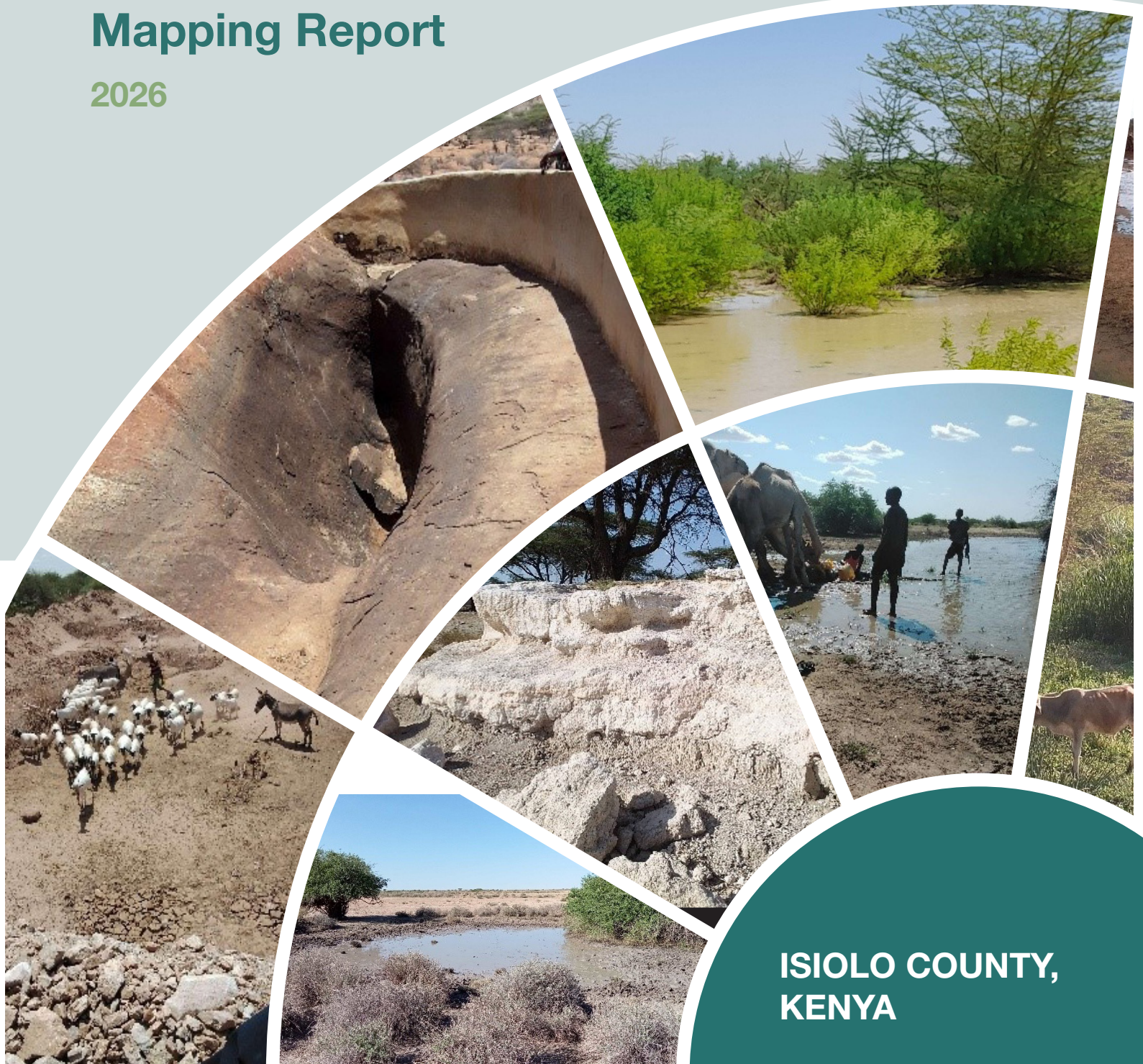




Dryland Natural Assets Inventory and Participatory Mapping Report

2026



ISIOLO COUNTY,
KENYA



WYSS
ACADEMY
FOR
NATURE



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KENYA

Foreword

Isiolo County, situated in Kenya's arid and semi-arid lands (ASALs), is endowed with a rich mosaic of dryland natural assets that are central to the livelihoods, culture, and resilience of local communities and associated landscapes. These assets, consisting of seasonal rivers, lagas, water pans, wetlands, salt licks, and islands of dense vegetation, pasture, rock catchments and springs, wildlife, biodiversity and genetic resources, support rural livelihoods, pastoralism, agro-pastoralism, wildlife conservation, and the broader ecological balance of these landscapes.

In the face of increasing climate variability and changes, land pressure from competing developmental needs, and resource-based conflicts, it has become essential to understand, document, and protect these critical resources through locally grounded, evidence-based, participatory and multi-stakeholder inclusive assessments, planning and policy development. This **Dryland Natural Assets Inventory and Participatory Mapping Report**, the first of its kind in Kenya and perhaps the continent, represents a significant step in this direction that not only provides the evidence but also establishes the urgent need to secure and protect the vital assets for posterity and sustainable development.

Through participatory and multi-stakeholder approaches, this report documents over 200 dryland natural assets across the county. Community elders, conservancy leaders, youth, women and men as well as spiritual and political leaders and technical officers came together to share knowledge and experiences, validate the assets and their locations, assessed the status and management priorities and concerns of the key assets in the county. The insights captured here are not only spatially accurate but deeply embedded in the lived experiences, indigenous knowledge and socio-cultural connectivity of Isiolo people and their landscape resources.

The report further provides a clear picture of management arrangements—highlighting areas of strong community and natural resources stewardship as well as the inherent gaps and threