional knowledge holders are the primary beneficiaries of the project.

Direct interviews, focus group discussions, and observations

Direct in-depth interviews and FGDs were spearheaded by a team of researchers from the Water Institute and the Department of Geography and Environmental Sciences at NUL through virtual methods, as well as field visits to the selected sub-catchments.

To get community buy-in, the interviews and group discussions were organised through the area chiefs within the sub-catchments. Using focal persons in each chieftaincy area, mobile numbers for targeted respondents were obtained. Interview guides were shared with some key respondents,who could not be reached during the visits. The respondents recorded voice notes and sent them back to the research team for transcribing.

In-depth interviews helped to draw out the perceptions and experiences of individuals, expressed in their own words. This was useful for gathering information on specific aspects of indigenous knowledge.

The FDGs were convened by the team of researchers in Lesotho who moderated and guided the discussion through key questions. This assisted with an understanding of social norms of the community, and the range of experiences, opinions, perceptions, and attitudes that exist within the community.

Alternative methods of data collection such as telephone calls and WhatsApp messages were employed for villages that could not be accessed due to the heavy rains or steep terrain in some sub-catchments. The research team requested the village head to advise the key informants a day before the planned telephone interviews. The research team encouraged the village head to organise an alternative phone as back up, in case of loss of power. This was the done successfully in the remote areas, especially in Khubelu, where it was difficult to access the selected villages physically.

The research was guided by the following key study questions.

1. What are indigenous knowledge systems?
2. Give examples of indigenous knowledge systems in land and water resources management in Lesotho and similar countries.
3. What is the importance of indigenous knowledge in integrated catchment management?
4. Why is it disappearing? Is it still relevant in today's changing environment?
5. How can indigenous knowledge be revived and integrated into today's modern technologies of integrated catchment management?

1.4 Target group

The research is targeted at benefiting the following:

- Government officials, traditional authorities, land and water planners/managers and legislators in Lesotho, who will benefit directly from the information generated by the project. The publication will enable them to use indigenous knowledge in the implementation of their responsibilities for natural resource management.
- Rural communities severely affected by land degradation and climate change in Lesotho, particularly those in areas affected by food insecurity due to increasing droughts and high soil erosion and siltation levels. They will benefit from the proceeds of this research, through embracing and reviving indigenous knowledge. The research is expected to benefit most of the 1.3 million people who reside in rural areas in Lesotho, nearly 66 percent of the total population. The main target groups include people who are marginalised, single-parent and child-headed households, and labour-constrained households, considering gender dimensions.

- Other communities downstream on the Orange-Senqu River in South Africa and Namibia, and indirectly in Botswana, whose livelihoods are likely to be affected due to the increasing levels of soil erosion and siltation in Lesotho.

The media can be a useful conduit through which the information and knowledge products can be disseminated through articles, direct interviews, and radio programmes.

FDGs were convened by the team of researchers in Lesotho. (Credit: National University of Lesotho)

Indirect beneficiaries

- Researchers and experts on sustainable land management and climate resilience will be made aware of these knowledge products as reference materials for their own work.
- Outside the research timeframe, the report will be peer reviewed and published in a reputable journal.
- The report is expected to be shared widely using existing online networks of key stakeholders.

1.5 Outline of the report

Chapter 1 introduces the report and purpose of the research, the process, target groups and outline of the report, as well as explaining why the research is necessary.

The overview of mainstreaming indigenous knowledge in integrated catchment management in Lesotho, contained in Chapter 2 provides a geographical scope of the pilot sub-catchment areas of Lesotho what defines indigenous knowledge in Lesotho, and explains its importance in integrated catchment management. The chapter explains the concept of integrated catchment management.

Chapter 3 provides the findings of the research from the literature review. The findings are presented in two parts. The first part looks at indigenous knowledge in Lesotho focusing on water management, livestock management, ecosystems management, and climate change-related issues. The second part provides success stories of indigenous knowledge in natural resource management elsewhere in southern Africa for the purpose of learning from others to help to assess what can be adapted or replicated.

Chapter 4 provides results of the primary research for the six sub-catchment areas of Lesotho - Hlotse, Khubelu, Likhetla, Makhalaneng, Maletsunyane and Senqunyane.

Chapter 5 analyses the reason why indigenous knowledge is disappearing and whether it is still relevant in today's changing environment. It provides reconstruction mechanisms, analysing how indigenous knowledge can be revived and integrated into modern technologies of integrated catchment management.

The report concludes with Chapter 6 presenting key highlights from the findings and recommendations for different target groups.

CHAPTER 2

Overview of the research

2.1 State of Lesotho as it relates to integrated catchment management

The Kingdowm of Lesotho is a landlocked country surrounded by South Africa, with a population of about 2 million people, and is highly vulnerable to climatic change. The country is characterised by a spectacularly rough terrain with high and steep mountains. The terrain has exposed large areas of the country to high rates of erosion. For example, when it rains, water flows down these slopes at a high speed, carrying with it some loose rubble, shallow-rooted forbs and shrubs, often leaving behind very shallow and unstable soils (ORASECOM, 2018).

The economy of Lesotho is based on subsistence farming and animal husbandry, as well as small-scale industries that include clothing, footwear, textiles, food processing and construction. The small manufacturing base depends largely on farm products to support the milling, canning, leather and jute industries.[1] Water is one of Lesotho's most valuable resources, which contributes to the country's long-term sustainable economic development and growth prospects. Even though the country constitutes only three percent of the Orange-Senqu basin area, it contributes over 40 percent of the annual run-off of the basin (ORASECOM, 2018).

The Lesotho Highlands are a source of water for southern Africa's most economically active region, supporting large-scale irrigation, industrial activities, hydropower, urban demand, and small-scale rural activities (ORASECOM and Lesotho Department of Water Affairs, 2018). A good case is South Africa's highly developed economy which draws most of its water from Lesotho, with Gauteng Province deriving over 32 percent of its water directly from Lesotho.

A programme to transfer water from Lesotho to Botswana is underway. The Lesotho-Botswana Water Transfer (L-BWT) Scheme will supply water to Botswana, Lesotho and South Africa from the Makhaleng Dam – part of the Lesotho Lowlands Water Supply Scheme – through a water conveyance pipeline of approximately 700 km in length from Lesotho, through South Africa, to Botswana. The L-BWT will address critical

1 https://www.gov.ls/lesotho-economy/

Map of the Orange-Senqu basin area.

water needs in the three riparian states. The transboundary water transfer project is timely, as Botswana is predicted to run out of water by 2025 if new water sources are not found.

Despite the immense contribution of natural resources to the socio-economic development of the basin, these resources have been severely degraded over time resulting in loss of biological productivity, deterioration of rangelands and poor crop and animal productivity, particularly in Lesotho, the source of the Orange-Senqu River.

Events of the past half century have greatly shaped Lesotho and the rest of southern Africa. Box 2.1 provides a snapshot of the history of Lesotho, showing how people lived in harmony with nature ,and how this changed.

Some of these gullies stretch up to 20 metres wide and 20 metres deep. A 2012 research (Orange-Senqu, Artery of Life) highlights that the Welbeddacht Dam just across the border in South Africa was 90 percent full of soil sediment, and the capacity of South Africa's vital Gariep Dam was diminishing at an alarming rate.

The 2015 Lesotho National Action Plan for combating desertification and mitigating the effects of drought notes that in the 1970s, a Lesotho sheep produced on average 5 kg of wool, maize yields were 2 tonnes/hectare, whilst wheat yields were 1.2 tonnes/hectare. However, in recent years, these yields have declined significantly to 2.74 kg of wool per sheep in 2010/11, 0.82 tonnes/hectare of maize yields, and 1.27 tonnes/hectare of wheat yields, in 2012/13 (Lesotho Government, Ministry of Forestry, Range and Soil Conservation, 2015.

On average, the annual cost of land degradation in Lesotho is estimated at US$57 million, which is equal to 3.6 percent of the country's Gross Domestic Product (UNCCD, 2018). Apart from the key drivers mentioned, climate change is increasing the volatility of rainfall, thus exacerbating the challenges of degradation and threatening livelihoods in Lesotho. The depletion of natural resources in Lesotho has deepened poverty levels in rural areas resulting in increased rural–urban migration (Government of Lesotho, 2013).

The highest population density is found in the lowlands of the country, where most of the arable land mass is located. Here the increasing population pressure compounds the problems of serious soil erosion and land degradation (Mafongoya and Ajayi, 2017).

Lesotho has been chosen as a case study for many reasons. Its vulnerability to land degradation as and its geographical position as the upper course of the Orange-Senqu River make it significant, as degradation in this country affects the rest of the basin. As the main source of water for South Africa and soon Botswana, negative impacts on water resources in Lesotho will adversely affect water supply in those two countries, and the rest of the basin. The lessons learnt from this research are expected to inform sustainable resource management in the Orange-Senqu basin and the rest of southern Africa.

The selected pilot sub-catchments areas of Hlotse, Khubelu, Likhetla, Makhalaneng, Maletsunyane and Senqunyane as per the Integrated Catchment Management programme, are shown in Figure 2.1.

Box 2.1: The history of Lesotho

Just 50 years ago, the beauty of Lesotho's Mobu valley was legendary and people said, it could make the heart beat nonstop. The main dialect, Sesotho, did not have an appropriate vocabulary for soil erosion, for it was not significant.

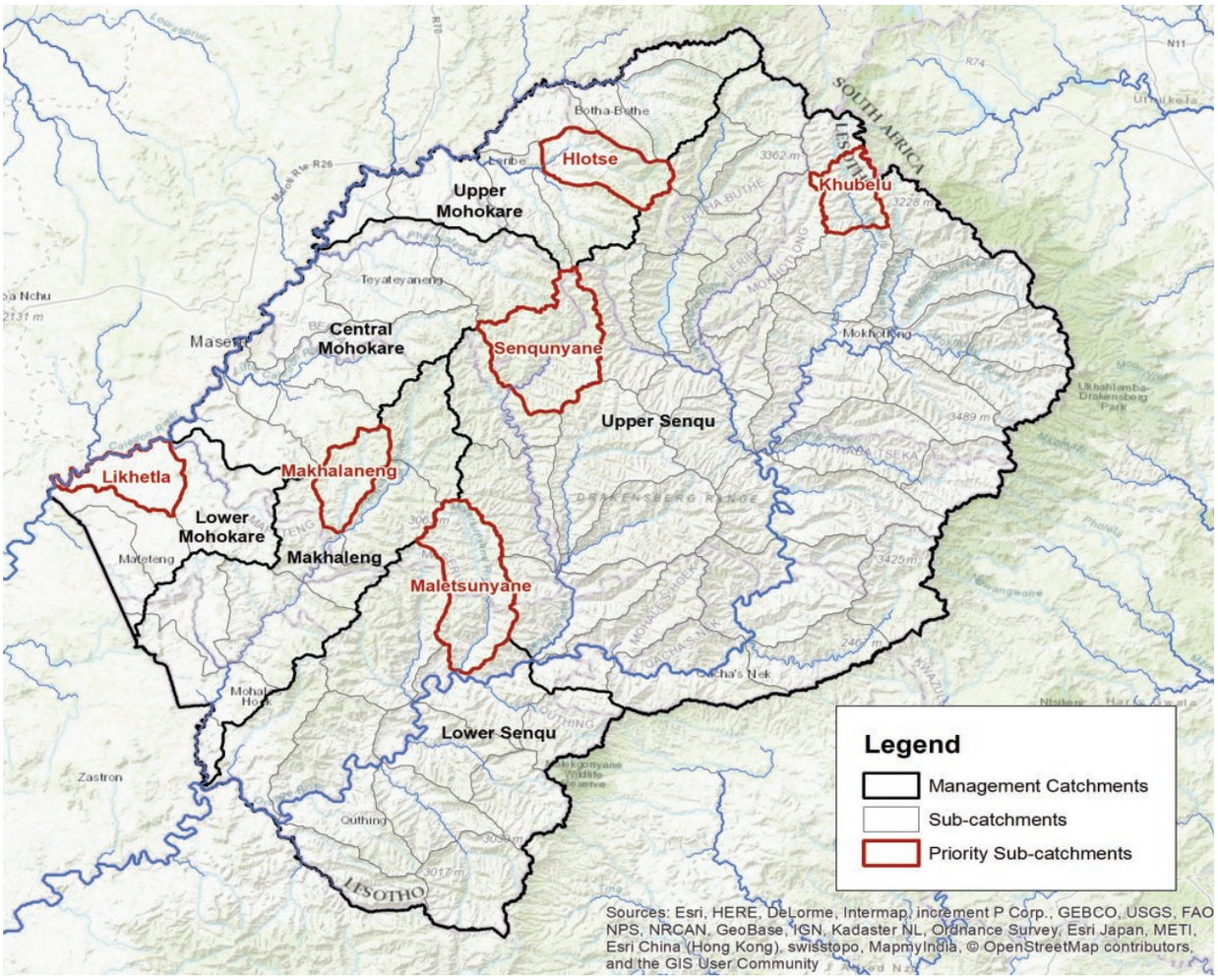
Basotho elders aged over 65 recall a countryside full of grass on the hills and in the fields. Livestock stayed in mountain pastures until the crops were gathered from the fields. Milk cows had separate grazing grounds from oxen, which were in turn distinct from areas reserved for horses. In low-lying wet areas grew the reeds for roofing and fencing.

Crop fields were punctuated by wide bands of thatching grass, which together with the reeds, formed the communities' commons. Harvest and use were regulated by the chief. Such was the ideal set up which governed Lesotho's unwritten environment policy for ages.

This changed drastically during the 1930s when drought swept across Africa, and an extensive contour bank system was introduced by the colonial government. Generally receptive to constructing contour banks at first, the Basotho soon noticed that water at shedding and distribution points was instead concentrating in rills and forming gullies.

Source: SADC, SARDC, IUCN 1994. State of the Environment in Southern Africa. Maseru, Harare

Figure 2.1: Overview of Catchment Management Areas and priority sub-catchments in Lesotho



2.2 Integrated catchment management

Integrated catchment management is an approach to sustainable land and water management, recognising flow-mediated connections through catchments and the need for interdisciplinary and community-based collaboration (Kattel et al., 2016). It refers to a holistic environmental planning process which approaches sustainable resource management from a catchment perspective, in contrast to a piecemeal approach that separates land management (including agriculture, forestry and tourism) from water management.

Integrated catchment management delivers measures to guarantee water quantity and quality in the entire catchment, such as protection of sources of water (*eg* wetlands), buffering of run-off (*eg* vegetation cover) and water quality (*eg* effluent control from urbanisation). It also includes measures to satisfy demand, such as water for irrigation, industrial use and household consumption. Managing water as an economic good is an important way of balancing competing uses and achieving equitable, efficient, and sustainable utilisation while encouraging conservation and protection.

2.3 What is an indigenous knowledge system?

Indigenous knowledge systems constitute the knowledge that people in each community have developed over time and continue to develop.[2] It is a complex set of knowledge, skills, rules, beliefs, norms, and technologies existing and developed around specific conditions of populations and communities indigenous to a particular geographic area. The local community is privy to this knowledge as it has been handed down from generation to generation, and hence is interlinked with their way of life.

Indigenous knowledge is shared and communicated orally. It is stored in people's memories (Von Lewinski, 2008) and activities and is expressed through stories, songs, folklore, cultural beliefs, and rituals (Nyota and Mapara, 2008).

2.4 Importance of indigenous knowledge and the need for documentation

Indigenous knowledge provides a basis on which communities base their decisions on issues such as agriculture, healthcare, food preparation, education, natural resource management, and a host of other activities in rural communities (SADC, SARDC, IUCN, 1994). When such information is disseminated in the community, its members tend to live in harmony with their natural environment in relation to past behaviour (Mapaure and Hatuikulipi, 2007). It contributes to local empowerment, and economic and political values. It preserves local cultures, instilling a cultural pride, and it also represents an important component of global knowledge on development issues.

Indigenous knowledge has many levels. Common knowledge is accessible to all members of a community regardless of age, gender or social status. Shared knowledge is held by many but not all, and specialised knowledge is held by a few people who might have had special training or an apprenticeship. A common theme is that indigenous knowledge is used for the benefit of the entire community.

Indigenous knowledge represents an important component of global knowledge on development issues and is considered as being sophisticated, scientifically valid, productive, and appropriate.

According to Hoskins (1990), few of the community projects initiated over the prior decade have succeeded. Many of them have failed because of the disregard for local needs and priorities, or the failure to involve local groups in the planning and implementation of local projects.

Indigenous knowledge is particularly relevant in resource conservation because indigenous societies have profound and detailed knowledge of the system and species with which they have been in contact for generations. Richards (1979) affirms that many traditional beliefs and attitudes to environmental resources are oriented towards conservation rather than exploitation. Supporting this note, Ajibade (1999) submits that indigenous natural resource management techniques are not primitive, destructive or ineffective, contrary to the belief of many policymakers and Western scientists.

There are indigenous practices and tools that can be promoted by decision makers to enhance sustainable management of natural resources. These include traditional institutions, taboos, beliefs and other conservation-related regulations, sacred sites, and sacred species. Attributes of indigenous and traditional knowledge which are relevant to conservation and sustainable development include the following:

2 https://www.researchgate.net/publication/228799155_Indigenous_Knowledge_Systems_and_Their_Relevance_for_Sustainable_Development_A_Case_of_Southern_Africa/link/54d5e2570cf2970e4e65c063/download

- **Locally appropriate**– Indigenous and traditional knowledge systems represent a way of life that has evolved with nature, so it is specifically adapted to the requirements of local environmental and social condition;
- **Restraint in resource exploitation**– Production is for subsistence needs only, therefore, only what is needed for immediate survival is taken from the environment;
- **Diversified production systems**– There is no over-exploitation of a single resource; risk is often spread out by utilising a number of subsistence strategies;
- **Respect for nature**– Indigenous knowledge contains a 'conservation ethic', whereby the land is considered sacred, humans are dependent on nature for survival, and all species are interconnected;
- **Flexible**– Indigenous and traditional knowledge systems are continually changing and adapting to changing environmental conditions; and
- **Social responsibility**– There are strong family and community ties with inherent obligations and responsibilities to preserve the land for future generations (Dewalt, 1994).

As indigenous knowledge is dynamic, some knowledge is however lost naturally as innovations and adaptations of techniques and tools occur, and some indigenous knowledge becomes disused. The rate at which indigenous knowledge is lost due to rapid population growth, changes in educational systems, environmental degradation, and development processes all leading to lifestyle changes, modernisation, and cultural homogenisation, is cause for concern.

As awareness of the value of indigenous knowledge has increased it has become apparent that it is threatened with extinction; the need to document it becomes crucial. The effectiveness of indigenous knowledge can be evaluated comparatively to determine the best solution to a problem or to determine its adaptability for use in other circumstances. Documentation allows indigenous knowledge practices to be acribed to the correct knowledge holders, allowing them to hold the rights to such knowledge, its use and any benefits accruing from it (Kihwelo, 2005).

2.5 Traditional cultural practices

The fact that the communities have regular interactions and are more familiar with resources in their environment than other potential stakeholders make them one of the best managers of resources, and who could contribute effectively to current conservation efforts (Kideghesho, 2009). Communities can be actively involved in managing resources if their traditional practices are cherished and enter mainstream practice.

Traditional African cultural practices are generally built into ways of conserving and protecting natural resources against over-exploitation using taboos and totemic affiliation with localities and wild flora and fauna species. The practices also involve devising institutions that can oversee and regulate resource use on a sustainable basis. Globally, these practices have been effective in protecting ecologically and economically important species.

Local communities attach great value to traditional cultural practices (Kideghesho, 2008). It is therefore apparent that official recognition of these practices will be an important factor in complementing current economic incentives seeking to motivate people to support conservation efforts. It has been demonstrated that non-economic incentives, which are culturally oriented, are equally important in motivating people to support conservation efforts. These traditional practices are economically affordable and sustainable, as they are part of community day-to-day activities and practices. They require minimal funding, as they are based on community respect of local taboos governing resource use and conservation. Traditional practices and indigenous knowledge are sometimes referred to interchangeably.

Traditional institutions

Traditional institutions can include traditional leaders, healers, and members of society who have excelled in traditional knowledge. These play a major role in overseeing and enforcing tribal rules/regulations or taboos. In enforcement, they act as a supreme court with the final say in all tribal matters. The role of traditional institutions in the conservation of natural resources is still evident in many areas in southern Africa, despite marginalisation of these institutions by colonial and post-colonial management systems, and cultural dilution caused by immigration and formal education (SADC, SARDC, IUCN, 1994). Revival and promotion of traditional institutions can play a critical role in integrated catchment management.

In Lesotho, traditional leadership is exercised through the chieftainship, which is hereditary. This leadership is hierarchical, consisting of the King, Principal Chiefs, Area Chiefs and Village Chiefs (or headmen). Each one of these levels is represented in the District Committees and Council Committees. The Principal Chiefs are responsible for overseeing all issues of traditional governance in their respective areas. In turn, the Area Chiefs take orders and advice from the Principal Chiefs. The Area Chiefs tend to administer a smaller administrative area than the Principal Chiefs. The Village Chiefs or headmen function as assistants to the Area Chiefs, and manage the daily administration of their villages. Overall, the customary functions that chiefs play are performing civil responsibilities.

Taboos, beliefs, and other conservation-related regulations

Taboos against specific actions and behaviours are common in most communities. These are moral or cautionary restrictions placed on certain actions by people with authority such as kings, priests, and elders. Taboos derive mainly from religious and long-established traditional beliefs and social customs, and some have developed as a response to environmental problems with logic derived from indigenous knowledge.

Conservation-related taboos may be categorised as specific species taboos and habitat taboos. The specific species taboos protect flora and fauna in space and time. They regulate and prohibit harvesting, detrimental use and consumption. Habitat taboos control access and use of resources in a particular area, for example in sacred habitats, thus checking anthropogenic interference detrimental to flora, fauna and their habitats.

Although theylack formal legal backing, taboos and regulations are effective in regulating human behaviour and forcing compliance with societal values, thereby enhancing conservation. Research has demonstrated their potential in protection and survival of the endemic, threatened and keystone species and habitats. The reason behind the conservation success is the belief that non-compliance with regulations or taboos governing sacred species or sites has the potential to result in to catastrophes such as disease outbreaks, death, severe drought, pestilence, or loss of assets (Kideghesho, 2008).

Examples from different cultures in Tanzania regarding sacred species and sites abound. For instance, in east Usambara, an association of skin diseases associated with the consumption of bushbuck (*Tragelaphus scriptus*) and bohr reedbuck (*Redunca redunca*) has reduced the vulnerability of these species from extermination by humans (Kweka, 2007). In Ugweno, a ground hornbill (*Bucorvus leadbeateri*) is protected by a belief that a person who kills it cannot stay alive. In Msasa village, Bukombe district, Shinyanga, touching the tree *Blighia unijugata* is avoided for fear of death (Temu and Makonda, 1999).

Sacred sites

Sacred sites include locations, objects, or edifices, believed to be sacred or to possess magical or supernatural energies, or to be the dwelling place of spirits of the dead, nature spirits or gods. The ‘‘power’’ at these points emanates from an inexpressible spiritual source, identified as cosmic in origin or part of the living Earth. Encountering

a sacred site instils feelings of wonder, awe, fear, fascination, and mystery (Mgumia and Oba, 2002).

Sacred sites include graves, forests, hills or streams, and other water bodies such as wells. Throughout history, traditional societies all over the world have set aside such places and protected them from destruction through taboos and cultural beliefs (Mwihomeke et al., 1998). These places present huge potential for ecosystems conservation, although they are often not recognised, and protected under official conservation systems. The species and habitats in such areas are fully protected as access and use are regulated. Conservationists see the potential of sacred sites as an opportunity for promoting in situ conservation of rare and endangered species (Mgumia and Ob, 2002).

Studies in Tanzania and elsewhere in Africa have indicated that sacred sites have high species diversity compared to adjacent areas, including government managed forest reserves. While most sacred sites are not protected under official conservation policies (unless they fall in gazetted protected areas), their integrity has been maintained through taboos, practices and beliefs.

> ***"Indigenous knowledge provides a basis for which the communities base their decisions on issues such as agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities"***

Sacred (Totemic) species

Many African societies consider specific species to be of religious and spiritual significance, and these species, play a symbolic role in respective clans and tribes. To underscore the importance of totemic species some families or clans are named after the species. For example, in the Ikoma tribe of the western Serengeti, some people are called Wankuru or Makuru (tortoise; *Geochelone pardalis*), Nkumari (green water snake; *Philothamnus angolensis*), Mahiti (hyena; *Crocuta crocuta*) or Machaba (a sacred elephant tusk) (Newmark, 2002). The adoption of animal names is also widespread among different tribes in southern Africa, and popular names include elephant, eland, zebra and buffalo. The totemic status assigned to different species has a significant role in species survival as they are less subjected to human impact and are protected through taboos and beliefs that prohibit harvesting, hunting, killing, or the destruction of their habitats. Populations of these species are relatively high in localities where they are sacred or totemic (Kideghesho, 2009).

Land-use rights vested in the chief

The pattern of land-use was established through a clan system in which rights of cultivation and other agricultural land-use practices originated with chiefs. Cultivation and other usage rights were granted by the chief, who had power over all productive resources, including wildlife. No land could be sold or given away. This system represented a form of landholding, vested in the chief as custodian of the people's cultural heritage and land, and it was greatly respected (SADC, SARDC, IUCN, 1994).

About 61 percent of the land in Lesotho was allocated by chiefs, followed by inheritance/gifts (29 percent) and land purchases (7 percent) (Lesotho Bureau of Statistics, 2013). This distribution was similar at district level, such as for the Mokhotlong District, where 66 percent had land allocated by the chiefs, followed by those who had inherited the land (32 percent). Only 2 percent of Mokhotlong landowners had acquired land through purchasing it (AFDB, 2019).

CHAPTER 3

Findings from literature review and online intervews

3.1 Success stories in Lesotho and in other countries

Several indigenous practices that seek to conserve natural resources and enhance environmental protection have been carried out over the years by communities in Lesotho. These practices that have been observed over the years, if revived and mainstreamed into policy planning, can play a major role in halting catchment degradation.

Rangeland management

Traditionally, in Lesotho, rangelands are considered a source of grazing, a source of materials for the building of homes as well as for the provision of livelihoods. Communities in Lesotho used to conserve their rangelands through observing a strict seasonal movement of livestock under the supervision of traditional leaders. The rangelands were divided into three grazing areas categorised into “A”, “B”, and “C” for purposes of management. The first grazing area was in the upper catchment far from the villages, and it included wetlands where marshlands and sponges provided important environmental services. This area was grazed during the summer months of November to March. Traditionally, these areas are under the control of the Principal Chief and it is s/he that issues permits for the area under their jurisdiction.

The second grazing area was at the centre of the catchment area on the lower slopes of the mountains and usually not far from the villages. The area was occupied during this period April to June/July to October, and were crowded with a lot of livestock. Area B was under the Principal Chief’s or Area Chief’s control.

The third grazing area (C) was situated near to the villages and was mainly used in winter and spring under the responsibility of the Village Chief. Most of the rangelands within the pilot sub-catchments fall within these C grazing areas. Through this practice, land degradation was controlled as the rangelands were used seasonally according to their condition (ORASECOM, 2014).

Other communities would rehabilitate their pastoral areas with leguminous trees and shrubs to increase and maintain soil fertility, and this allowed communities to diversify their livelihoods. These steps to tackle and reverse the deterioration

of rangelands have proven to be positive, and their integration into catchment management strategies is critical.

Wetlands restoration

To rehabilitate degraded wetlands, the Khubelu Sponges Pilot Project was planned to demonstrate a sustainable wetland management strategy that supports both people and the ecosystem to ensure long-term supply and quality of water from the upper Orange-Senqu catchment area (ORASECOM, 2018). The indigenous method of rotational grazing was borrowed in the form of high-density rotational grazing. This was embraced by participating livestock owners and herders to reduce the impacts of unregulated grazing.

Through this approach, the livestock groups are limited to a clearly designated grazing area for a given time span. This prohibits them from grazing selectively over a wide area and choosing only their preferred plants. Limiting their movement not only forces the livestock to graze a wider range of plants, but also ensures that they trample the area, break down dead plant matter, and trample it into the soil with their own faeces and urine. The project also implemented mobile kraaling at night, where animals were enclosed in fenced areas (ORASECOM, 2018). The introduction of moribund litter, dung and urine into the topsoil improved soil fertility, decreased raindrop effect sand promoted water percolation into the subsoil.

In addition, the traditional farmers knew that some invasive shrubs had prevented palatable grass favoured by their animals to grow. Hence, they embarked on removal of invasive species to allow the indigenous grass to grow.

Further outcomes from the implementation of the strategy include improved seed germination and root and plant conditions, as well as recovery of palatable grass. Other positive results are improved livestock status through reduced movement to remote pastures - leading to improved livelihoods. The recovery of quantity and quality of grass resulted in improved livestock carrying capacity of up to six times the previous rate and improved retention of soil moisture leading to improvement in wetland conditions (ORASECOM, 2018).

Healthy wetlands in Khubelu.

Protection of riverbanks

Basotho avoided cultivation of crops near streams as a risk aversion strategy. This was the case for sorghum production, which were often destroyed by birds. Because the grains are hard to gobble from the heads, the birds often fly to the nearest stream to dip their wings in water and then fly back to the sorghum heads to wet them so that they might eventually succeed in removing the grains.

Furthermore, in the mountains of Lesotho, grandparents used to tell children that if they "got too close to the colourful blankets drying on the riverbanks, snakes would seize them and drag them into water, hence protecting riverbanks (*Orange-Senqu, Artery of Life,* 2012). Stories like this are essentially inspired approaches to managing relationships with water, rivers and wells and they have evolved in many parts of southern Africa.

Weather and climate

In Lesotho, indigenous Basotho agriculture is adapted to climatic and weather fluctuations and historically maintained a good vegetative cover

which protected the soil from accelerated erosion (Singh, 2000). The Basotho people have many ways of predicting weather. The villagers could understand rainfall through the evaporation of water from the ground leading to the formation of clouds in the atmosphere. Showing their interpretation of the hydrological cycle the Basotho could predict that, if the land were dry, rain was less likely because there is no supply of moisture (Pepin, 1996).

Traditionally, Basotho predict rain as the clouds rise from the north and west early in the day. In this case, the villagers in Machache, which lies in the lowland foothills of Lesotho between the highlands of Maluti and the lowlands of the north-west, realise that much of the rainfall over Machache originates from the north or west. They also realise that widespread rainfall is often associated with a powerful low-level trough to the west of Lesotho, where upslope winds develop from the north-west over the Machache region, and that orographic enhancement leads to precipitation (Pepin, 1996).

The villagers have suggested that if the cloud obscures the mountains to the immediate east of Machache, there is a likelihood of heavy rainfall for two or three days (Pepin, 1996).

The reference to the moon provides additional indications of rain known by the villagers. A halo around the moon is used as a rain forecast, and the shape of the moon suggests whether the month will be dry or rainy (Pepin, 1996).

The behaviour of animals and birds is also used to predict rainfall. Examples include pigs grunting during the day, the swarming of larks and swallows, cows frolicking, and the singing of the 'hammerhead' bird (*mamasianoke*). In many cases it is likely that the animals sense the increased humidity and become irritable. In the case of larks and swallows, swarming means that there is a plentiful supply of flying ants near the surface (upon which the birds feed). These insects like to fly when the air becomes humid.

Certain Basotho say that they can smell rain in the air. Others get bouts of asthma and some others (mostly women) suffer from itchy feet (Pepin, 1996).

Start of rain season and planting of crops

Traditionally, a year in Lesotho is based on the natural cropping cycle which starts in spring. The community identified several items as indicators of the arrival of spring to mark the start of the new cropping calendar for sorghum. For example, sprouting of grains left at the fields where threshing was done is a reliable indicator that spring had come, and communities could get ready to start the cultivation of sorghum.

Changing weather conditions, which became mostly windy, dusty, and rainy, also signifies spring. This response was given in the same way by all the communities and had no spatial or temporal variation.

Behaviour of domestic animals is observed and used for determining when to start cultivation. This is the case when sheep started to shed some of their wool and become smooth. The mating behaviour of animals, especially donkeys and cows, is also observed. Once they start mating, it is regarded as time to get ready for sorghum cultivation.

Hail control

The communities said that many methods were used in the process of hail control (*ho upella sefako*) such as the use of the heads of a cobra or puff adder being is placed at all the corners of a field. It is believed that hail destroys many crops nowadays, because there is no substitute Western technology available for hail control. This could, however, be a result of the changing climate, as this traditional method had no scientific explanation.

All indigenous knowledge discussed had the power to shape the environmental behaviour of people, and therefore communities were able to conserve natural resources.

Soil erosion control

The communities in south-east Lesotho have taken the initiative to find ways to control soil erosion. They have constructed stone walls at the Ha Sekhonyana site, which are physical barriers to slow down the flow of water, thereby reducing its energy to corrode loose and exposed soil (ORASECOM, 2014). This has been a traditional practice which has since been adopted by current system for controlling soil erosion. The soil carried by the water is deposited by the barrier and trapped, providing a base on which vegetation can rejuvenate. The primary focus was to facilitate the re-establishment of vegetation cover, which would make a positive contribution to the regeneration of rangelands (ORASCECOM, 2014).

Communities collect stones and other locally available materials to control soil erosion. (Credit: ORASECOM)

Some farmers used to maintain grass field boundaries as a way of controlling soil erosion. If a break were noticed, sod or stones would be taken from another part of the landscape and placed to fill the gap. If a rill began to enlarge into a donga, wheat chaff was put in a wire mesh bag and placed in the rill as a sort of wall to stop the water. Furrows were also dug at the tops of field, either to collect water or to divert water away from fields.

Stone walls slow down the flow of water, thereby reducing its energy to corrode loose and exposed soil. (Credit: ORASECOM)

Other practices of soil erosion control include the removal of invasive shrubs (*Chrysocoma ciliata*) in the rangelands that have negative effects on grazing capacity, infiltration of rainfall and conservation of soil. Cleared and damaged areas were re-seeded with local grass (*Eragrostis curvula*) to rapidly re-establish grass cover. The impacts were positive, with good grass in some areas relatively covered (ORASCECOM, 2014).

Communities working together to clear invasive shrubs in rural areas of Lesotho (Credit: ORASECOM)

The method of using purchased *Eragrostis curvula* seeds is technically feasible, but considering the use of locally collected seeds from indigenous grass species for rehabilitation may be more effective from the perspective of biodiversity, ecosystem health and livestock production (ORASCECOM, 2014).

Resting some of the grazing rangelands is also a method of controlling soil erosion that was being practiced. To allow the grasslands to recover and regenerate, livestock were removed from certain areas that were cleared of *Chrysocoma* during the summer. The resting period proved successful in terms of allowing the grass to recover in vigour. Increases in both the grass' basal and canopy cover thus improved the protection it provided to the soil. Seed wer also produced (ORASCECOM, 2014).

In Zimbabwe, and the rest of southern Africa, the main forms of soil conservation are through practising *manje* (zero tillage) and intercropping. Zero tillage involves digging holes where the seeds are planted and leaving the other areas intact. This conserves the soil structure and soil fertility, as well as reducing soil erosion. *Marozhi* (stone ridging) was another form of soil conservation used in most of the dry areas of Zimbabwe. Mixed farming in which different seeds are planted in the same field was regarded as an effective method of soil conservation (SADC, SARDC, IUCN, 2008; Siriro et al., 2013).

Prevention of water pollution

There were frightening myths that were intended to protect water sources from pollution and to protect children, particularly boys, from waterborne diseases. The boys were frightened that urinating in water would change them into the opposite sex, or that their cow would calve in water. This myth was based on the scientific fact that there are some bacteria living in water, and which normally move in a direction opposite to the water. Therefore, such bacteria would flow against the flow of urine until they entered the male organ and infected the boys (Raselimo, 2007).

Deep pools were said to contain "water snakes". This was meant to scare aware children and keep the water clean.

In Zimbabwe, there are sacred wells around Bvuma, Chikona and the Runinga Hills which are well protected. The water from the sacred wells is fetched by water gourds. Metal objects and blackened clay pots are not allowed to collect water from the wells. It is believed that the wells have got *njuzu* (mermaids), who if offended by the use of unacceptable utensils to collect water, would make the water muddy, or would drown the offender. These myths and beliefs help maintain the sacredness of these places, thereby keeping the water unpolluted and conserved.

The use of water gourds to fetch water is economical as small amounts of water is collected from the well at a time. Water gourds are also clean, as opposed to blackened pots, thereby leaving the water unpolluted after collection. Aquatic life such as frogs are conserved through this way, as killing them will bring calamities such as the drying of wells (SADC, SARDC, IUCN, 2008).

Conservation of flora

In Zaka District in Zimbabwe, some plant species are planted around homes with the belief that they ward off lightning and evil spirits. Some plants are used for medicinal purposes. Various taboos are taken care of before extracting medicinal herbs. Exposed plant roots are covered with soil. Medicinal herbs should continue to survive after extraction. It is believed that the ill person is not going to get cured if the plant dies (SARDC 2005; Siriro et al., 2013). This belief ensured that traditional healers would not destroy the whole plant when extracting medicine from plants.

Seed preservation

In the Basotho village in Tsitas Nek, techniques were used for the preservation of crops. The best Sorghum heads were identified during harvest, cut, threshed, and the grain stored separately. Before storage, the seed was traditionally dipped in water with leaves from bitter and strong-smelling bushes and plants such as *mofifi (dogwood), Sehalahala sa Matlaka (erescephalus panctulatus) and Mohalakane (Aloe stirtantula) to protect it against pests such as Tsupa (snout beatle) and Seseli (cut worm).*

For other indigenous vegetables such as cow peas, the villagers would use bags known as silos to collect the crop by hand. These were dried so that the seed could be opened and released. Native vegetable seeds and seedlings grew naturally and locally (Notsi, 2012). Seeds of indigenous vegetables such as *rothwe*, *theepe, tenane* and *morogo wa dinawa* were collected when dry. By shaking the dry vegetables, women dispersed the seeds and used bags or clay for storing them. Shaking or threshing of dried indigenous vegetables was typically enough to remove the seeds (Notsi, 2012). The seeds were prevented from over-drying by covering them with leaves or other specially prepared mixtures before the winnow method could be used to separate the seeds from the chaff. To mitigate the risk of over-drying, bags or clay pots were used. Many seeds or seedlings could remain viable for several years if they are thoroughly cleaned and stored properly. In most situations, women participated in these activities with children (Notsi, 2012).

Pest control

Since some crops such as pumpkins serve as natural repellents to some insects, intercropping practices contributed to the control of pests (Mafongoya & Ajayi, 2017). The deliberate rotation of the crop helped to interrupt the life cycle of insect pests. Regular weeding also helped to manage pests and diseases during the year.

Herbs with a strong smell and bitter taste, such as the *Seholobe* (*Aloe striantula*) and *Sehalahala* sa Matlaka (*Eriocephalus punctulatus*) and *Letjoi* (*Datura stramonium*), were boiled, and the concoction was sprayed on sorghum crops to kill the pests. Wood ash was also used to keep pests away fromharvested crops. Crops could last for 2-3 years without pest infestation.

In Tsitas Nek village grass was also harmful impacting on native plants. The only way to control it was to dig it out. Both men and women used an instrument called a *kepu/kepi* to dig it out (Notsi, 2012).

Sticks with mud were often used to chase birds away from crops or plants. Often a *sjambok* or *sephali* was used. Some of the diseases that target indigenous vegetables in Tsitas Nek are attacked by *Hoaba* (small black, watery insects) and are only treated and washed away by rain from plants such as *dinawa* and *rothwe.* Herbs were also used to treat worms that consume *Mabele* and other native vegetables (Notsi, 2012).

Biodiversity conservation

In Lesotho there several species of plants, birds, reptiles, amphibians, and insects that have been conserved over the years for biophysical and possibly spiritual reasons (Mokuku and Mokuku, 2004). Like most African societies, Basotho had strong traditional belief systems that were intended to encourage conservation of natural resources by fostering positive environmental behaviour among children. In the case of birds, they were considered sacred, emblematic of fortune, and brought bad omens if they were killed. For example, there were frightening myths and taboos which discouraged children from killing certain bird species. Killing a Hamerkop (*mamasianoke*) or interfering with its massive nest meant that one's home would be struck by lightning. If it cries, this signals a bad omen.

This was a common belief among all Basotho children. They were warned against certain things without much reasoning, and the "truth" would be told as they were initiated into adulthood.

The protection of reptiles included their role in the food chain, where for example, some snakes would be protected as mice predators, thereby reducing destruction of crops by mice (Mokuku & Mokuku, 2004). In the case of amphibians, the rationale for preserving the aquatic river frog, for example, was based on the biophysical role it plays in the food chain as well as its function as a good indicator of water quality (Mokuku & Mokuku, 2004).

Regarding flora, the Basotho people had a strong dissuasive effect on the use of some plants that had a negative impact on health and on livestock (Mokuku & Mokuku, 2004). The children, especially boys, knew most plants by name and could easily identify areas where such plants would be found. The plants that were believed to be harmful were avoided. One of such plants is *monkhoane* (*Heteromorpha*). There was a myth that if this shrub were burnt there would be lightning. A scientific explanation was that smoke of such plant species was dangerous if inhaled.

In addition to the traditional laws that strengthened the conservation of native plants such as *maboella* were protected. The laws prohibited the local communities from cutting or destroying indigenous trees. Those who wanted to cut off portions would request approval from the chief. These laws strengthened conservation and encouraged the sustainable use of natural plant resources (Raselimo, 2007).

Table 3.1 shows plant varieties that have been conserved over the years through indigenous beliefs.

Table 3.1: Local conservation knowledge of plants

Sesotho name	English name/ Scientific name	Possible conservation basis/strategy	Apparent biophysical Rationale*
Moomang	*Gnidia burchelii*	Using it as firewood, especially at home, calls for starvation/brings bad luck/one does not prosper/causes mental illness/causes quarrels amongst the family. If eaten by livestock, they 'dry up'/ 'omella'.	Contains poison that affects the mucous membrane
Monkhane	*Heteromorpha arborescens*	If cut and used to hit a cow, your cattle will not multiply/ 'ha li sa tla khona ho ata' that is, 'lia ts'eha'.	Emits toxic smoke when used as firewood.
Phefo	*Gnaphalium undulatum;*	If used as firewood, it causes wind/'*e tsosa moea*'.	Emits toxic smoke
Moferefere	*Senecio asperulus*	Causes bad luck	Not known
Morara	Vines/Capsular fruits	Causes bad luck when used	Not known
Sehloko	*Euphorbia clavarioides*	Causes some form of bad luck	Not known

Source: Mokuku and Mokuku, 2004

Relay intercropping in the Machobane Farming System

The Machobane Farming System (MFS) is an indigenous knowledge practice used in Lesotho to facilitate the sustainable production of crops, and to mitigate against loss of crops by disasters such as hailstorms (Mafongoya and Ajayi, 2017). The technique involved planting the next crop immediately after or during harvesting. This acted as insurance in times of crops being damaged by hailstorms or other climate-related events. The relay allowed for three harvests of different crops per year instead.

Organic manure and ash are used by the Machobane Farming Method. Manure provides essential nutrients for plant uptake, and by enhancing its physical properties, increases long-term soil fertility. On the other hand, ash provides nutrients such as potassium, and on acidic soils it has a liming effect. In the mountain and foothill villages performing the MFS, it was evident that the practice sustains soil fertility by slowly releasing nutrients and conserving moisture (Mafongoya & Ajayi, 2017). The MFS is highly adaptable and resilient to climate change, enabling farmers to harvest a variety of crops throughout the year. However, this system is challenged due to resource limitations. For example, ash and manure for applying on soil is often in short supply. There is also competition over land for grazing and land for farming. The case study below provides more detail about how the system started.

Relay intercropping in Machobane Farming System. (Credit: Helvetas Lesotho)

> ***"The Machobane Farming System (MFS) is an indigenous knowledge practice used in Lesotho to facilitate the sustainable production of crops, and to mitigate against loss of crops by disasters such as hailstorms"***

Case studies of effective practices in indigenous farming system

Box 3.1. Machobane Mantsa Tlala: Drive Out Hunger

The system developed by Machobane (1914-2006) was designed not only to drive out hunger, but to restore indigenous knowledge and ecological resilience. Rather than try to plant on as much land as possible, he concentrated on intensifying production on one acre. His method developed from close observation of the land–the mainspring of indigenous ecological knowledge. Machobane interviewed the villagers about the methods used by their elders, uncovering systems of rotational intercropping which had been undermined with the introduction of commercial maize and wheat production. He spent several seasons experimenting until he found a balance that could produce enough food to sustain families while maintaining the integrity of the soil and water.

His views, based on long-term ecosystem health and response to local conditions, were completely at odds with the prevailing wisdom of the state. The government, aided by multilateral institutions, was promoting the use of tractors, pesticides, and chemical fertilisers. Machobane could see that these methods were unsustainable. Ploughing on hillsides caused soil erosion and disturbed essential microbial life. Plantation-style methods were also detrimental to self-reliance, as they necessitated ever greater concentrations of store-bought fertilisers to sustain yields. The common property ecological management system–which had traditionally manifested as rotational grazing, crop production, and periods of fallow recovery–began to break down as farmers concentrated on market-oriented monocultures. Segregation between blocks of maize resulted in the failure of the contour system. Erosion gullies began to ruin arable farmland.

The indigenous approach championed by Machobane focused, instead, on cultivation of inner resources–attentiveness to the unique ecology of a field and their own ability to improvise and experiment–as a farmer's best asset. Machobane fertilised with local material–compost, manure, and ash–and encouraged planting a diversity of perennials and fruit trees, incorporating indigenous chickens and grazing livestock in rotation. Many of his techniques developed in response to climate variability. After a devastating hailstorm which wiped out his entire bean crop, he introduced relay intercropping as an insurance policy, so that if one crop were to be damaged another would be immediately emergent. Succession planting allowed for three harvests per year instead of the single harvest provided by maize, freeing farmers from the risk of having to store crops when markets were poor or glutted.

Rather than adopting the information-deposit model of agricultural extension officers, Machobane selected 12 students to learn side by side with him in the fields in order to share his Drive Out Hunger/ *Mantsa Tlala* methodology. He recruited agricultural pupils from ghettos and bars. All he required of learners was self-belief and a commitment to teaching the method to others upon graduation.

In 1956, Machobane challenged the government to a Battle of the Potatoes. Pitted against one another potato to potato, Machobane's collectivist trainees outperformed the state's agronomists.

By the mid-1960s, 250 students were enrolled in five regional branches of the *Mantsa Tlala* College. He established a learning centre that housed and taught students, issuing annual certificates and diplomas to those who completed five full years of training. Through the "each one, teach one" ethos embedded in his teaching methodology, Machobane imagined his system piggy-backing its way across the nation.

A classic example of resilience thinking, Machobane's system of communal resource management was explicitly designed to nurture "active transmission of knowledge on a daily innovative practice".

However, his philosophy was largely dismissed by an NGO sector who, with their emphasis on King-Sized Development, did not understand the value of a system based on "antiquated" methods which was designed to function on a household scale. Machobane met with strong state opposition and outright sabotage.

Source: Palframman, 2014 https://books.google.co.za/books/about/Drive_Out_Hunger.html?id=cjZEFh3m-w1UC&redir_esc=y

A Basotho indigenous champion called Black Jesus

Black Jesus (BJ) provided food for his household, with surpluses supplying a vegetable wholesale business. His land was situated upon a gently sloping, bare sandstone plateau, an unlikely place for a farm. This was the state of the land when he initially began his farming experiment. Despite the lack of soil, water, or biomass, BJ was determined to turn the site into a garden. He collected leaves, cow dung, and ashes to construct raised beds atop the rock. Tilling was never an option, so he practiced the laying on of heavy layers of mulch to keep the earth moist, gradually building the nutritive value of the soil. He laboured by the principal familiar to Machobane, that one should "be content with what you have, and use it!" His sense of agency was vital to his project (Berkes and Ross, 2013.) Although he grew more for home consumption than for market in his later years, there was always an impressive variety of pumpkins, spinach, cucumbers, beets and carrots planted in the metre-deep beds. BJ's rock-top garden also incorporated peach and apple trees, grapevines, and sunflowers. Winding channels were dug to guide roof-caught rainwater through the garden, soaking the roots as it travelled downhill. Ever improvisational, BJ explained that he kept one plot aside for research and seed testing. Having tried chemical fertilisers, BJ concluded that the organic method, though producing smaller yields, was more sustainable. "Where we used fertilisers, the land would dry out quickly, so we trusted our organic method." Old tyres were loaded with soil to become potato planters, sheets of corrugated tin became makeshift dehydrating racks and a shed was built from soda cans. In one of his toilets, a typical long drop, a small chamber collected waste into a box. When the box fills, he explained, it was removed, mixed with leaves and ash, and allowed to compost. After several years, the compost would be ready to use and mixed in barrels of water to form a fertilising "tea".

Source: Palframman, 2014

3.2 Knowledge is disappearing

Indigenous knowledge is at risk of becoming extinct, largely due to the negative attitudes of the youth and the superiority that has been accorded to Western knowledge (Raselimo, 2007). A prior study on indigenous knowledge systems in sorghum production and sustainable agriculture in Lesotho shows that Western dominated technological knowledge has negatively impacted on conservation practices not only in Lesotho but also in other Africa countries (Mashinini and Mokhothu 2009). For example, Western technological imperialism resulted in existing indigenous knowledge being demeaned in statue and value. The study further notes that within the context of southern Africa, historical evidence abounds which illustrates the efficiency of indigenous knowledge in the promotion of sustainable agriculture, which was subsequently suppressed by colonial capitalist interests in the region in pursuit of commercial agriculture. The net result of the introduction of Western market-oriented technology and science laid the genesis for the current chronic land degradation (SARDC 2005, Palmer and Parsons, 1977).

Colonisation in southern Africa disregarded indigenous knowledge systems that are important in the conservation of biodiversity within indigenous societies (Risiro and other, 2013). The colonisers, in pursuit for local resources, engaged in resource exploitation without much consideration of the cultural beliefs embedded within the local communities. This has resulted in rampant destruction of forests, animals and land degradation. Some observers argue that diminution of the authority of chiefs over grazing controls is a more important factor for the rapid degradation of vegetative cover, soil erosion and gully formation over much of Lesotho (Lesotho Government and the World Bank, 1998). There is a strong suggestion that the collapse of pivotal local institutions governing grazing rotation and livestock movements has aggravated the emergence of open-access and haphazard range management that has led to the majority of herders continuing to strip the rangeland.

Although there is evidence that indigenous knowledge has the potential to influence people's behaviour towards the environment, it has been marginalised in colonial education, and continues to be marginalised in the current formal school ingsystem. It is not incorporated in the education policy formulation, planning and decision-making (Mashinini and Mokhothu, 2009). Many children attend urban schools and residential schools, which cuts the ties between children and their parents as well as their grandparents, who would otherwise pass the necessary indigenous knowledge on to them (Raselimo, 2007). Such times when grandparents used to instruct little ones to live in harmony with nature have gone as there is no longer a way to pass on that traditional wisdom, leading to severe degradation.

Abandonment of IKS practices has led to severe land degradation in many parts of Lesotho. (Credit: ORASECOM)

Effects of structural adjustments on indigenous knowledge systems

With modernity, came the strict prescription of Economic Structural Adjustment Programmes (ESAPs). Many countries in southern Africa suffered extreme political and social upheaval. Funding institutions made sure that these economic austerity measures were adhered to by countries that sought assistance in the form of aid. For the transgressors, tough sanctions were instituted to guarantee conformity. In the process, most southern African states such as Malawi, Mozambique, Zambia, and Zimbabwe (notwithstanding prevailing internal economic mismanagement and maladministration), had suffered the results of ESAPs and were forced to cut down on critical social services such as education, health and welfare. By the time it was realised that the approach of the ESAPs was out of synch with prevailing local conditions, the damage had already been done. In all of these endeavours, there was no due appreciation of the local conditions and more importantly of indigenous knowledge.

How construction of hydroelectric dams in lesotho disrupted indigenous practices?

Large-scale technological change can also be quite harmful to the environment and does lead to the dislocation of communities' livelihoods. In the developing world, the decades spanning 1950-1980 were characterised by capital intensive development projects, such as hydroelectricity dams. In Lesotho in the 1990s, indigenous communities witnessed large-scale displacement through the Lesotho Highlands Water Project (LHWP). Dam construction resulted in loss of common resources (grazing land, topsoil, woodlots) and income through land submersion, and flooding of ancestral burial grounds (Bond, 2000). The dam pushed rural villagers and farmers onto soil more vulnerable to erosion, destroyed crucial habitats of the Maluti minnow (an endangered species), and impacted on the societal fabric. The most affected villages were Ha Soai, Ha lejone and Ha Theko (Manwa, 2014). Box 3.1 illustrates how modern technology contributed to the destruction of the environment and disappearance of indigenous knowledge.

Box 3.2 Impact of modern technology on the environment

The government, aided by multilateral institutions, was promoting the use of tractors, pesticides, and chemical fertilisers (Boehm, 2003). Machobane could see that these methods were unsustainable. Ploughing on hillsides caused soil erosion and disturbed essential microbial life. Plantation-style methods were also detrimental to self-reliance, as they necessitated ever greater concentrations of store-bought fertilisers to sustain yields. The common property ecological management system, which had traditionally manifested as rotational grazing, crop production, and periods of fallow recovery, began to break down as farmers concentrated on market-oriented monocultures. With the countryside slowly transforming from communal to private, segregation between blocks of maize resulted in the failure of the contour system. Erosion gullies began to ruin arable farmland.

“Large-scale technological change can also be quite harmful to the environment and does lead to the dislocation of communities’ livelihoods.”

CHAPTER 4

Case Studies from the priority sub-catchments in Lesotho

4.1 Introduction

Site visits were carried out for the six priority sub-catchments as per the Integrated Catchment Management programme by the research team in Lesotho. The research team mainly utilised the interviews and focus group discussions to understand people's perceptions on indigenous knowledge in integrated catchment management. The interviews and focus group discussions were well balanced in terms of gender representation, and most of the respondents were elderly people who possess a better understanding of important indigenous knowledge strategies that were implemented in the past. Some further research including online interviews in the priority sub-catchments, as well as in areas outside the Priority Sub-Catchments was conducted to compliment the ground research. The results of the research are presented in case studies for each of the priority sub-catchments. The case studies present the indigenous knowledge practices in each of these areas as well as how these are perceived by the present generation. The case studies conclude with possible ways to revive the implementation of indigenous knowledge.

"Site visits were carried out for the six priority sub-catchments as per the Integrated Catchment Management programme by the research team in Lesotho"

4.2 Hlotse priority sub-catchment

Background

Hlotse sub-catchment is found in the northern part of Lesotho. Map 4.1 provides the exact location in reference to the rest of the country.

In terms of terrain, Hlotse consists of flat lowlands and hills. The sub-catchment has a population of 23,308 people comprising of 11,569 males and 11,639 females. Of the six priority sub-catchments Hlotse has the largest population evidenced by the built-up area in Map 2. It consists of 109 villages under six Area Chiefs. The main environmental feature is the Tšehlanyane National Park in the southern part of the sub-catchment.

Table 4.1 reflects the research techniques used and the respondents who attended according to their villages, gender and rages of age.

Map 4.1: Hlotse sub-catchment

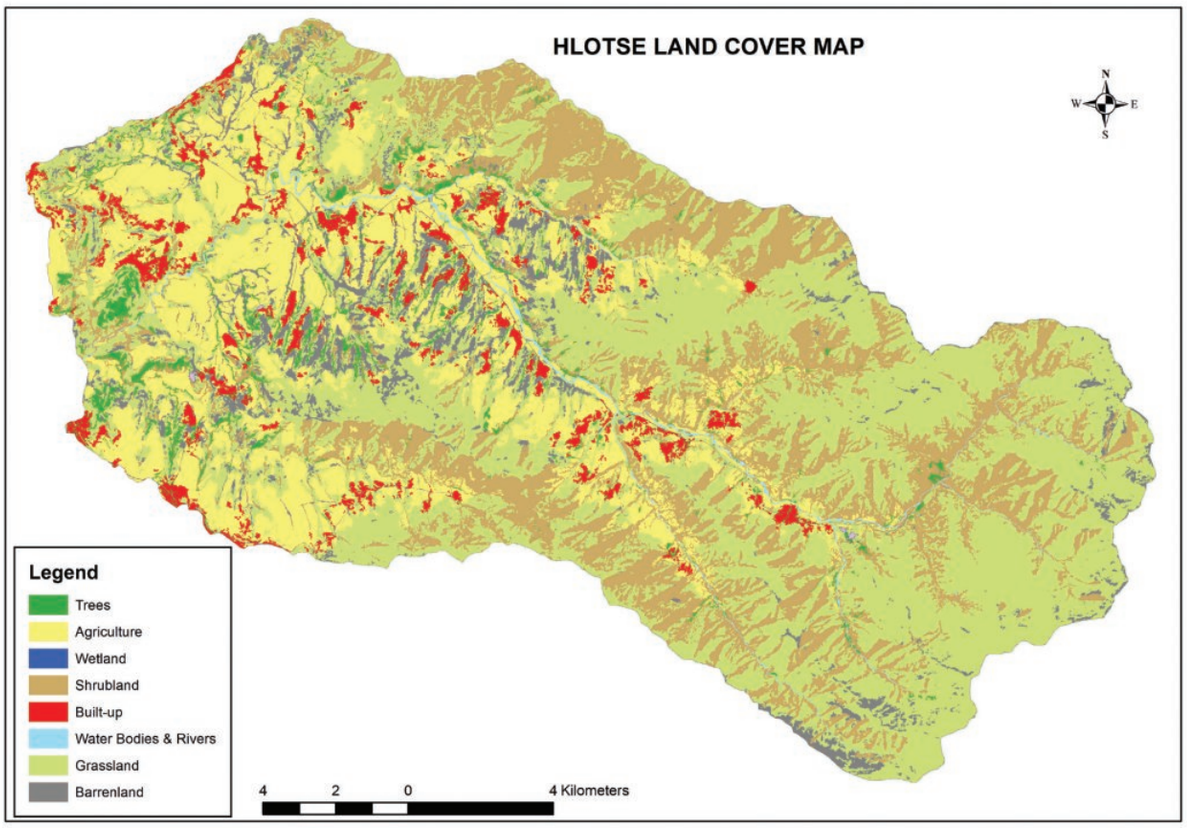


Table 4.1: Research techniques and age ranges of respondents

Method	Village	Men	Women	Age Range
Interview	Mate Community	Elderly men (2)	-	Over 80 years
Interview	Mate	-	Elderly woman	Over 70 years
Interview	Mate Community	Elderly men	-	Between 60 and 65
Interview	Mate	-	Elderly woman	Over 70 years
Interview	Mate-Ha Selebalo	-	Elderly woman	Over 70 years
Interview	Mate	Elderly man	-	75 years
Interview	Ha Mots'oane	Elderly man	-	70 years
Interview	Ha Libenyane Mots'oane	Elderly man		Mid 70 years
Interview	HaLetsie Mots'oane	Elderly man	-	Mid 70s
Interview	Ha Khabo	Elderly men	-	Over 65 years
FDG	Ha-Khabo	Elderly men	Elderly women	Over 70 years
FDG	Ha Khabo	Elderly men	Elderly women	Over 70 years
Interview	Pela-Ts'oeu area in Ha Majara	-	Middle aged women (2)	Between 30 and 40
FDG	Pela-Ts'oeu, Ha Majara		Elderly women (2)	Over 70 years
	Ha Nkopa	Elderly man	-	Over 70 years
FDG	Kota and Kotanyane	Elderly men	Elderly women	Over 60 years
FDG	Kota	Elderly men	Elderly women	Over 65
Interview	Kota and Kotanyane	Elderly men	-	Over 70 years
FDG	Kota, Kotanyane, Pofa &Thopo	Elderly men (2)	Elderly women (5)	Over 70 years
FDG	Ha Mohale, Ts'ehlanyane	Young men (13)	Woman	Below 70 years
Interview	Ha Mali – Ts'ehlanyane	Elderly man	-	Over 70 years
FDG	Ts'ehlanyane	Elderly men (3)	Elderly woman (1)	Over 60 years
FDG	Pela Tsoeu	Elderly men	Elderly women	Over 65 years
FDG	Pela – Ts'oeu	Elderly men	Elderly women	Over 70 years
FDG	Kota Top (KT)-Lipofeng	Elderly men	Elderly women	Over 70 years
FDG	Mohale, Ha Mali and Masianokeng – Ts'ehlanyane	Elderly men	Elderly women	Over 50 years

Men and women actively participate in focus group discussions on the use of IKS in the management of their environment. (Credit: National University of Lesotho)

Key findings

Soil and water conservation

Most of the respondents interviewed acknowledged the importance of indigenous knowledge in promoting soil and water conservation and highlighted several practices. Communities in Hlotse used a system called *ngoapa u jale*, (digging and planting a seed), which allowed them to dig small holes in the ground to plant the seeds instead of cultivating the entire field. The system was not intensive since farmers used sticks to make the holes, while manure and ash were concentrated in the specific holes.

Farmers used to decompose organic matter from dead plants and spread it across fields to fertilise the soil. They would use manure from livestock as it is known to be less acidic and does not require much decomposition.

Communities were discouraged from using one pathway for a long time as this promoted gully formation. Others would plant kikuyu grass especially in areas that were prone to soil erosion.

To protect wetlands, the livestock were not allowed in wetlands areas and springs were protected using stones and sticks. The communities used to build a protective shelter over the spring using stones and this was an exercise done collectively by the community. They used *mohope* (a Basotho household utensil that is used to dish out liquids such as water and soup) to fetch water from the spring area. *Mohope* is made from calabash skin, with the inside soft and hollowed out, and while the outside is dried and hardened.

To preserve water, dams were constructed on perennial rivers. Ponds were dug downstream of wetlands for animals to drink.

Rangeland management

Respondents confirmed the rotational grazing as one of the effective land management strategyies that was employed. As in other sub-catchments, reserved land was set aside at the beginning of December and livestock would be allowed to graze in April. This was administered in phases to allow regeneration of vegetation. Only animals

that provided milk for the children and those that would be used for transport would not be sent to the cattle posts. In some cases, livestock would be allowed to graze after the thatching grass, *Hyparrhenia hirta* (*mohlomo*) had been harvested. Burning of rangelands was prohibited to avoid destruction of seeds that would be dispersed to allow for germination in the next growing season.

Biodiversity and forestry management

Respondents highlighted that they used to preserve herbs and other forest products in a sustainable manner. They stated that the extraction of medicinal plants was done using a *kepa*, a small rod used by herbalists to dig plants. Conservation of biodiversity used to be under the jurisdiction of the chief, and one would seek permission to collect firewood in the mountains. However, due to mismanagement, most of the respondents revealed that native reeds such as the African bamboo (*Thamnocalamus tessellata)* used at the initiation schools and the common reed (*Phragmites australis)* used to make grain storage are now scarce in the communities.

Several respondents added that historically, people never ran out of biomass because there were many sources of fuel such as *litlhaka* (maize stalks); *lisu* (dung cakes that are dug from the kraal); *khapane* (dung cakes that are moulded from wet fresh cow dung); and another type of *khapane* collected from the field where animals graze. Once animals had defecated into the field, that dung would dry and was then collected by young girls and women to be used as fuel.

> *Collection of dried cow dung from the field was done in winter, as because in summer there are dung beetles that roll away the dung, leaving behind only the fluffy material which does not make much mass for burning. In winter, there are no dung beetles in the field and the dung is left intact and dry. In summer women make dung cakes with their hands.*
> Elderly respondent in Hlotse.

Use of indigenous knowledge in weather prediction

Respondents noted that during droughts, girls would play a game called *lesokoana.* The girls would pay a visit to a nearby village with the intention of stealing a wooden mealie pap stirring stick and then run away with it. The practice was believed to cause rain even if the clouds were initially not showing any signs. The girls and young women from the village where the stick would have been stolen from would then chase after the ones who took the stick to retrieve it. As the girls and young women were being chased, they would be singing traditional songs, and immediately as the girls are still celebrating, rainfall would start. In fact, sometimes it would even start as the girls were still running from the other village.

A number of rituals used to be performed in the past to call for rain whenever there was drought. (Credit: National University of Lesotho)

Similarly, boys would have a traditional game for rain called *molitsoane* when there is drought. In this game, boys would go hunting for wild animals. After catching animals, they would go to

the top of the cliff where they would slaughter the animals and burn them. While hunting and preparing the meat, the men would be singing *mokorotlo,* which were traditional songs sung by men. When men got down from the cliff, the rain would start falling. Though this ceremony had no scientific link, the Basotho used to believe in it and link it to the coming of the rains.

The falling of snow was another indication of good moisture in the coming growing season and good harvest.

Fruit trees were another indicator for climate prediction. For instance, when peach trees in the area blossomed at the same time, it meant a good season ahead.

People would also observe the behaviour of animals such as pigs, sheep, and cows. If they were seen running around, it was a sign that rains would fall soon.

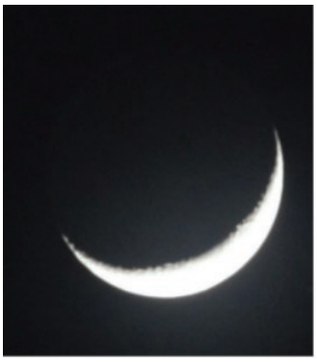
Communities used to observe the behaviour of birds as an indicator of weather and climate. Hadeda ibis (*Bostrychia hagedash)* birds were not usually found in the settlement areas. They are usually found in the rangelands, away from people. If these were seen flying from one side of the village to the other side, this was a sign that rain would soon fall.

Farmers could also predict flooding by observing the height at which weaver birds build their nests along river-courses. If it is too high, then flooding is eminent.

Another way to predict the weather was by observing the orientation of the moon. If the crescent was facing up, as illustrated in Figure 4.1, it meant that there would be no significant amount of rainfall. In this orientation, the moon was said to be containing or holding water, which is rain. In Sesotho they say, *khoeli e khakellelitse pula*. The crescent of the moon could also tilt slightly to being perpendicular tilt as in Figure 4.2. This tilt meant that the moon is spilling water (rain), meaning that there would be a lot of rainfall. In Sesotho they say, *khoeli e qhalile pula*. These findings are in line with what Mosime (2018) observed in southern Africa. The author states that stars and the moon are used extensively by communities to predict when rain can be expected. For instance, at certain times, when the moon is observed to be in halo in certain communities, it signifies good rain in the upcoming season.

Figure 4.1: The orientation of a crescent moon facing up. ‘Khoeli e khakellelitse pula.’

Figure 4.2: Tilted crescent moon. ‘Khoeli e qhalile pula.’



Suppressing hail storms

The act of suppressing hail was done by herbalists through the use of traditional herbs. They could also divert hail or torrential rains by making use of *lithakhisa,* which would have been provided by the herbalist. The *lithakhisa* would be taken out when there were hail bearing clouds. These were taken out by a reputable old man, not by a woman. The reason why women could not participate in this particular ritual was not specified. The other *lithakhisa* was planted in high areas close to the village to protect the entire village against hail storms.

Why indigenous knowledge is disappearing in Hlotse catchment

Most of the informants in Hlotse confirmed that indigenous knowledge practices are disappearin,g mainly because of the changed beliefs and behaviour, particularlyamong the youth..

They said that in the past children never used to question elders when they spoke, and were always obedient. Children are raised differently these days, where only the parent disciplines a child. In the past, every child would obey any elder regardless of whether he or she is related to them and could be disciplined by anyone for misbehaviour. In most cases, the youth no longer listen or take advice from the elders. As a result, there is no longer that transfer of indigenous knowledge from any elder, which used to be the case in the past.

Further, it was highlighted that the young generation associate some of these practices with witchcraft and this has contributed to the total withdrawal from the traditional practices, including those which were genuinely clear and effective.

People would adhere to the provisions and rules set by traditional leaders, for instance in the case of setting aside reserved grazing areas as well as in the harvesting of thatching grass and wild plants. Nowadays the kids burn the closed/reserved land or just release their animals to go and graze, even in areas where there are young trees.

Other respondents attributed the disappearance to the impacts of climate change. For instance, communities no longer set aside reserved grazing areas due to delays in the onset of the rainy season affecting the rotational system. The grazing areas have degraded and this has led the herders to take the animals to other people's crop fields, thereby creating conflicts.

Another cause for the disappearance of indigenous knowledge, particularly relating to rotational grazing, was the increase in the rate of livestock theft. This has discouraged people from taking livestock to the cattle posts.

Some respondents said the government is excluding traditional methods in favour of Western approaches in policy and strategy formulation. For example, the nature reserve park, which has control of some of the rangelands, does not fully incorporate the traditional way of range management.

The government also encourages the use of modern fertilisers which destroy the soil and reduce production in the long run.

Others claimed that the planting of exotic trees such as the eucalyptus contributed to the destruction of the environment, and said that if they had only planted indigenous trees and plants, they would still have enough water and grass for thatching and grazing. A eucalyptus tree uses anything from 100 to 1,000 litres of water per day, with the effect of reducing water sources in the area. Eucalyptus trees and are used to drain water from swamps.

Another cause for disappearance mentioned was the changed way of life where all children attend school and are no longer able to attend events such as *lesokoana*. Furthermore, most men have left the villages for better jobs in the cities, and no one is able to go to the mountains to make calls for rain in line with their historical practices and beliefs.

With regards to some of the impacts of this, several respondents pointed out that lots of animals have been hunted to extinction, adding that only a small population of the helmeted guinea-fowl (*Numida meleagris*) and grey-winged francolin (*Scleroptila africanus*) are left. Some lamented that the grass which used to cover the soil, and which was used for roofing, is no longer available.

The expansion of settlements has also taken up space previously reserved for rangelands and the growing of trees. Wild animals have deserted the area, as the habitats have been disturbed by settlements.

IKS practices is disappearing as the young generation no longer take advice from elders. (Credit: National University of Lesotho)

Importance of reviving indigenous knowledge systems and proposed strategies

While most of the respondents expressed the need to revive indigenous knowledge, they admitted that this was not going to be an easy task. Communities acknowledged that indigenous knowledge ensures protection of wetlands that would ensure availability of water for communities and the livestock. Wetlands provide water throughout the year, even in times of drought. Setting aside reserved grazing areas helps the grass to strengthen and this allow grass to mature and bear seeds.

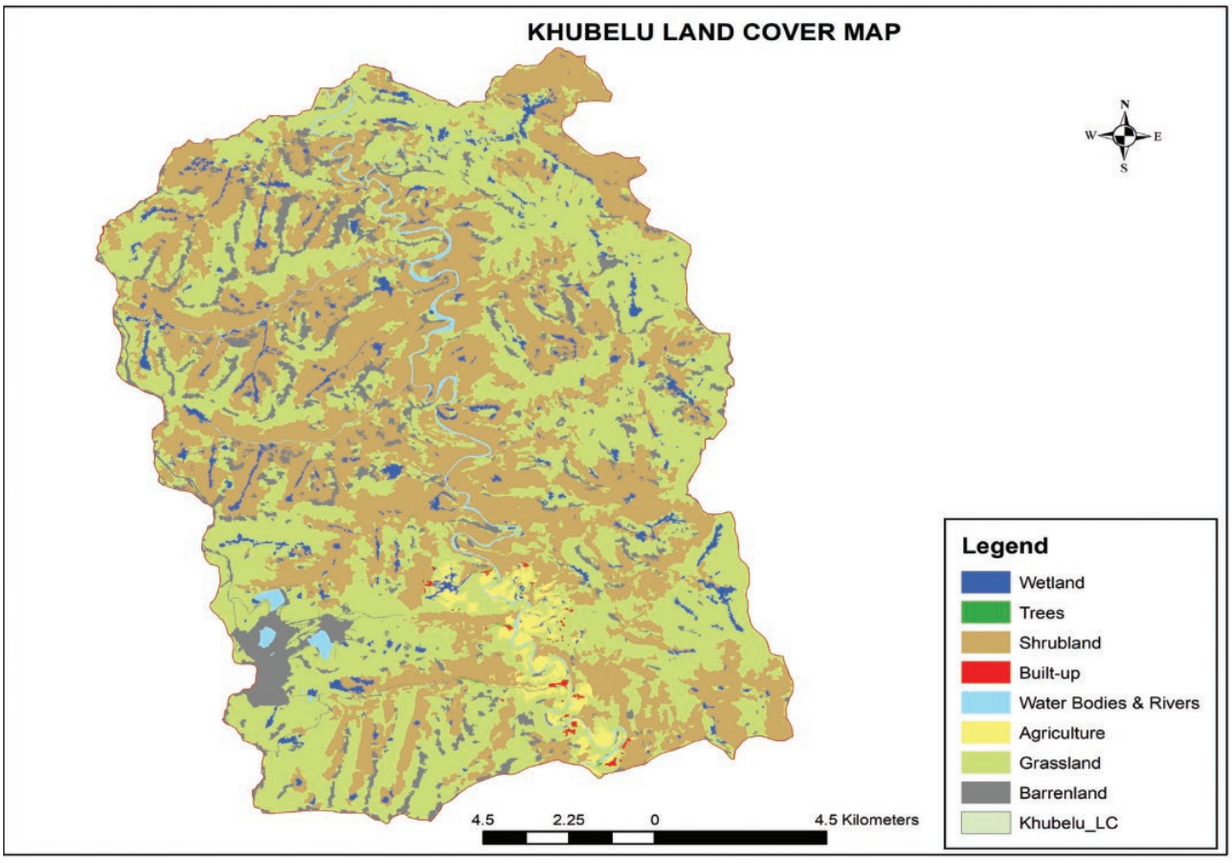
On whether indigenous knowledge still exists, some pointed out that they are still following some of the practices, though not as much as the older generation uhad done. For example, some communities still set aside reserved grazing areas, though not as effectively as before. The grass is not as rich as it used to be in the past.

Some suggested that strategies to revive indigenous knowledge include the following:

- Indigenous knowledge practices can be better reintroduced if the bottom-up approach is adopted in management of natural resources as opposed to the top-down approaches currently in use. The respondents underscored the need for the government to take into consideration the views of communities at grassroots level whenever decisions are being made;
- No settlements should be allowed in the grazing and farming areas. Both chiefs and the community councillors should work together when allocating sites for residential use;
- The government should facilitate removal of pine and eucalyptus trees from the wetlands and cliffs;
- There is a need for training herd boys to gain education on environmental management;

- There must be clear instructions on how much the traditional doctors can harvest in the forest to reduce over-extraction of herbs. The medicinal plants should only be extracted by people who are authorised by the chief and should only be extracted based on how much is available;
- There is need for restoration of traditional authority so that chiefs have the responsibility for the protection and conservation of natural resources;
- A law enforcement agent cannot be strengthened. Law enforcement of natural resource management can be strengthened.
- Households should take the best from indigenous knowledge and practice that as part of their culture. Chiefs are expected to take the lead and be advocates for restoration of effective traditional indigenous knowledge practices.

Map 4.2: Khubelu sub-catchment



4.3 Khubelu priority sub-catchment

Background

Khubelu sub-catchment is located in the north-eastern corner of Lesotho as shown in Map 4.2. It is characterised by highlands, and the key environmental features include the Khubelu wetlands, rangelands, the Polihali Dam and minerals. Khubelu sub-catchment is one of the sources of Lesotho's 'White Gold' (water), and the source of water for the entire Orange-Senqu basin.

> *Up in the highlands, a large number of wetlands or 'sponges' slow the flow of flood waters, and receive, purify, and store rain-water, releasing it slowly throughout the year, ensuring water in the rivers during the dry season.*
> (ORASECOM & Lesotho Department of Water Affairs, 2018)

The sub-catchment has a population of 1,104 people comprising of 563 males and 541 females. It consists of nine villages under one area chief. Of the six sub-catchment areas, Khubelu has the lowest population and number of villages.

Due to the steep terrain in most places and the destruction of bridges in others, few villages were visited. The other village informants were contacted through telephone interviews.

Table 4.2 shows the research techniques used and the respondents who attended according to their villages, gender, and rages of age.

Table 4.2: Research method and ranges of age of respondents

Method	Village	Men	Women	Age Range
Interview	Maloraneng	Traditional healer	-	Over 60
Interview	Pae-lea-itlhatsoa	Man	-	46 years
Interview	Pae-lea-ithlatsoa	-	Woman	Over 60
Interview	Patising		Woman	Over 70
Interview	Maloraneng	Elderly man	-	Over 70
Interview	Maloraneng	Chief	-	Over 60

Communities discussing management of Khubelu wetlands. Source: Orange-Senqu, 2014

Key findings

Use of indigenous knowledge in soil and water conservation

Communities in Khubelu protect wetlands by fencing the area. This prevents livestock from grazing and trampling the wetland areas, especially during the wet seasons. To promote the provision of safe water, dead animals are carefully buried underground to avoid contaminating water sources.

To reduce erosion, communities build structures along gully walls and protect it from further collapse. Rotational grazing is practiced and movement of livestock in wetlands is restricted.

The protection of water systems is done through *maboella* or reserved grazing lands and if any violates the set rules and allows livestock to graze in these protected areas, the animals will be confiscated until an agreed fine is made. The important contribution of reserved land in the country is affirmed by Marake and others (2019) who state that *maboella*, which is a traditional management strategy of the rangeland common property resources, remains the cornerstone of all range management systems in Lesotho.

Rivers are protected by planting indigenous grass such as *ts'ane* or *seboku* (*themeda triandra*). In summer, communities set aside areas to allow for grass re-growth, and animals are not allowed to create paths in the grasslands. This reduces the chance of gully formation and possibility of erosion. Furrows are sometimes created to re-direct water flow to the stream.

IKS helping in the protection of wetlands.
(Credit: ORASECOM)

When ploughing, communities leave out strips of land in between known as *makorota* to prevent soil erosion.

Rangelands

In terms of rangeland management, the livestock would go to the cattle posts during the summer months to preserve the grazing areas at home. The idea of sending livestock to the cattle posts is supported by Swallow and others (1987), who state that seasonal rotational grazing was started a long time ago in Lesotho, whereby animals were rotated from the cattle posts in summer to the lowland grazing areas in winter. This was beneficial as it would give the grass an opportunity to grow seeds to maturity. When the animals finally come back in winter, the grass seeds would have fully grown and dried. During grazing, the animals would then disperse the seeds for re-seeding purposes. If grazing were to occur while the plants were still growing, the animals would eat the seeds, thereby, reducing chances of regrowth and leading to reduced vegetation in the area.

Communities send their livestock to cattle posts to control grazing. (Credit: ORASECOM)

Biodiversity and forestry

Community leaders at times call for public gatherings where communities are sensitised to the importance of sustainable ways of managing the environment. This is still being practiced. To reduce deforestation, the cutting down of trees was restricted to the winter season or when there are important ceremonies, such as funerals where a lot of firewood will be required. Otherwise, alternative sources of firewood such as cow dung were used. To utilise plants sustainably, the herbalists would harvest fully grown plants. The smaller immature plants were spared, especially those that are harvested with the root system.

For wildlife, communities were not allowed to randomly hunt animals except in special ceremonies such as the *Molitsoane*. Some animals that could be hunted freely were *phokojoe* (jackals), which used to pose a threat to livestock. The jackal hide was and is still being used to make clothes, including the Sesotho hat called *kuoane*.

A fence surrounding Letšeng Diamonds mining site demonstrates the impact of grazing on the vegetation cover. (Credit: National University of Lesotho)

Weather prediction using indigenous knowledge practices

Communities in Khubelu catchment engage in a range of activities associated with rainmaking. For instance, the herbalist uses medicinal portions to prevent hail and heavy rainfall that would otherwise cause floods and destroy crops. This practice has been popular in the past but is disappearing as communities no longer believe in this.

> *In the old days, it was believed that if anyone does work at midday in the field like collecting firewood, vegetables, and any agricultural work, they would destroy the medicinal portions that prevent undesired climatic conditions. To avoid*

> *that, residents were only allowed to work in the morning until just before midday and start again in the afternoon from around 2 pm. They were also able to prevent hailstorms traditionally by the use of traditional herbs that is applied to a "stick" and then used to "dilute" the hailstorm into normal rain.*
> Extract from an interview held with a community member in Pae-lea-itlhatsoa Village.

Communities in Khubelu confirmed that they used to play *lesokoana* for girls and *molitsoane* for boys as practiced in Hlotse sub-catchment. In addition to the explanation made in Hlotse, communities in Khubelu said the men would slaughter a sheep, eat it and finish it at the top of the mountain on the same day. Immediately when they come down, rain would start falling.

Herbs were used for different purposes from healing diseases to suppressing hailstorms. (Credit: National University of Lesotho)

For *lesokoana*, the game was explained slightly differently in Khubelu. The mothers would prepare *likhobe* (a dish usually consisting of a mix of maize, sorghum, and beans) at home so that when the girls came back, they bring *lesokoana* to the chief's place and then sing and eat *likhobe* Immediately after this has been done, the rain would fall.

If a woman loses a child or husband to death, a cleansing ceremony was performed during the winter season. This included slaughtering an animal to clothe the dead. If the ritual was done in summer, it was believed that the cold would come too soon and the plants in the field would be destroyed before reaching physiological maturity (*lia bajoa*), thereby causing famine.

Like in Hlotse, communities in Khubelu confirmed the use of indicators such as birds and animals to predict the weather.

Why indigenous knowledge is disappearing, and strategies introduced to revive the practice

Communities in Khubelu regard indigenous knowledge as an important practice which used to help the Basotho to harvest good yields with plenty of grass for their livestock. It was however noted that most of the indigenous knowledge practices no longer exist due to various reasons. especially the increased penetration of Western values. It was found out that the youth are no longer obeying advice from elders. Herd boys were no longer practicing rotational grazing. They prefer to graze their livestock near homesteads, which destroys the nearby grazing areas.

The lack of respect for traditional culture has resulted in over extraction of resources, increased land degradation and increased food insecurity. According to the Ministry of Forestry and Land Reclamation (2014), increased land degradation in Lesotho is partly as a result of livestock owners and herders who no longer respect the local authorities because of the conflicts between the leaders.

Strategies to reduce land degradation in khubelu

As a strategy to reduce environmental degradation, communities are now establishing different groups including grazing associations. An example is the Tlokoeng Tourism Association (TTA), which was established through assistance and advice from the Lets'eng Diamond Mine. The associations are tasked to sensitise communities about land degradation and what can be done to improve the situation. An example of a successful initiative through the grazing associations in collaboration with the District Authority and Area Chief is the high-density rotation grazing in the Khubelu wetlands. Box 4.1 illustrates this initiative, which can be replicated in other areas.

Open engagement with the principal chief from the onset of the project was instrumental to ensuring his full support, community awareness of the project, giving legitimacy to the project, and facilitating community participation in achieving project goals and objectives. The principal chief provided useful insight into community concerns in relation to livestock rearing. For example, some of the farmers in the Khubelu catchment made use of the traditional medicine to strengthen and protect their animals. This made them wary of mixing their livestock with those of other farmers who were not protecting their livestock in similar ways. Yet, the high-density rotational grazing and kraaling method requires the livestock of different farmers to graze and be kraaled together. The principal chief was sensitive to and cognisant of the cultural beliefs and norms of the target communities and the engagement involved finding ways to tackle such concerns.

Other proposed measures to revive indigenous knowledge systems

- Communities highlighted the need for indigenous knowledge to be taught in schools and incorporated it in the school curriculum;
- Engagement of law enforcement agencies in management of natural resources;
- Livestock herders to respect the protection of rangelands through setting aside reserved lands; and
- The need for Basotho to appreciate the useful practices in their culture.

> ***"Communities in Khubelu regard indigenous knowledge as an important practice which used to help the Basotho to harvest good yields with plenty of grass for their livestock."***

Box 4.1: High-density rotational grazing

Realising that one of the primary causes of rangeland and wetland degradation is uncontrolled grazing, high-density rotational grazing was introduced to and adopted by participating livestock owners and herders. This was an integration of indigenous knowledge and modern strategies introduced by government working together with the area chief and the private sector. Under this approach, groups of livestock are limited to a clearly designated grazing zone for a specified time. This prevents them from grazing selectively over a wide area, only choosing their preferred plants. Limiting their movement not only forces the livestock to graze on a wider range of plants, but also means that the livestock trample the area, breaking down dead plant matter and treading it into the soil with their own faeces and urine. The project also introduced mobile kraaling at night, where animals were enclosed in fenced off areas.

The results of the high-density rotational grazing included the following:

- Incorporation of moribund litter, dung and urine into the topsoil which increases nourishment, reduces run-off, reduces the raindrop-effect and encourages water percolation into the sub-soil;
- Improved seed germination and root and plant conditions;
- Recovery of palatable grass (due to sufficient time between rotations);
- Improved condition of livestock through reduced movement to remote pastures - leading to improved livelihoods and reduction of poverty;
- Improvement in grass quantities and quality, resulting in improved livestock carrying capacity of up to six times the previous rate;
- Improved retention of soil moisture leading to improvement in wetland conditions; and
- Improved fodder and water conditions leading to improved livestock conditions, quality and quantities.

Key stakeholders involved and their responsibilities:

- The Mokhotlong District that manages public local affairs and resources, was responsible for overseeing governance processes that assisted in sensitising, engaging and encouraging the involvement of the farming community in the project;
- Letšeng Diamonds, which operates a mine in the Mokhotlong District, contributed financially and materially to the project;
- The principal chief of Batlokoa is the legal authority of the pilot site rangelands. He is responsible for the allocation of grazing rights to livestock owners. He was instrumental in sensitising the wider community about the project and encouraging their support and involvement;
- Farmers and herders from the Bohale-Ba-Nkoe and Mofolaneng Grazing Associations were responsible for putting into practice the high-density rotational grazing and kraaling methodology;
- Members of the community were employed to conduct manual removal of alien invasive plants in the rangelands, and in the construction of the physical structures to address erosion and raise the water table of the wetland;
- The Community Councils of local government are responsible for establishment of legislation to manage environmental resources, land use, planning and development support at the community level. Their role was to ensure balance between delivery of governance, technical support and community compliance to interventions.

Source ORASECOM and Lesotho Department of Water Affairs, 2018, Protecting the Source of Lesotho's White Gold.

4.4 Likhetla priority sub-catchment

Background

Likhetla sub-catchment is located on the western side of Lesotho. The sub-catchment is dominated by arable land with patches of built-up areas. Grassland, shrubs, and forests are sparse (Map 4.3). Likhetla priority sub-catchment has a population of 7,908, comprising of 4,010 males and 3,898 females spread across 35 villages.

The names of villages that participated in the research and the ranges are indicated in Table 4.3.

Elders who participated in the focus group discussions. (Credit: National University of Lesotho)

Map 4.3: Likhetla priority sub-catchment

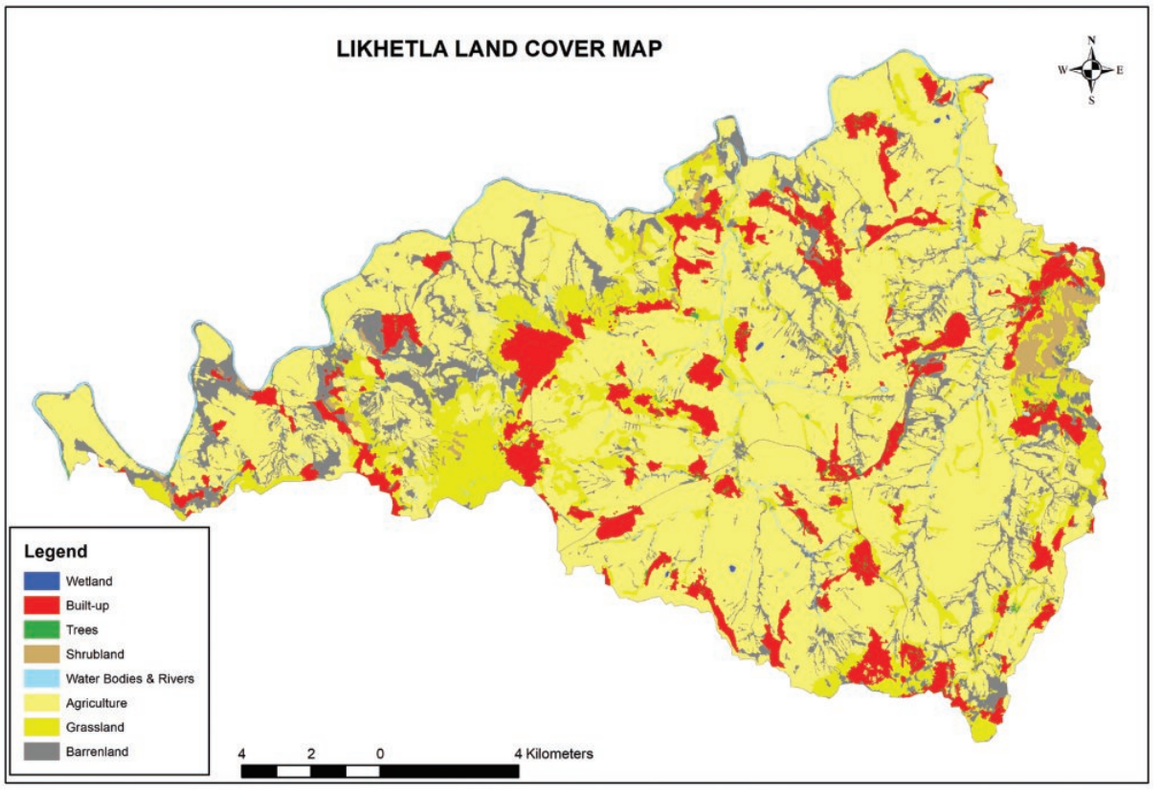


Table 4.3: Research techniques and the respondents age ranges

Method	Village	Men	Women	Age Range
FDG	Tebang, Matsoseng, Noang, Khoola, Ha Semoli and Rabeleng	Men	Women	Over 60 years
Interview	Bolikela	-	Elderly woman	Over 70 years
Interview	Traditional Doctor from Bolikela		Elderly woman	Over 50 years
FDG	Mats'oseng	Men	women	Over 70 years
FDG	Ha Mphulenyane and Koung	-	Elderly women	Over 70 years
FDG	Tebang	-	Elderly women	Over 70 years
Interview	Koung, Bolikela	Elderly man	-	77 years
Interview	Ha Tokonye	Elderly man	-	70 years
Interview	Ha Semoli	Elderly man	-	70 years
FDG	Kolo Farmers	Men	Women	Over 60 years
Interview	Ha Semoli in Tebang	Elderly man	-	Over 70 years

Key findings

Water conservation and protection from pollution

As a way of protecting water sources, the respondents indicated that they used to clean and cover the springs. Animals would drink from specific areas where they were allocated.

Communities used to respect water sources by observing certain myths. Children were told stories of snakes that stay at the springs which produce light at night and could swallow those who violate the set rules.

These findings are supported by Bernard (2003), who states that among the many southern African indigenous people, there exists a set of complex beliefs regarding water, river systems, and riparian zones. Rivers, wetlands, and the sea were considered the dwelling places of such manifestations and were of fundamental importance to many of the African healing traditions and their practitioners.

In Bolikela Village in Likhetla, communities used to collect water from the rivers and, as expressed by one of the traditional doctors

> *Before the pump system was installed in this community, we used to collect water from the river sand. We would go to the river and move the sand and when the water appears, we would wait for the suspended solids to settle and then collect water for domestic use. We would make a small ditch like a small dish of not more than 2 centimetres. If more than that, the ditch would collapse.*

One woman respondent reported that in the 1990s, a chief in her village protected a spring which still exists to date. The chief instructed men to dig a hole in the ground of about two metres by two metres and installed a metal tank in the hole and

covered it with concrete slab. The water collects in the tank from the spring and villagers are still using water from that tank for drinking and other domestic uses.

Other respondents revealed that they plant trees at the riverbanks. The trees mostly preferred include the willow (*Salix babilonica*), poplar (*Populars Canescens*) and wattle (*Acacia dealbata*), since they prevent soil erosion as well as proviide wood for roofing and firewood.

Soil and land conservation

In the past, some communities would remove the maize cob and leave the stalks in the fields. The cattle would eat the top part of the maize stalks without removing the stem. Communities also used to leave weeds in the fields and later mix them with the soil, adding ash and manure to improve soil fertility.

To maximise the arable land, the Basotho villages are located up on the hills while the fields are on the lower lying grounds. This would allow enough space for crops on the lower lying areas which have deep soil that support agriculture.

Even though fields could be found on hills, they would prefer to do most of their farming on the less sloping lands to reduce erosion. Furrows were created to prevent overland flow during heavy rainfall. Terraces known as *makorota* or *mankanisi* were created to prevent erosion in the fields, particularly on the sloping fields. Communities would also build structures at the edge of the garden heaps to avoid losing soil from erosion when ploughing.

Rangeland management

Communities in Likhetla used to set aside grazing rangelands, creating *maboella* (closed rangelands) as reported in the Khubelu sub-catchment. Rangelands were set aside for the two purposes. *Maboella a liremo* was set aside for the harvesting of plants such as grass. This was usually an area where thatching grass for roofing was found. The animals were prohibited from grazing at the reserved grassland to avoid destruction of the roofing material. The other rangeland, *Maboella a ho lisa,* was set aside strictly for animal grazing. Rotational grazing was practiced in the rangelands. During summer, cattle were driven to the cattle posts, usually in highlands, to allow vegetation close to the settlements to grow. The animals would then be fetched back from the cattle post in winter where animals would be utilised for harvesting and transporting the harvest from fields.

Some of the herbs planted around homesteads act as soil erosion barriers. (Credit: National University of Lesotho)

Both IKS and modern ways of preserving the environment are needed to reduce the negative impacts of land degradation. (Credit: National University of Lesotho)

Biodiversity conservation

After planting trees, livestock were prohibited from grazing in the area for a period of about ten years to allow trees to grow with minimum disturbances. After the stipulated time, communities would then seek permission to cut trees for firewood,

and would herd livestock in the area. There were several alternative sources of firewood including use of cow dung.

> *When we were young, we used to dig the compacted old cow dung from the kraal, which would come out in the form of bricks. Those would be dried and later used as firewood. We did not have to depend on trees then, there were many sources of firewood. Those blocks are called lisu, while the thin ones, which would dry faster and to be used first, were called* makhola. *The women would pile them in the kraal. When it is about to rain, the women would remove it to avoid it being destroyed by the rain. There were many sources of fuel for making fire then. We could use dried maize cobs, maize stalk and* likhapane. Likhapane *is cow dung that was left in the field to dry.*
> Extract from an interview with an old woman

Aloes were planted at the edges of the fields as they make strong and tall poles/stalks, which could be cut and used as firewood. The forests were controlled by chiefs who would allow people to cut trees if they had a funeral. Otherwise, everyone would be allowed to cut the aloes at a certain time in the year.

The forests had health benefits, and medicinal herbs were only extracted by herbalists using a *kepa,* as explained in Hlotse. The *kepa* was preferred as it does not take out all the roots of the plant. If one uses a spade, as is done now, all the roots are exposed. Respondents revealed that the disappearance of herbs such as *sehalahala sa matlaka* is a result of people selling those herbs in town, leading to over harvesting and the uprooting of the whole plant.

Some respondents further stated that some birds such as white necked raven (*Corvus albicollis*), secretarybird (*Sagittarius serpentarius*), and squacco heron (*Ardeola ralloides*) no longer exist, as the ecosystem has changed due to over exploitation of forests and plants.

Weather prediction using indigenous knowledge practices

Communities in Likhetla also practiced the rain making ceremony of *lesokoana* for the girls and *molitsoane* for the boys, as explained in the other priority sub-catchments. Respondents noted, however, that the situation has changed, and some wondered if the chiefs are even going to the mountains to pray.

Regarding hailstorms, the chief would call the community together where a traditional doctor would be chosen to prevent hail. The traditional healer would either dilute it or make it stand still over the mountain. Several rules were supposed to be followed to successfully stop hailstorms. For instance,

> *No hanging of the clothes on the washing line during the day;*
> *The bereaved women should not be walking around during the day; and*
> *The bereaved women must make sure that when the sun sets, they are already at their homes.*
> *Whilst this was a way of protecting the vulnerable groups, the communities believed that following such practices would help in controlling hailstorm. However, this suppression of hail had no scientific explanation.*

Community perceptions on existence of indigenous knowledge systems

While most of the respondents acknowledged the importance of indigenous knowledge in natural resource management, they bemoaned its disappearance. About three quarters of the respondents said that nowadays children no longer understand *letobo* (deferred grazing areas), as children are now free to do whatever they please. While communities used to play *lesokoana* and *molutsoane* for rain, the young generation seem to not believe in the tradition, and some are not interested in agriculture.

The culture of planting trees at riverbanks has also disappeared, and the restriction of animals from grazing in wetlands is no longer done as some herdsmen no longer abide by the rules of the community.

Some highlighted that they are experiencing long periods of drought, and hailstorms are rampant. The animals no longer go to the mountains because of an increase in theft. As a result, there is no more controlled grazing. As overgrazing leads to land degradation and development of many gullies, communities linked this to the disappearance of indigenous knowledge.

While most of the respondents acknowledged the need to revive indigenous knowledge systems one challenge that was mentioned was that the new generation expect to be paid for carrying out communal duties that benefit them,

> *In the old days, villagers used to work together as a group in what was called* Letsema*. At that time, the chief would instruct women in the village to cook food for a particular day where the community would gather to do the work without any payment. Such initiatives are no longer done as people now demand money in almost everything.*
> Said one elderly woman.

Suggested ways of reviving indigenous knowledge practices.

Some respondents expressed the need for dialogues between the traditional leaders and the government ministries related to integrated catchment management on what could be done to return to the effective indigenous ways of managing the natural resources. The need to restore the powers of the chiefs over management of natural resources was emphasised.

Others said that the law enforcement agents should assist in observing the set aside grazing areas. In some districts, the police are assisting in enforcing compliance to the rotational grazing system, and positive results are seen. The need to include indigenous knowledge systems in the school curriculum at an early age was underscored.

4.5 Makhalaneng priority sub-catchment

Introduction

Makhalaneng sub-catchment is situated on the western central side of Lesotho. It has a balanced land use of pattern of arable land, grasslands, shrubs, and built-up area (Map 4.4).

The sub-catchment has a population of 6,928, of which 3,483 are male and 3,445 are female, found in 50 villages located mainly in foothills. Table 4.4 shows the research techniques used as well as the categories of respondents by gender.

Map 4.4: Makhalaneng sub-catchment

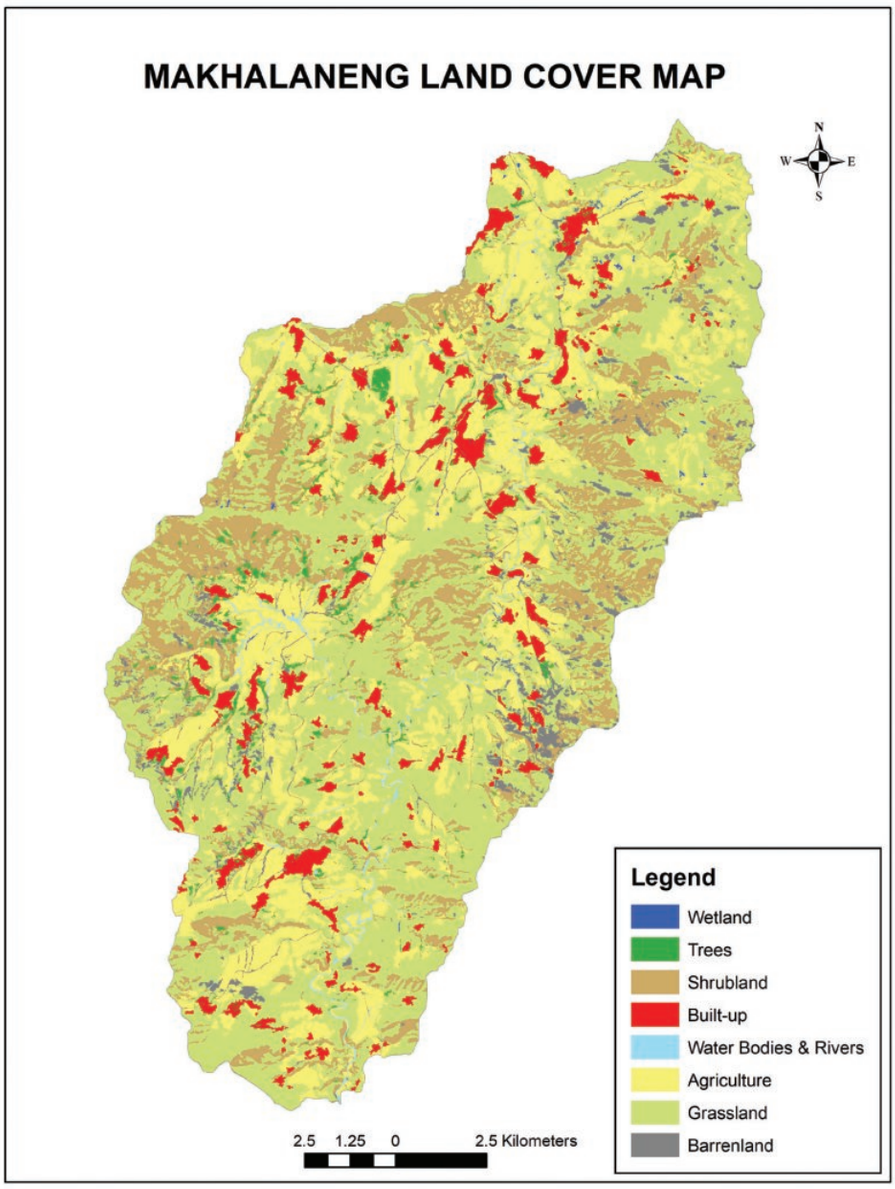


Table 4.4: Research technique and categories of respondents

Method	Village	Men	Women	Age Range
FDG	Ha Raboletsi	Elderly men	Elderly women	Over 70 years
FDG	Ha Raboletsi	Herders	-	-
FDG	Ha Raboletsi	Traditional Healers	-	From 50-60 years
FDG	Ha Motlejoa	Men	Women	Early 40s to early 70s
FDG	Ha Lithathane, Ha Kali, Ha Pholo, Ha Fokoane, Ha Kori, Ha Lekota and Ha Mokola	Headmen	Headwomen	late 40s to late 60s
FDG	Ngope Tsóeu Community of Ha Ngaka Village,	Men	Women	Over 70 years
FDG	Kanana Ha Masireletso and Khotso Ratiea	Initiation school, traditional healer	-	Around 60
FDG	Mpatane Community of Ha Masakale	Men	Women	Over 70
FDG	Ha Motseki, Ha Moshe	Men	Women	Over 70
	Moits'upeli	Farmers	Farmers	Around 40-50
Interview	Koung Ha Chere	-	Elderly woman	Over 70 years
FDG	Sekhutlong	Farmers	Farmers	Between 35-60
	Ha Dinizulu	Men	Women	Mixed
FDG	Mpatane and Ha Ts'iu	Men	Women	Around 40
FDG	Ha Lithathane	Elderly Men	-	Over 70 years
FDG	Ha Lithathane	-	Spiritual healers	-

Key findings

Water conservation

Most respondents reported that communities still apply indigenous knowledge in conservation of water resources such as wetlands. Feedback from herbalists show that some wetlands are still being preserved as they are considered sacred and to have spiritual qualities for healing.

Whenever vegetation density decreases in wetlands, communities plant reeds in such ecosystems and build walls around them to restrict animals from entering. Respondents highlighted that they also plant reeds along riverbanks to reduce the flow of water so that animals can drink. Further, the water found in the deepest parts of the river had a spiritual significance, as they believe such areas are inhabited by snakes with unimaginable powers. In Sesotho, this area is known as a *koetsa* or *lets'a* and a person with spiritual gifts, a *lethuela* in Sesotho, also known as *sangoma*, is initiated by going to this *koetsa* to form a relationship with the snake.

Focus group discussions held on IKS and integrated catchment management. (Credit: National University of Lesotho)

The springs found in abandoned settlements are given special attention as communities prefer using this water, which has a spiritual connection with ancestors, and they use it to perform rituals. In the past, when a spring was identified, elders would dig a well, which was a small ditch into which the water would collect, and this was done to increase the storage so that women and girls could easily collect adequate water from it. The rocks were piled around the spring, to make sure that overland flow did not contaminate the spring and a small opening was made to prevent animals from drinking there.

The elders reported that the springs would never dry up because people believed that a snake was found in the spring which, if killed, would lead to the drying of the spring. Some elders further stated that in the evenings, a moving light would be seen around the spring, indicating that the snake is feeding around the well. The communities also talked of the frogs called *nketu* in the spring, which were not supposed to be killed lest the spring would dry.

Biodiversity and forestry conservation

In terms of biodiversity conservation, most of the respondents acknowledged the importance of indigenous knowledge in preserving natural resources. Some of the respondents highlighted that in the past, medicinal plants were harvested under strict conditions, and only known herbalists were allowed to harvest these herbs. In addition, the plants were picked in a way that allowed the shoots (roots) to remain in the soil so that once the rains came, they could grow again. Instead of using a spade as is done in these days, the elders and the herbalists would use a *kepa,* as was practiced in the Likhetla priority sub-catchment.

However, some respondents lamented the rampant exploitation of these plants and other tree species, stating people no longer respect indigenous values. Respondents highlighted that the situation has changed as there are many herbalists who harvest loads of medicinal plants from villages for resale in the city. This has led to some native herbs such as *moferefere* (*Senecio asperulus*), *phefo* (*Helichrysum odoratissimum*) and *tikamotso* (*Malva parviflora*) to become almost extinct because of overharvesting.

Some respondents said that several bird species which used to be found in wetlands have since migrated to other places due to the disappearance of the ecosystems. In the past, when a bird called *mamasianoke* (*Scopus umbretta*) made its characteristic sound, it meant that lightening would strike.

The topography in Makhalaneng sub-catchment. (Credit: National University of Lesotho)

In addition, when a *mokunyane* (*Bathyergidae*) which is normally found only in the rangelands, was seen around villages, it meant death in the village. Some of the trees like the *cheche* tree were protected, as they were important at the funerals and elders had to protect it for other special uses.

Despite the disappearance of much of these indigenous knowledge practices, some respondents insisted that they plays a pivotal role in their day to day lives. For instance, in some areas certain trees were cut at an angle that promote regrowth. The surface of the stump is left slanting to promote the flow of water down and reduces decay of the tree. Communities also plant trees where there are gullies to restore the land and stop soil erosion. Trees planted include the willow, poplar and eucalyptus, which can thrive in dry periods.

Some noted that one would seek permission to cut trees from the Area Chief, and no tree is cut for commercial purposes. This is supported by Leipzig (1996) who states that Lesotho has a traditional system for conserving indigenous trees and shrubs involving the control of their exploitation by hereditary chiefs. The author further notes that many generations ago, small and generally open grazed areas of indigenous trees and shrubs were declared as controlled harvesting areas. Outside these area, trees and shrubs could be exploited without prior approval of the chief.

Soil Conservation

Respondents highlighted several indigenous knowledge measures which were implemented in the past to conserve soils. For example, they said that communities would dig furrows on slopes to divert water away from the field. A challenge however came with the introduction of another strategy *Makorota (*strips of uncultivated land cutting across the field*)* which forced other people to stop making furrows thinking that *makorota* would address soil erosion.

Some said, they used to grow a lot of *makhala* (aloes) in a straight line perpendicular to the direction of slope to reduce erosion. Others would plant the aloe at the edge of the yards at homes.

Further, they would plant trees and fill sacks with soil and place them where gullies would be forming to stop the impact of overland flow. While some mentioned that they still attend trainings on how to plough using *likotjana*, or ripping - whereby the whole village apply minimum tillage and put in maize seedlings - others said that people have gone back to their ordinary ways of ploughing as they no longer work together like in the past.

Rangeland management

On rangeland management, respondents highlighted that they used to practice rotational grazing by interchanging between pastures close to settlements and those at cattle posts. For instance, during the period ie. November - March animals were taken to the cattle posts up in the mountains. This allowed grass and herbs close to the settlements to grow back. The communities

had m*alila-mats'oaea-koena*, grazing areas which were reserved for the chief's animals. As a current practice, communities harvest some *ts'ane* (*Eragrostis chloromelas*) when the grass matures, and thresh it to get seeds for planting in the next season.

Some mentioned that they rehabilitate gullies and remove *lihalahala* (*Chrosocoma ciliate*) in the rangelands. They indicated that the removal of *sehalahala* (*Metalasia muricata*) is done by forming groups from different villages. *Sehalahala* is unfavoured by sheep farmers as it reduces the value of wool.

Other respondents revealed that climate change has affected rotational grazing due to changes of seasons, which makes it difficult for them to decide on which times to send animals to the cattle posts. Further, rangeland management used to be successful when chiefs were respected. Now there are no strict laws.

While efforts are being put in place to reduce erosion, most of the respondents stated that this is a challenge. Even though famers put aside *maboella*, deferred areas, their children disobey. Some households have animals which are way above the carrying capacity.

Most respondents strongly discouraged burning of rangelands and hunting to stop further reduction of wild animals. Area chiefs work with communities to identify portions of rangelands where grazing is not permitted, to allow vegetation growth which act, as a habitat for wild animals.

Indigenous knowledge systems of predicting weather

Most respondents highlighted that communities believe in performing rituals in understanding climate predictions. For instance, they mentioned that the presence of *Hirundo rustica* is a sign that rain will fall. Like in the other priority sub-catchments, communities in Makhalaneng performed rain making ceremonies.

They would also observe the state of certain water springs to predict weather. When a certain spring had water or showed some seepage, the communities would know that rain was coming. There were birds called *mahaqasui,* that if seen flying and catching mosquitos and other flies, signalled the coming of rains.

Another indigenous knowledge system still being practiced in some areas is the observation of the moon phases to predict climate and weather patterns. Like in Hlotse, communities in Makhalaneng could predict whether they were going to receive heavy rain or not by simply observing the shape of the moon, as explained earlier.

Communities also celebrate snowfall because it means that there will be enough moisture in the soil for planting crops. This is because snow does not easily flow away as it takes time to melt, and promotes infiltration.

Like in other priority sub-catchments herbalists in Makhalaneng practiced suppression of hailstorms using certain traditional herbs.

Importance of indigenous knowledge

Most of the respondents agreed that they use indigenous knowledge to manage their resources and preserve their cultural heritage for use by future generations. They noted that indigenous knowledge helps them to appreciate the environment better, as well as to preserve crops and animals. Citing an example of an indigenous knowledge system for protecting crops, respondents said that growing certain herbs around their sorghum fields would scare away birds from eating the grains. Communities acknowledged the use of indigenous knowledge as a disease control for their livestock, crops, and human beings.

Through rotational grazing, respondents noted that deferred areas become a source of food supply for their livestock. When rangelands are taken care of, animals can easily access good pastures which is less expensive compared to

buying hay and straw for them.

Existence of indigenous knowledge practices

There were mixed reactions from respondents as some stated that IKS is used only partially by a few people, mostly by older people, while some said that they still practice it though not as much as before.

It was mentioned that wetlands and springs are no longer protected as before ever since the piped water connections were put in place. This led to the depreciation of other water sources. Some said it seemed logical to stop protecting them because they have no other domestic value apart from providing water for the livestock.

Several respondents said that some of the indigenous knowledge is disappearing as the youth no longer have an interest in such practices. The youth are now more inquisitive and challenge the usefulness of some of the belief systems which were not making sense. It was felt that the elders have failed to properly teach the young generation. When the youth ask questions, some elders fail to respond, which makes it difficult for them to practice what they do not fully understand. Others attributed this to human rights and equality, which seem to have tainted culture.

The other reason was that governance systems have changed, and chiefs are no longer being respected as before. Responsibility has been passed on to law enforcement agents such as the police.

Impacts of the disappearance of indigenous knowledge practices

Due to the disappearance of the rotational grazing system, pastures no longer sustain livestock due to overgrazing. Respondents stated that failure to set aside reserved grazing areas has led to conflicts. In some cases, this has led to deaths, as people fight over good pasturelands.

Others attributed widespread destruction of the environment to climate change with some saying that water will soon become scarce. Some believed that disregard of indigenous knowledge practices has led to occurrences of unusual periods of extreme drought and hailstorms, which have become frequent in the communities. On rainfall prediction, they revealed that they no longer rely on hammerkop as these have since migrated due to degradation of habitats.

> *These days it is impossible to reprimand a child who is misbehaving because of child protection rights unlike in the olden days when every adult had the authority to reprimand children if they misbehave.*
> An old man in Makhalaneng.

Ways of reviving indigenous knowledge practices

All the respondents were keen to have some indigenous knowledge practices be revived, though they acknowledged that this will not be easy. Some said that reviving indigenous knowledge can be achieved only if elders are allowed to punish children when they commit offences and if children can be taught to take pride in their traditions.

Other respondents suggested an upward review of the fines which offenders pay, as well as the restoration of the chief' governing powers. Empowering chiefs helps them to command more respect in communities and enables them to enforce laws that govern their communities.

Others cited the need for inclusive discussions and regular trainings on indigenous knowledge systems. Platforms to learn about the usefulness of medicinal plants as well as the methods that could be used to eradicate invasive species which tend to degrade the rangelands, should be availed.

Some suggested that the King of Lesotho should declare a state of emergency that forces everyone to use certain and effective indigenous methods, and establish laws that prevent people from killing wild animals and overharvesting medicinal plants.

Some respondents emphasised that the governance of natural resources should be less politicised, and should ensure that the Lesotho Constitution includes indigenous knowledge issues. Some proposed that the government could meet with traditional leaders through their unions/associations and have discussions to encourage sustainable ways of integrating indigenous knowledge systems.

Finally, the majority of the respondents supported the documentation of indigenous knowledge systems rather than over relying on passing the message to the next generation through word of mouth.

4.6 Maletsunyane priority sub-catchment

Introduction

The Maletsunyane sub-catchment is mostly grasslands with some shrubs, with arable land - mainly in the middle of the sub-catchment (Map 4.5). The main environmental feature is the Maletsunyane Falls with a drop of 192 metres.

The sub-catchment has a population of 6,637, comprising of 3,456 males and 3,181 females spread over 71 villages.

Table 4.5 provides data on the respondents consulted during the site visits.

Map 4.5: Maletsunyane Sub-catchment

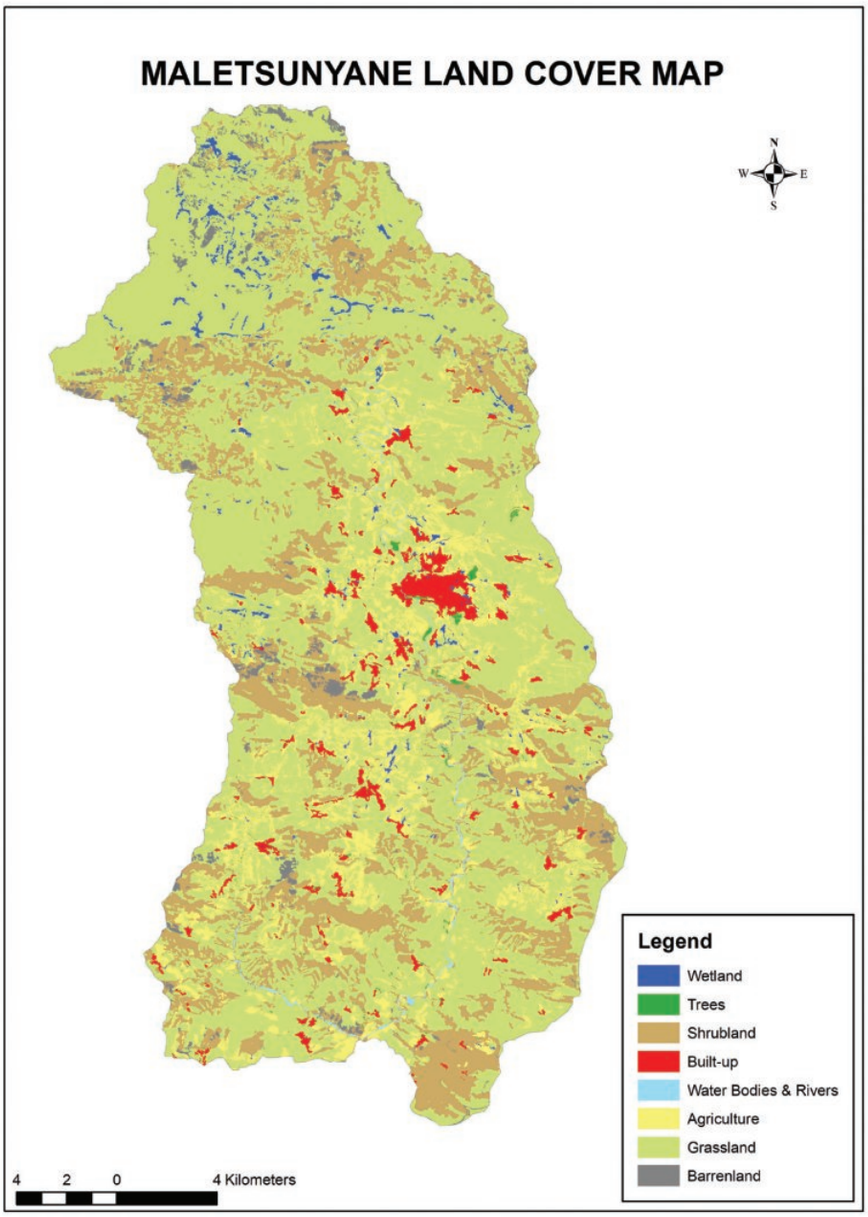


Table 4.5: Methods and categories of respondents by gender

Method	Village	Men	Women	Age Range
FDG	Ha Lechesa, Ha Popa and Nchakha	Men	Women	Over 60
FDG	Ha Mateketa community	14 men	13 women	Over 60
FDG	Semonkoaneng, Sethua-majoe and Polateng	Men	Women	Early 30s to early 60s
FDG	Sekhutlong, Mabote and Auplas - Ha Moahloli	Men	Women	Early 30s to early 70s
FDG	Ha Phallang	Men	Women	Early 30s to early 70s
FDG	Ha Lepae	Men	Women	Early 30s to early 70s
FDG	Ha Lentiti, Konyana, Khonyeli and Tso'ana	Elderly men	Elderly women	Over 70 years

Key findings

Water and soil conservation

Respondents reported that they demarcate wetland areas with stones marked white around the margins to prevent grazing, and to protect special plants found in these sensitive ecosystems from depletion. Burning or ploughing in wetlands remains prohibited, and this applies mostly to those with fields near wetlands who tend to encroach into the margin areas. Those found grazing their livestock in the wetlands pay fines to the Grazing Association Committee. To protect springs, communities use local materials such as stones, sticks and mud to deter animals from drinking from them.

To protect soils, communities construct terraces to curb soil loss during heavy rains, while those with fields in sloping areas build stacks of rocks to divert water from flowing across the fields. To reduce erosion, farmers plough along the contours and not down the slope. Basin farming is also encouraged as a practice that preserves soil from erosion and retains moisture for a long period of time.

Focus group discussions held with communities to discuss IKS practices in management of natural resources. (Credit: National University of Lesotho)

Like other priority sub-catchments described earlier, most communities in Maletsunyane practice rotational grazing by setting aside reserved grazing areas, *maboella,* for the period January - May. From August, animals are allowed to graze on the reserved grazing areas up to December. Burning of rangelands is not allowed, as this kills seeds of grass and tree species for the next season.

The disappearance of IKS practices such as rotational grazing leads to increasing rates of soil erosion. (Credit: National University of Lesotho)

Biodiversity and forestry conservation

Communities used to protect *roro* (a type of reed for roofing) in the wetland areas by prohibiting grazing until July of each year, when the reeds would have dried. Only then would communities be allowed to go and cut it for roofing. The local chief would allocate portions to be harvested to the community members.

People had to seek permission from the chief before they could dig out medicinal plants. It was mainly the traditional healers who had to dig out medicinal plants and herbs. As with other priority sub-catchments, a *kepa* was used to carefully remove part of the plant without destroying the rest of it. Some of the medicinal plants would include black *pelargonium* (*khooara*), aloe (*lekhala*) and *Bulbine narcissifolia (khomo-ea-balisa*).

Grazing of livestock was prohibited in areas where trees have been planted until the trees are grown enough to withstand possible destruction. Communities would also construct fire guards around the forest area. Forest management was supervised by the chief, who would give permission to harvest the trees in a sustainable manner.

Weather prediction using indigenous knowledge practices

Most of the respondents in Maletsunyane shared the same sentiments with regard to the practices to attract rain as other priority sub-catchments. The act of suppressing hail was done by traditional healers by smearing herbs on a stick, referred to as *thakhisa* which was kept at the chief's home. Men would waive the *thakhisa,* in the direction of the hail-bearing clouds to suppress the hail. Some respondents noted that this method is still being used, especially at initiation schools.

During the cropping season, a traditional doctor is requested to come and protect the village from hailstorms. Every family would pledge to pay a dish of maize, sorghum or beans once harvested as a way of thanking the traditional doctor. For *muti* to work, villagers were not supposed to bring firewood to the village during daytime. Older women wearing mourning clothes and mothers of newly born babies were not supposed to shout or go out during the day. They believed that if these rituals were not adhered to, the *muti* would not be effective. Whenever hail-bearing clouds occurred, the *muti* would then be used to divert or suppress

the hail. In that process, a respectable elderly man would take the *muti* out and shake it.

Existence of indigenous knowledge practices

Most respondents acknowledged the importance of indigenous knowledge in safeguarding the environment. They noted that indigenous knowledge has helped them to prevent soil erosion, promote sustainable grazing in rangelands, ensure protection of wetlands and guarantee water supply throughout the year.

On whether such indigenous knowledge practices still exist in their localities, a good number of respondents confirmed that they still practice some to a certain extent. In some areas, communities still plough along contours on sloping fields and girls still play *lesokoana* for rain.

Practices that are no longer being observed include rotational grazing, as herders are not abiding by the rules. Some said that reserving grazing areas brings conflict, since people are not ton he same level of understanding. Further, the fine for offenders is too low leading to herders disobeying instructions, as they are able to pay the fines.

Promoting sustainable grazing in rangelands ensures protection of wetlands and guarantees water supply. (Credit: National University of Lesotho)

Why indigenous knowledge is disappearing

Respondents said that disappearance of indigenous knowledge is a result of changes in the governance system, where responsibility for protecting the environment was taken away from the chiefs and given to the counsellors. The need to restore the authority of the chiefs over management of resources was underscored.

Another reason for the disappearance of indigenous knowledge is the commercialisation of traditional herbs. Nowadays, extraction of medicinal plants has become a business. Many people are harvesting the medicinal plants and the method of extraction is not sustainable.

These findings are supported by Mugomeri and others (2016), who note that the extinction of medicinal plants and the loss of the associated knowledge about herbal medicines will have an adverse effect on the existing healthcare system in Lesotho. The authors add that the existing regulations on harvesting, transporting and exporting of herbal medicines need to be strengthened and new regulations on the sale of the medicines on the informal public market must be introduced.

Impacts of the disappearance of indigenous knowledge

Several respondents were clear on the impacts to the environment that have been caused as a result of the loss of indigenous knowledge practices. They reported that the disappearance of indigenous knowledge has led to a deterioration in the condition of the rangelands, wetlands and that those springs have dried up.

These findings are supported by the Ministry of Forestry and Land Reclamation (2014), which highlighted that the degradation of the natural grazing lands of Lesotho is largely due to changing land use patterns, such as encroachment of

cultivation and settlements, into rangelands, the partial breakdown of traditional seasonal grazing patterns, less mobility of herds as a result of new settlements and the loss of authority of traditional chiefs, among others.

Ways of reviving indigenous knowledge systems

Most respondents stated that reviving indigenous knowledge is the only way degraded areas can be rehabilitated. In addition to giving back responsibility to the chiefs, respondents highlighted the need to train herders on environmental protection, as well as tightening the laws for the offenders.

Others noted the need to exact powers on the youth to oversee the proper use and conservation of natural resources. Some, however, saw the need for incentives to encourage the youth to take part in indigenous knowledge practice.

The need to promote the *letsema* – working together as one community – was also underscored. In *letsema*, community members could perform different roles to accomplish a significant task that would take a single person days or weeks to complete. *Letsema* could be for tasks such as construction of stone lines on the grazing land to trap water and soil during rains, donga rehabilitation, removal of invasive shrubs on the grazing land, and the establishment of communal gardens. The initiator of the task prepared food for the participants and, in most cases, it was an elaborate event with singing, poetry and ululation accompanying the communal work. This strengthened family ties and encouraged the spirit and passion of teamwork and social cohesion within the community.

Maletsunyane falls, a key attraction to tourists. (Credit: National University of Lesotho)

4.7 Senqunyane sub-catchment

Background

Senqunyane sub-catchment is located in the highlands of central Lesotho. The main environmental features are the vast areas of grasslands, with patches of shrubs. Cultivation is mainly along the Senqunyane River and its tributaries. The Senqunyane River flows into Senqu the main river that forms the Orange-Senqu basin (Map 4.6).

Another important feature in the sub-catchment is the Mohale Dam along the Senqunyane river. It is the second dam, under Phase 1B of the series of dams of the proposed LHWP and is designed to divert about 70 cubic metres per second of storage to the Katse Dam reservoir. The water supply meets the needs of the Gauteng region in, South Africa.

Senqunyane sub-catchment has a population of 3,554, comprising 1,838 males and 1,716 females. Table 4.6 provides data on the respondents consulted.

Map 4.6: Senqunyane sub-catchment

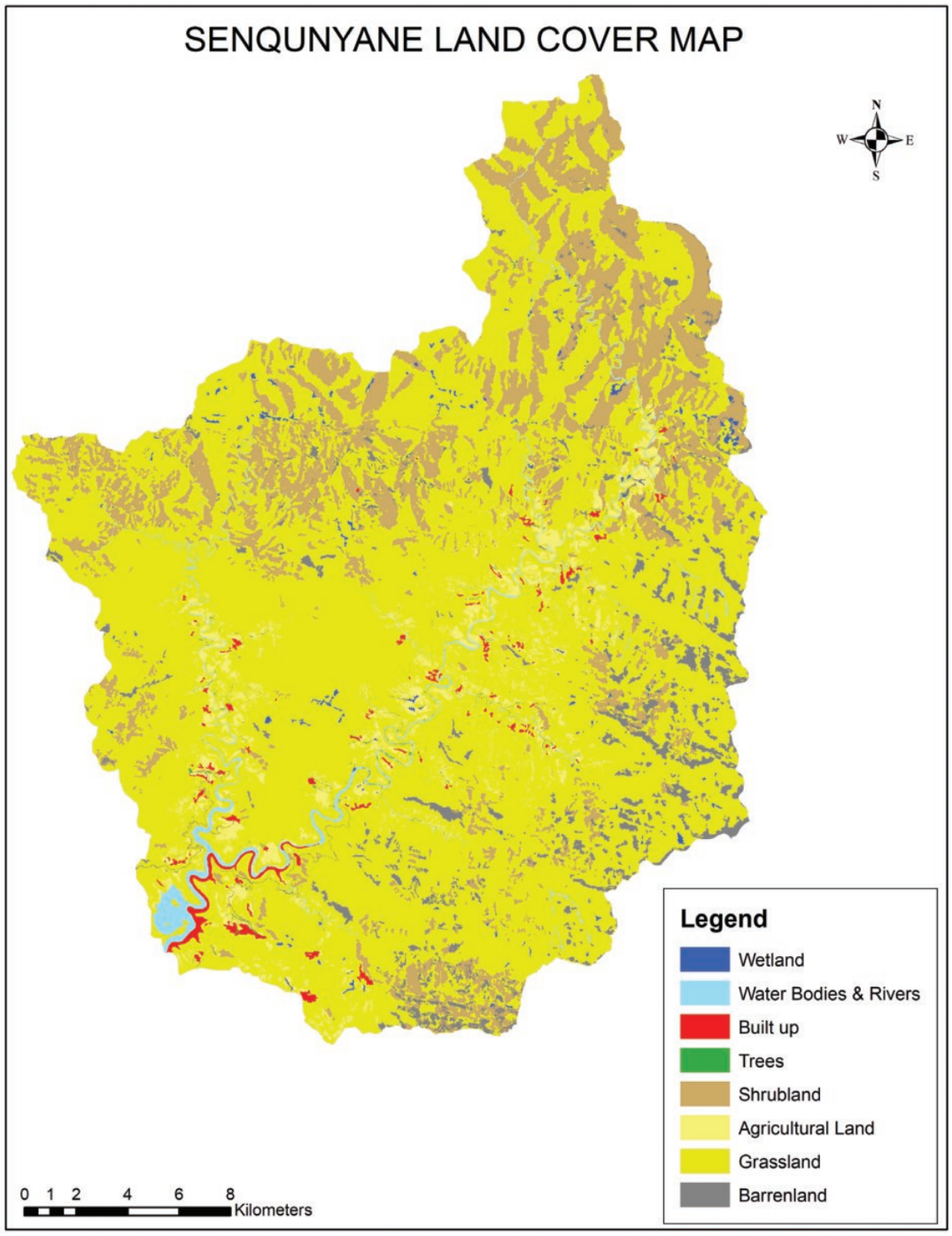


Table 4.6: research techniques and categories of respondents

Method	Village	Men	Women	Age Range
FDG	Khohlong, Ha Koporale	Elderly men	Elderly women	Above 60 years
FDG	Ha Pae Pae (Sankong)	Men	-	20-60 years
Interview	Ha Joele (Sankong)	Eldely man	-	Above 70 years
FDG	Letsatseng Community of Ha Koporale Village	Men (9)	Women (5)	From 30 years
FDG	Ha Koporale-Khojane Community	Men (5)	Women (7)	From 40-60 years
Interview	Khojane Community in Ha Koporale	-	Elderly woman	75 years

Focus group discussions with communities held in Senqunyane. (Credit: National University of Lesotho)

Key findings

Soil and water conservation

Most respondents demonstrated a general level of understanding of what indigenous knowledge means as they managed to cite several practices that still exist. Communities in Senqunyane protect wetlands and other water sources such as springs using locally available material like stones, sticks and mud. To prevent animals from drinking water from the same water sources, the communities leave a small opening on the springs to allow women to draw water using their *mohope* (traditional jug).

Respondents reported that they plant *cheche* (*Leucosidea sericea*) and other popular trees in areas that are susceptible to erosion. They place rocks to retain soil and avoid the formation of gullies. In the past, special plants were found in the wetlands such as *sereleli,* and no animals were allowed to graze in the wetlands. Communities used to practice terrace farming on sloping fields to stop erosion and to conserve water from overland flow.

Water supports community livelihoods in Lesotho. (Credit: National University of Lesotho)

Rangeland management

Like in other priority sub-catchments, the practice of rotational grazing was highlighted, where animals were allowed to graze in one area for at least three months before they are moved to the next, depending on the condition of the range. The Letsatseng community indicated that in September, cattle would be taken to the cattle posts in the Maluti Mountains for grazing, a period during which pasturelands in the homesteads and community would get a chance to grow thicker grasses. This would happen until April, when the animals would come back at a time when temperatures would get very cold in the Maluti Mountains. At that time, animals would be at home ready for ploughing in August. Burning of rangelands was prohibited and the communities would remove unwanted weeds such as *hlabahlabane* from their rangelands and fields.

Biodiversity conservation

Communities in Senqunyane used to conserve and harvest herbs for several purposes. People would seek permission from chiefs to dig plants for medicinal purposes, and not everyone was involved in harvesting of such plants. Wild plants such as *lengana* (*Artemisia afra*) were used for medicinal purposes and for roofing. Areas with good medicinal plants were set aside and not open for grazing.

The Ha Koporale-Khojane Community, however ,highlighted that nowadays things have changed, as anyone can harvest medicinal plants in whatever quantities are required for sale. For example, the *lesooko* plant has since disappeared, while *lehlomane*, which is used to heal gall bladder issues in cattle, and *khooara* for diarrhoea in sheep and goats, are hardly found in the fields. The disappearance of traditional herbs in Lesotho is confirmed by Masupha and others (2012), who indicate that traditional healers are faced with serious declining resources due to the rampant uprooting of the whole of medicinal plants by herbalists from urban areas.

Many households had small forests, and if anyone wanted some wood, the owner would give it to them. These days trees are only cut during a set period of the year and are mainly used for firewood.

Use of indigenous knowledge in rainmaking

Most of the respondents were familiar with the cultural rain making practices which existed in the communities. This is the same ceremony explained in earlier priority sub-catchments where girls, boys, men and women would participate in different roles. One elderly woman said that in the beginning of the year, the chief would call a public gathering where men would ride horses and go to a far away place and pray for the rain. On their return, there would be ululations and traditional dances on the mountain called *Thaba-Litsebe* (mountain with ears), and rain would fall.

The act of suppressing hail was, and in some places is, still being practiced by herbalists using traditional herbs; instead of hail, they would get rain. Some respondents said they would also get plants from the herbalist which they used to guard against lightning strikes. During hail, lightning or thunder, Basotho elders would bang a bucket like a drum and then place it outside in an upside-down position. Each time Basotho would do this, the hail would instantly stop.

In addition, a type of bird called *Lengangarene* was used for rain forecasting. Whenever that bird would make a sound, communities would know that it was going to rain.

Another traditional method of rain forecasting was to observe the behaviour of cattle. If the head of the cattle is noticed to be hesitant to go for grazing, it shows that the rains are to come within a few hours. Other farmers mentioned that cows in the field lie down when the rain is on its way and is coming within a few hours. Whether the calves are sensitive to low pressure systems, high humidity or changes in temperature, is not yet well known.

Responses on whether indigenous knowledge still exists

Most respondents said that though they are still using indigenous knowledge in some cases, much of it has disappeared. For instance, they agreed that though wetlands conservation using reserved land is still being practiced, it is no longer as effective as it used to be. In the case of the increasing degradation of rangelands and wetlands, respondents attributed this to the fines which are too low to dissuade people from violating the laws. Traditional herbs are now accessible to anyone and are being sold at the market, leading to overexploitation.

Most respondents said that indigenous knowledge is disappearing as communities no longer work together on matters that concern them. Politics now plays a major role in people's lives.

On the impacts of the disappearance of the indigenous knowledge, most of the respondents said that this has led to the deterioration in the condition of the rangelands. Additionally, they are seeing a reduction of palatable grass species in the rangelands, and there has been an increase of invasive species *Chrysocoma ciliata* (*sehalahala*).

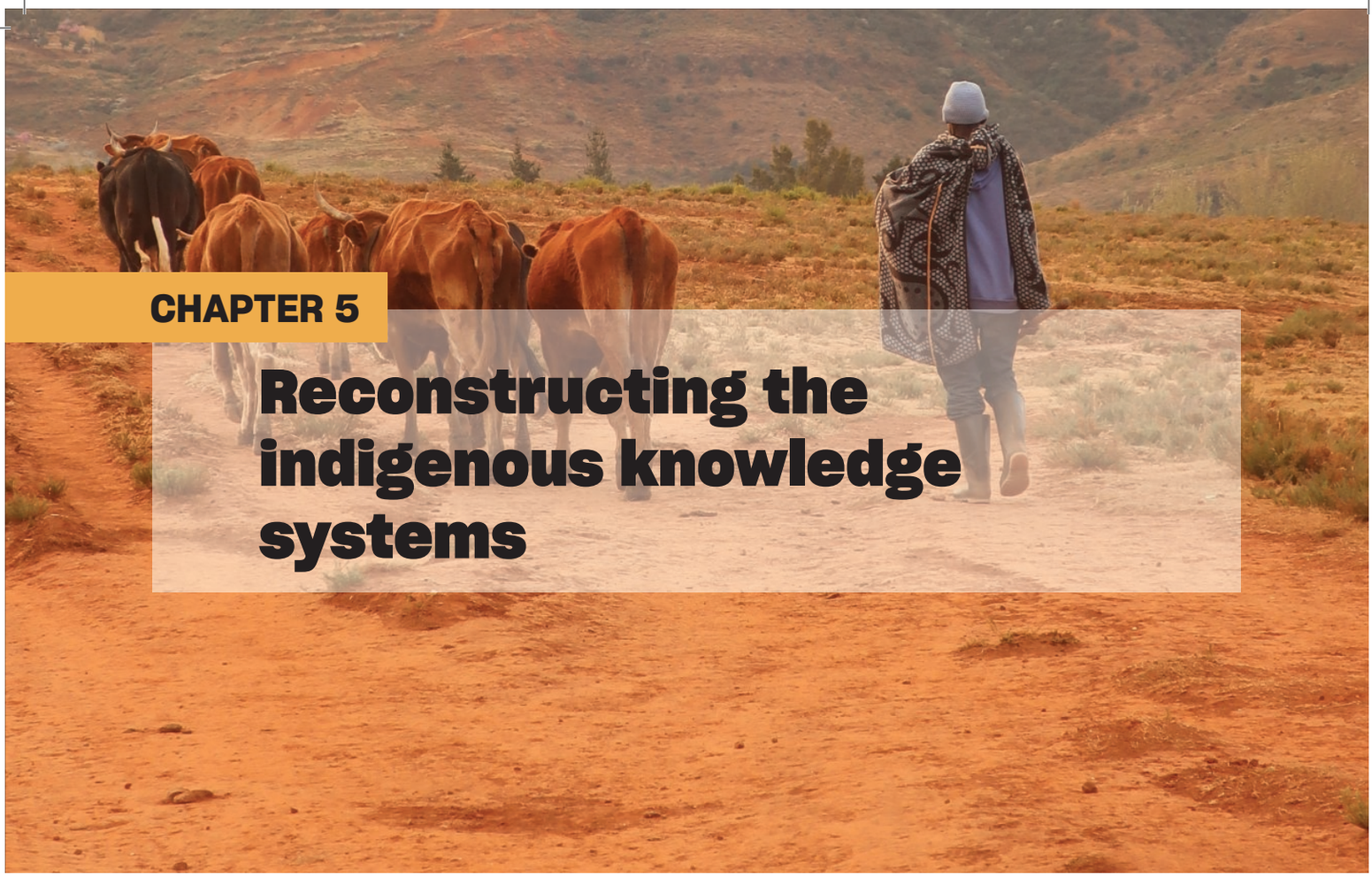
Importance of reviving indigenous knowledge systems

Most of the respondents were clear on the importance of indigenous knowledge and emphasised its value in the protection of wetlands, which provide enough water for them and their livestock. There were however a few middle-aged women who were against restricting access to herbal plants.

> *It would be expensive for us to buy and heal our children when they are sick. This would be unfair because we all know the necessary plants that we need, and we can identify them in the field, so why should we buy it?*
> One Woman from Khojane Village in Senqunyane Priority Sub-Catchment.

Despite some of these concerns, respondents suggested that indigenous knowledge can be revived through various initiatives, including giving people some incentives. It was suggested that people can be motivated by giving them tools to be used for removing *hlabahlabane* in the rangelands, along with training. Others were of the view that if people were at the same level of understanding on matters concerning the environment, some of the practices could be revived. Some were of the view that indigenous knowledge should be taught in schools and be part of the school curriculum. Some in Letsatseng Community pleaded and requested assistance from King Letsie III to talk to Basotho, encouraging them to go back to their traditional ways.

Typical settlement areas in Lesotho. (Credit: National University of Lesotho)



CHAPTER 5

Reconstructing the indigenous knowledge systems

5.1 Summary of key findings from the research

The research results confirm that communities in Lesotho, like the rest of southern Africa, have been able to utilise and manage thire resources sustainably. While some practices were specific to certain communities, most of the indigenous knowledge cited in the study was common to the rest of Lesotho.

One such practice was the rotational grazing system where rangeland was set aside for a period long enough for it to recover, whilst livestock were taken to cattle posts away from the villages. This system is still being practiced in some parts of Lesotho, though with less success than in the past.

Terracing of sloping fields to reduce erosion was common as Lesotho has many hilly areas with arable land. This was also combined with planting of aloe and vertiva grass, as well as laying stones as well as soil-filled sacks to create barriers to erosion. Farmers would plough along the contours and not down the slope. Basin farming was another form of reducing soil erosion, as well as to retain moisture for a long period of time.

What was also common in almost the entire country was the belief about the presence of snames in water bodies which would scare people away. aIt was accepted that this belief existed to avoid the pollution of water sources such as wells, dams and rivers, as well as protection of riverbanks from erosion. Apart from keeping the water sources clean, it had the effect of encouraging the efficient use of water. For example, fetching water with a gourd takes time and reduces the number of times one visits the well.

It was common to observe the shape of the moon, types of clouds, and the behaviour of animals, insects and birds in forecasting weather and climate. For example, during the rainy season, if the herd of cattle is hesitant to go for grazing, it would mean the rains are to come within a few hours. Cows would also lie down when rain is hours away. Farmers could predict flooding by observing the height at which weaver birds build their nests along river courses. If they are too high, then flooding is eminent.

Basotho also believed they could manipulate hail and cause rain to fall through their use of herbs and observing certain rituals. Whilst there is still no clear scientific explanation regarding the games played and the onset of rain, this was a belief common to all the sub-catchment areas, and the rest of Lesotho.

To predict the beginning of spring, communities in Lesotho could observe the sprouting of the grains left in the fields. The change of weather to windy and dusty also signified spring. The mating behaviour of donkeys and cows was similarly a sign for spring. When sheep would start shedding their wool, communities would start preparing for sorghum cultivation. Some fruit trees were also good indicators of either drought or a good season. When peach trees blossomed at the same time, it meant a good season ahead, and when there were many wild fruits, it meant drought in the following season. These predictions were common throughout Lesotho.

Seed preservation using herbs was effective and common among Basotho. The seeds could be selected carefully early as soon as the crop is ripe, then dried with herbs and stored separately. The main traditional pest control mechanism was intercropping. Most Basotho knew that some crops such as pumpkins are natural repellents to some insects. Use of herbs with strong smells and bitter tastes were boiled and spread on sorghum crops to get rid of pests. Wood ash was another common pest repellent used.

Use of organic fertiliser from crop residue and animal dung was a common practice in most catchment areas. This kept the fertility of the soil and ensured high yields. Communities used to dig holes to preserve moisture and apply the manure in the hole. This is similar to the zero tillage being promoted today in many countries.

The practice of restricting access to certain plants and trees was effective in conserving biodiversity. The use of special tool *kepa* that does not destroy the whole plant when extracting part of it was effective in conserving the herbs. This is a system which has since deteriorated, as anyone can harvest plants and trees and pay a negligable fine if caught. The use of cow dung, crop residue, and maize cobs as fuel was common in most communities. This was a way of conserving the minimal forest they had. Grazing of livestock was prohibited in areas where trees have been planted until the trees are grown enough to withstand possible destruction. Communities would also construct fire guards around the forest area.

Communities in Lesotho observed certain myths which restricted the unnecessary killing of animals, birds and reptiles. Reptiles were protected for their important role in the food chain. Snakes, for example, reduced the number of mice that destroy crops. Aquatic river frogs were kept as they are a good indicator of water quality.

In most of the activities which required hard labour, such as removing invasive species, rehabilitation of dongas, zero tillage and planting of vertiva grass and trees, communities could work together to accomplish a significant task that would take a single person days or weeks to complete. The initiator of the task prepares food for the participants. This is a practice that strengthens family ties, and passion of teamwork, and social cohesion within the community.

The study confirms the main reasons why indigenous knowledge is disappearing include: the removal of responsibility to manage the natural resources from the chiefs; colonialism, which saw indigenous knowledge as inferior and excluded it in the education system; and the disappearance of the social structure. There is no longer a platform for storytelling with the elders, as this has been replaced by new technologies such as television and social media. Therefore, there is minimal passing on of indigenous knowledge from the elders to the young generation within households. Another challenge is lack of a national policy that supports indigenous knowledge systems in natural resource management.

Through the several case studies and success stories captured in this study, it is evident that

indigenous knowledge is still very relevant in natural resource management in today's context. With the advent of increasing impacts of climate change, indigenous knowledge has become even more relevant as nature-based solutions are proving to be more successful as opposed to external interventions. Most of the climate adaptation and mitigation strategies borrow from the indigenous knowledge systems. For instance, the zero tillage, *pfumvudza* in Shona and *temo ea lekotjana* in Sesotho, is in fact derived from the indigenous way of farming, and so are the intercropping, rotational grazing, terracing, and use of organic fertiliser techniques. Indigenous knowledge has proved to be more sustainable, as it focuses on addressing needs in appropriate cultural contexts.

It is important to note that 2021 to 2030 has been declared the UN Decade of Ecosystems Restoration where nature-based solutions with indigenous knowledge systems are central. Climate change impacts have called for adaptation and mitigation strategies which recognise the need to revive indigenous knowledge.

Since indigenous knowledge is still relevant in Lesotho, like the rest of southern Africa, there is a need to revive and integrate it with the modern technology. Some of the suggested ways to integrate indigenous knowledge with modern technology are explained in the next section.

Terracing and contours help to reduce levels of soil erosion on steep slopes. (Credit: ORASECOM)

5.2 How integration of indigenous knowledg with modern technologies can be realised

Empowering local traditional leaders

Throughout this research, the need to restore the responsibilities of traditional leaders - such as chiefs - to manage natural resources has been emphasised.. The research indicates that in the past when Basotho chiefs had powers to manage natural resources, communities used to live with greater respect for their environment and more sustainably. Communities in southern Africa have managed to conserve forests through respecting their traditional rituals and norms, with guidance from their traditional leadership. According to a recent study, the effective management of the sacred forests in Thathe Vondo community in Limpopo Province, South Africa, is thriving under the oversight of traditional leaders (the custodians of the forest), who base their conservation strategies on their local knowledge (Sinthumule and Mashau, 2020). The study reveals that the community has strictly followed their cultural norms and rituals in protecting the forest, while traditional leaders ensure that tourists and visitors do not violate the Venda people's customs and beliefs.

As echoed by many respondents, the empowerment of chiefs can be attained through the enactment of relevant legislation, and giving title deeds to traditional leaders on specific areas where wildlife, sacred lakes or forests still exists. These efforts not only help to empower them ,but will help the environment to keep providing a variety of goods on a sustainable basis.

Recognising community elders as environmental educators

Integration of indigenous knowledge in contemporary techniques of managing natural resources in Lesotho and the rest of southern Africa can be achieved through the recognition

of community elders as environment educators. In many ways, elderly people are regarded as potential repositories of indigenous knowledge and their participation in environmental education programmes can strengthen uptake of traditional knowledge within the education system. In this regard, local elders should be given an opportunity within education programmes to facilitate lessons using their local knowledge. Such initiatives can even assist to bring back the African traditional education system in which every community elder was a teacher. Once local people are given an opportunity to actively participate in environmental programmes, it will help to reverse the inferiority complex attached to the local knowledge and further assist learners to recognise that even if indigenous knowledge is not directly examined, it is still useful in everyday life.

Learning from the grassroots - a bottom-up approach

Learning from local political ecologies is akin to Machobane's approach of observing, interrogating how things were done in the past, and responding to the unique characteristics of the landscape (Box 3.1). Farmers who, for instance, know that the height at which weaver birds build their nests along river courses is a predictor of flooding, are attuned to nature's varying pulse. The institutions that support the needs of indigenous people should provide a platform for the local experts to engage with decision makers in the design of integrated catchment management. This interplay between the adaptive capacity at the grassroots level and adaptation of policy at the institutional level offers fertile ground for further research.

But without being joined up at the roots, once the funding dries up and the aid agency goes away, programmes imposed from the top-down tend to wither.

Indigenous-led, community-driven initiatives on the other hand, are run by people who take a long-term view of development and have intricate knowledge of social and ecological networks and relationships. While they operate with a different set of skills from a professionally run NGO, it is these grassroots institutions, such as farming cooperatives and community centres, that are positioned to deliver leadership and take concrete action towards climate adaptation.

Government programmes should not be imposed. Communities ought to be involved right from start designing of the programme. Community views should be incorporated in any intervention. Some villagers in Tanzania refused to plant a certain tree which they knew provided nesting ground for quellea birds, which eat vast amounts of grain (SADC, SARDC, IUCN, 1994). The government or NGOs should not create further roadblocks to restoring the environment. It is always necessary to carry out research and introduce initiatives which suit the area.

Multi-disciplinary approach required

The indigenous methods are not limited to technical farming knowledge, but extend to knowledge, beliefs and practice of Ubuntu, *lipitso* (community consensus decision-making), and *letsema* (voluntary communal work parties). Currently, Lesotho's adaptation programmes are focused upon scenario-building and strategic planning at the state level. While these efforts may result in policy recommendations and inform official government responses, the resulting texts are largely inaccessible to communities. Transformational change at the individual, household, or community level may enable resilience at systemic levels.

Integration of indigenous knowledge with modern technology requires a multi-disciplinary approach. For example, Machobane's farming system's goal is not climate adaptation alone (box 3.1). The aim is to address a whole range of problems, in many directions and all at once. By engaging with soccer teams, burial societies, and HIV support groups, grassroots trainers are tapping into and building community resilience that is key to enduring the present and pending climatic changes facing Lesotho.

Using local languages within learning processes

Research shows that language plays an important role in the generation of knowledge. Since traditional knowledge is expressed through a native language, it is critical for environmental education programmes to create a conducive environment for the use of learners' mother languages in the teaching and learning processes (Zazu, 2007). Once this is done, it will enable learners to learn in a way that is culturally inherent and allows them to use their traditional knowledge and values. It has already been observed that learners and teachers are usually motivated when they use their own language to learn about their own local matters (Masuku in Zazu, 2007). In addition, use of local languages is critical as it helps learners to express themselves confidently and make it possible for local elders to participate in the learning processes. Both the communities and the educators involved should strive to use local languages so that revival of these marginalised languages is not confined to young people in schools, but becomes a part of the broader society, where indigenous languages are used, accepted, and spoken with pride.

Use of traditional methods of teaching

Research has proved that indigenous knowledge has been handed down orally from generation to generation. Traditional methods of teaching and learning, such as traditional folklore, proverbs, idioms, ceremonies and rituals, songs and dances, should be promoted. Learning by doing is critical. According to one Basotho proverb, "if you want to hide something from Basotho, just put it in a book". Using oral traditions has proven effective in educating communities about HIV/AIDS. Machobane's trainers achieved success when they departed from the workshop/classroom modality and brought their messages into communities through hands-on demonstrations using proverbs and folk stories to animate the transfer of indigenous farming knowledge. Based on their successes in communicating using familiar oral vernaculars, trainers with the Machobane Farming Society are now using these tools to educate and engage communities around climate adaptation. To this end, such culturally familiar and accessible communication modalities should be foregrounded as two-way communication tools, which both educate people about integrated catchment management and invite grassroots-orientated, locally appropriate and adaptive solutions.

Demonstration projects

Indigenous knowledge for integrated catchment management should be hands-on and incorporate field activities. When communities practically participate it is empowering. In matters of community development, past interventions have revealed that expertise comes out of action.

Incorporation of indigenous knowledge in school curriculum

There is a growing recognition of the need to incorporate indigenous knowledge into formal education to promote sustainable conservation of natural resources, particularly with the advent of education for sustainable development. The rationale for the incorporation of indigenous knowledge into formal school curricula is that it is less expensive, readily available, environmentally appropriate, and familiar, and most importantly, it has a proven record of effectiveness (Mahammad, 1998).

Another support for incorporation of indigenous knowledge into formal learning in Lesotho is evident in the Environment Act (Act 10 of 2008). Section 67 (vi) states that *the Authority shall issue guidelines for integrating traditional knowledge for the conservation of biological diversity with mainstream scientific knowledge.* This Act clearly reflects government's commitment to including indigenous knowledge systems as part of biodiversity conservation.

The oral tradition of sharing indigenous knowledge could be used as an approach to transmitting indigenous knowledge among schoolchildren. Teachers can assign students to work on collecting

poems, legends, proverbs, and myths that relate to environmental protection.

Documenting and hosting indigenous knowledge talk shows

It has been observed that the elderly people with specialist knowledge are sometimes reluctant to impart their knowledge to young people and most of them die without succession and continuity (Mashinini and Mokhothu, undated). It is therefore recommended that intensive research and documentation is initiated by related government ministries and other stakeholders to rescue the indigenous knowledge from extinction. A viable entry point in this regard would be to guarantee intellectual property rights to the communities and persons who possess this knowledge to facilitate their reward and motivation to share with the public to promote sustainable development (Mashinini and Mokhothu, undated). Talk shows can be arranged to give community elders like traditional leaders a platform to share their knowledge and experiences with a wider audience.

Mainstreaming indigenous knowledge in national conservation frameworks

Another way of increasing the uptake of local knowledge is through mainstreaming indigenous knowledge in contemporary natural resource management frameworks. The application of indigenous knowledge in conservation strategies has already yielded positive results in the management of conservation areas in South Africa. Studies point out that many species may have become extinct in South Africa because colonialism and apartheid thwarted the application and use of indigenous knowledge, with most of those now protected areas (national parks) being established without consulting the local people (UNEP, 2008).

However, with the end of apartheid, the government has shown greater interest in the use of indigenous knowledge which has since brought many changes in natural resource management. For instance, the Imbewu Youth Programme of the South African National Parks (SANParks) uses traditional knowledge, to engender environmental awareness in its programmes. The programme follows the "social ecology" approach to conservation, contributing to the new political, economic, and social realities of South Africa (Makwaeba, undated). It addresses the need to recognise the value of local, indigenous, and intangible heritage. Focusing on the historically disadvantaged youth of townships and rural communities labelled as the "lost generation", Imbewu aims to rekindle self-identity within and amongst youth, acknowledging the cultural perspective in the broadening of environmental interpretation and education (Makwaeba, undated). The programme focuses on the traditional knowledge of retired indigenous park rangers, who use their oral tradition to communicate with the youth, hoping to promote interest in conservation efforts.

Further, SANParks are seeking to transfer power and control of resources to the local people. In the past, conservation areas in South Africa were largely established through enforcement of compulsory exclusion. The history of South Africa's national parks was often characterised by conflict between the parks and neighbouring communities, mainly due to disrespect for local indigenous knowledge and traditional conservation practices (UNEP, 2008).

In Eswatini, a country well-endowed with flora and fauna, the government has developed various indigenous methods for protecting biodiversity, as local communities have long recognised the value of biodiversity. Among others, the Swazis use biodiversity products almost daily for needs such a traditional medicine, food, building materials, traditional attire, religious rites, crafts, and they do have long-standing cultural practices and folklore that helps in preserving biodiversity (UNEP, 2008). For example, medicinal plants enjoy special protection in Eswatini and only the part of the plant that is required is harvested, while the ringing of the bark is discouraged, as this would kill the tree.

In some cases, harvesters place cow dung where the bark has been peeled off as this accelerates callus formation and regrowth of the cambium layer (UNEP, 2008). Similar methods are used to protect indigenous food plants such as fruit trees, vegetables, and tuber plants. For instance, some root and tuber crops are protected by harvesting only large roots or tubers through a process known as "milking" -harvesting only large and harvestable roots or tubers which increases the chances of farmers retaining their crops.

5.3 Examples of integrated indigenous knowldge with modern technology

Integrating indigenous knowledge in agriculture based production techniques

Incorporating indigenous knowledge in agriculture has proven to have immense benefits for boosting crop production. As mentioned earlier, the Machobane Farming System (MFS) demonstrates the critical role of indigenous knowledge in promoting food security in Lesotho, and how this can be up scaled in other countries in southern Africa. To address productivity declines, thousands of Basotho farmers are turning to MFS, described as an integrated system that incorporates several agro-ecological principle. It has proven to out-yield conventional cropping methods by nearly three-fold (Oakland Institute and Alliance for Food Sovereignty in Africa, undated). Considered as an intensive, low-input, intercropped farming system, MFS shifts away from grain monocultures, encourages ecological intensification of cultivation on small plots, and provides a year-round supply of food (Oakland Institute and Alliance for Food Sovereignty in Africa, undated).

In other countries the Tonga people of Zambia, have long utilised their local knowledge to practice sustainable agriculture, causing them to be considered as the chief producers of Zambia's core food crops (Central Statistical Office, 2016). The Tongas have continuously produced various crops on their land through the application of environmentally-friendly practices as the basis of sustaining their soils for agriculture (Kanene, 2016). The Tonga people use crop rotation in their farming, essentially involving maize, sunflower, groundnuts, soya, beans, peas, sorghum, and sweet potatoes. Maize is grown in the same field for about three years before another crop is planted. This benefits the land through the difference in crop nutrients requirements and different nutrients fixing in the soil. In addition, this helps break disease cycles of crops. Through integrating indigenous knowledge in agriculture, it can be noted that much of the maize exported by the country either comes from Tongaland, or is produced by this ethnic group in many areas of the country where they are scattered (Kanene, 2015).

Another way of promoting the use of traditional knowledge is through integrating it into the agriculture extension services package that is given to farmers. It is important that local technical advisors such as the agricultural extension workers take heed of the relevance of the indigenous knowledge in promoting agriculture and reduce the impact of climate change, such as droughts. The extension workers therefore need to include indigenous knowledge in the advisory packages and educate farmers on how they can synchronise indigenous knowledge to improve on food security.

Potholing and keyhole gardens in Lesotho

An initiative known as potholing was introduced in Maseru, and this has increased production of different agricultural crops. In the past, farmers used to dig holes similar to the potholing initiative. This requires a farmer to dig a series of holes, each 30 centimetres wide, and 30 centimetres deep. The holes are one metre apart and run in rows parallel to the slope, but are offset from their neighbours. Ash and cow dung is used as

fertiliser and maize, beans and other plants are planted while surrounding weeds are kept in check. The hollows catch eroded soil and water coming down the slope. As a result, the ground starts to stabilise, and crops thrive. More than 3,000 families have been practising this farming method which conserves soil and stores moisture for the plants.

Another initiative to produce nutritious vegetables at the homesteads level, common with the Basotho especially in southern part of Lesotho, is keyhole gardening. These consist of beds measuring two to four square metres. The small gardens are raised to hip height and are fringed by stones which protect them from livestock, winds, and flooding. Farmers mix ash and cow dung for fertilizer and plant cabbages, onions, and tomatoes. On one side the bed has a narrow entrance - the keyhole, to allow watering, harvesting and tending of vegetables.

Keyhole gardens helping communities to produce nutritious vegetables at their homesteads. (Credit: ORASECOM)

Potholing system increasing crop production through maximising available moisture. (Credit: ORASECOM)

Integrated pest control

Science has provided evidence that cow urine is useful in agricultural operations as a biofertilizer and biopesticide as it can kill number of pesticide and herbicide resistant bacteria, viruses, and fungi (IJIRSET 2016). This has been a method used in the past where farmers would use the mixture of cow dung with urine obtained from the cattle and spread it over their crops as fertilizer as well as pesticides. Some communities in Lesotho have added modern ingredients to create a spray for plants out of cow urine, yogurt, milk, and *ghee* (clarified butter). This can displace synthetic pesticides and foliar sprays that might have large negative impacts on the environment.

Using indigenous knowledge in ecosystem and rangeland management

Integration of indigenous knowledge in integrated catchment management can further be attained through combining it with ecosystem and rangeland management. This practice has seen positive results in the Maputsoe community in Lesotho.

In addressing land degradation, six villages from Maputsoe have formed a grazing association, named *Boikaloso.* The association formed with the full support of the Ministry of Forestry, Range and Land Reclamation, has ongoing initiatives which seem to be doing well in reversing land degradation in the area. Councillor Monaheng introduced and encouraged the association to use one mechanism *Boikaloso* based on the association's priorities. The mechanism involves: identification of grazing zones to be managed by the grazing association; preparation of letters to the chiefs and the community council requesting permission to control the selected zones; developing bylaws for control of the grazing zones identified in each of the six villages; coordination of the grazing zones between the communities and the community council; and management of the grazing zones. The system gives responsibility, ownership and empowerment to the community and encourages participation in all steps.

Rangelands rehabilitation in Mount Moorosi, Lesotho

Communities in the four villages located in the Mount Moorosi area in Lesotho participated in the rangeland rehabilitation project (ORASECOM, 2015). Activities included construction of physical barriers on the mountain slopes to slow runoff, trap sediments and promote infiltration. The project also involved physical removal of alien species, sowing grass on bare soil, and allowing grasslands to recover by minimising grazing.

At project handover, the rehabilitated and rested rangelands had some good vegetative cover and regeneration of palatable grasses (ORASECOM, 2015). The silt traps built to reduce the rate of run-off as well as the removal of invasive bushes, have had a positive impact in reducing soil erosion and restoring the rangelands. The handover was done in the middle of the winter when most plants were dormant and could not be seen. This means the same area had potential for more flora and fauna in summer.

> *We have seen restoration of the environment. The grass is coming back. Those rocky patches where we removed the invasive bushes are now getting covered. The wildlife, the birds and animals that were almost extinct in this area are back, some of which the children had never even seen. We are seeing our piece of land reminding us of the past, which means things are getting back to normal, so to us it's a very big improvement to this area.*
> From Ha'Mantsoepa project participants (ORASECOM, 2015)

This suggests that the rehabilitation and proper management of the sites have had some positive impacts on restoration of biodiversity.

Other income generating projects introduced at Mount Moorosi include Koekoe chicken breed, which is an excellent free-range bird for meat and egg production, even with poor or limited feed; and the production of fodder on marginal cropping lands to supplement feeding of livestock, as well as to control soil erosion.

> *We noticed the area being eroded and did not know what to do. Through this project we have been able to stop the rate of soil erosion. Not only that, but before the Koekoe intervention, we did not have easy access to eggs as a source of protein. But now, our households have immediate benefits. We eat the eggs and some of us have even been able to breed the Koekoe, using our indigenous chickens.*
> Ha Sekhonyana Project Participants (ORASECOM, 2015)

Improved livestock breeds in Mount Moroosi, Lesotho

As part of the ORASECOM Integrated Water Resources Management demonstration sites, improved breeding stock of Merino rams and Angora buck have been provided to livestock owners. This has been done to expand the hereditary quality of

livestock to increase the yields of animal products. Livelihoods of the people around the project area have significantly changed with the support from the project. The demonstration project has opened doors for networking and integration with similar projects being conducted in Lesotho. The initiative has provided an opportunity for involvement in other integrated water resources management initiatives, as well as national and basin-wide action plans (ORACESOM, 2015).

Traditional well management of African pastoral groups

A few pastoral groups have formal organisations for controlling and managing communal wells. For example, the Northern Somali have an elected committee of 3-20 water managers who allocate water to the community and guests, guard the wells, enforce and devise rules of use, charge fees, and maintain the well (Putman, 1984). The Borana of Southern Ethiopia have a council of well users that appoints a 'father of the watering order'. He regulates daily use of the well by appointing two men to supervise the livestock, a man to sweep and clean out dung, a man to coordinate the work of the 15-20 men and women who draw water and pass it along to a common basin, and someone to plaster the basins with clay every morning (Helland, 1982). These organisational structures can be used to manage newly constructed boreholes if the ownership of the well is officially transferred to the local people and if the users are trained in its maintenance.

Other ways of integrating indigenous knowledge with modern technology are given in Table 5.1.

Table 5.1: Indigenous practices blended with western knowledge

Indigenous practice	Western knowledge	Indigenous practice blended with Western knowledge
Carry dry biomass from the forest (eg from *Albizia sinensis* trees) and burn it on fields	Green manuring using *Desmodium*, *Gliricidia*, and *Flamengia*	Promote growing of indigenous tree species on farm for biomass production
Slash and burn cultivation on rotation basis	Use of leguminous tree species	Use of leguminous hedgerows to maintain soil fertility on slash and burn fields to turn them into continuously cultivated fields
Construct contour barriers from dry branches, shrubs, and bamboo	Contour canals and hedgerows to reduce erosion	Strengthen barrier with live hedgerows and combine them with contour ditch uphill form the barrier
Integrate trees into fields in irregular pattern	Regular planning distances among trees; tree not planted in fields	Improve planning patterns of existing practices in fields
Construct terraces from rocks	Live hedgerows	Strengthen terraces with live hedgerows

CHAPTER 6

Conclusions and recommendations

6.1 Conclusion

The study has investigated what indigenous knowledge is in natural resource management, its importance and relevance in today's context, as well as how it can be integrated with modern technology. The research has established that there is a rich body of indigenous knowledge in natural resource management resident in the community elders and some documented but being threatened by external forces including natural forces such as climate change. The research has revealed that indigenous knowledge is key in addressing changes taking place in the environment, mainly as a result of climate change and variability. Through colonialisation and modernisation, indigenous knowledge systems that had served Basotho communities in the past were considered inferior in the pursuit of commercial farming and mass production. The challenge today is shifting the present generation's conscience to know what it means to live a life true to nature. The majority of communities in Lesotho still have confidence in the indigenous knowledge and are willing to see the disappearing strategies being revived. There is also realisation that indigenous knowledge cannot exist in isolation especially in response to mechanism and recovery strategies. This study has also revealed that the benefits of integrating indigenous knowledge into modern methods of managing natural resources far outweigh the benefits of modern science alone. With the increasing impacts of climate change, indigenous knowledge has become even more relevant as nature-based solutions are proving to be more successful than externally generated interventions. The research has revealed that the success of integrated catchment management lies in the hands of indigenous knowledge systems, and indigenous knowledge should be mainstreamed throughout the programme.

6.2 Recommendations

While section 5.2 captures most of the recommendations, a summary is listed here. The recommendations to the Government of Lesotho, integrated catchment management practitioners and other key stakeholders are categorised under policy and institutional reforms, capacity building, research and documentation, and public awareness.

Policy and institutional reforms

- Incorporation of indigenous knowledge in national conservation frameworks is essential. There is a need to mainstream indigenous knowledge in all policies and strategies related to environmental conservation. Indigenous knowledge should not be considered as an add-on to development strategies but be embedded from the beginning of formulating integrated catchment management strategies. This will enable it to be budgeted for in all development strategies.
- The government should consider developing a legal instrument supporting the integration of indigenous knowledge in integrated catchment management, or natural resource management. The international convention on the Rights of the Indigenous people should be recognised.
- Restore responsibilities of traditional leaders such as chiefs to manage natural resources. Empowerment of chiefs can be attained through enactment of relevant legislation that gives them a mandate to control certain areas of natural resources.
- Integrated catchment management policies and strategies should be attuned to grassroots wisdom and expertise. This is critical to ensuring that interventions do not end up divorced or at cross-purposes from community views, interests, and priorities.
- Ensure the full and equal participation of traditional knowledge holders during all stages of developing plans, programmes, and policies.
- The process of listening to and empowering community-led adaptive strategies could serve to counterbalance the powerful influence of state and multilateral institutions. This powerful external influence often results in communities that are dependent.
- The institutions that support the needs of indigenous people should provide a platform for the local experts to engage with decision-makers in the design of integrated catchment management.
- The government is encouraged to consider the incorporation of indigenous knowledge in school curricula, starting at primary level.
- Training centres for indigenous practices such as livestock management should be established in communities.
- A bottom-up approach is recommended for addressing community problems. Communities ought to be involved right from the design of the programme. Community views should be incorporated in any intervention. It is recommended to listen and observe people and institutions at the village level. Integrated catchment management practitioners could benefit by observing existing resilient strategies within the communities prior to proposing and implementing programmes.
- Acknowledge and respect the social and cultural bases within which traditional knowledge is embedded.
- The government and other implementers are encouraged to recognise the rights of traditional people to own, access and realise benefits of their knowledge, resources and systems.
- Integrated catchment management practitioners should ensure that partnerships with traditional knowledge holders are only entered into with prior consent and that they are fully informed and understand the ramifications of partnerships.
- Integrated catchment management practitioners are encouraged to promote models for environmental and sustainable governance that establish principles of effective and equal partnership between scientific and traditional knowledge.

Capacity building

- In schools, there is a need to foster improved communication and collaboration across disciplines and programmes, promote understanding of diversity and its importance, and enhance recruitment and retention of indigenous students. Diversity of teaching methods is crucial. Indigenous knowledge should be taught through folklore, storytelling, proverbs, songs, ceremonies, dances, drama, debates, and quizzes. School workshops with competitions for the younger children, and essays and poetry competitions for the older children, could be conducted in both English and local languages.
- Funding partners are encouraged to provide financial resources for short courses on indigenous knowledge in integrated catchment management and other related issues such as climate change. The course modules will integrate indigenous knowledge systems with modern scientific approaches for integrated catchment management.
- Use of local languages which allows learners and teachers to express themselves confidently and use their traditional knowledge and values is encouraged.
- Making use of community elders as environment educators is encouraged, as they are knowledge holders of indigenous knowledge systems. The elders could be given an opportunity to actively participate in environmental programmes.
- Learning by doing is key to building capacity in indigenous knowledge. When communities practically participate, they are motivated and empowered.
- Support innovative, interdisciplinary programmes that provide educational opportunities across the humanities, natural resource management, and the environmental sciences and integrate Western and indigenous thought.
- At tertiary level, there is a need to provide advanced coursework and research opportunities that incorporate indigenous environmental knowledge into existing programmes of conservation biology, environmental biology, wildlife and fisheries sciences, forest resources management, and environmental studies and science.
- Promote training and capacity development programmes to better equip scientists and traditional knowledge holders to conduct research on traditional knowledge.
- While Lesotho has one main dialect, Sesotho, there is need to stimulate intercultural dialogue on indigenous knowledge to consider the minority dialects of isiXhosa and isiZulu.
- Capacity building of communities in the management of breeds such as the Koekoe chicken, which is an excellent free-range bird for meat and egg production, even with poor or limited feed, is encouraged.
- Production of fodder on marginal cropping lands to supplement feeding of livestock, as well as to control soil erosion, is highly recommended.
- Management of improved breeding stock of Merino rams and Angora buck, which have proved to be successful, should be encouraged.
- Capacity building of herd boys in the management of improved breeds is recommended.

Research, and documentation

- A study on the linkages of indigenous knowledge and evidence-based scientific methods should be conducted. This will help to provide evidence of similarities in science and indigenous knowledge, providing credibility to the latter. The study could also identify the strengths in indigenous knowledge and strengths in scientific

strategies, in order to take the best of each and formulate a strong integrated catchment management strategy.

- To enable recognition and integration of indigenous knowledge in integrated catchment management strategies, there is a need to develop a manual on mainstreaming indigenous knowledge in integrated catchment management and development strategies.
- Documentation is crucial to save indigenous knowledge from being lost. There is need to build a repository of indigenous knowledge that is accessible to anyone.
- An indigenous knowledge systems awareness kit could be developed, similar to the River Awareness Kits of River basins such as the Orange-Senqu and Limpopo River Basins. This consists of a website with projects on indigenous knowledge, documents, defined terms, and all the basic information on indigenous knowledge.
- Research papers could be encouraged to develop a journal of indigenous knowledge systems in Lesotho, as well as expanding it to southern Africa.
- The study recommends that further research should be carried out on indigenous knowledge in the other districts, countries, and entire region.
- Indigenous knowledge data banks and networks should be established.

Public awareness

- Different outreach materials should be developed to reach different target groups. These could include policy briefs for policy makers, research papers, reports, and fact sheets for mainly academics and researchers, and posters, banners, brochures, and bookmarks for the public, including communities.
- There is need to make use of information and communication technologies to widen the dissemination of indigenous knowledge. This would be useful, specially to target the youth who spend most of their time on internet. Radio programmes incorporating traditional ideas, locally-composed songs, and interviews, and YouTube clips in local languages (possibly for television) based on popular culture, could be developed.
- Some form of incentive for indigenous knowledge holders to encourage sharing of ideas with the general public should be considered.
- Talk shows can be arranged to give community elders like traditional leaders a platform to share their knowledge and experiences with a wider audience.
- District and provincial think-tank sessions should be organised to brainstorm indigenous knowledge issues and how best to make use of the rich source of knowledge. The sessions will involve the traditional leaders in the communities from different districts, researchers, and experts in natural resource management. These could be held regularly to keep on updating each other on indigenous knowledge issues.
- When discussing indigenous knowledge in integrated catchment management, there is a need to bring out the added advantages of sustainable health benefits derived from organic and traditional foods, such as the small grains, traditional vegetables, and nutritious diet staples such as mice, caterpillars, mushroom, and black jerk.
- There should be more awareness o fthe impact of climate change, which include increased frequency and severity of floods and drought. This is necessary to understand the need to use both indigenous knowledge and scientific strategies in integrated catchment management.

- The study revealed that indigenous knowledge systems can promote poverty alleviation through traditional food production and preservation, and healthcare through traditional medicine practices. In this regard, there is a need to promote the use of indigenous knowledge to achieve poverty reduction.
- Indigenous knowledge, if well harnessed, can provide openings for small local enterprises. These include beekeeping, planting weeds that deter pests from the fields, and traditional crop varieties that grow best in local conditions.

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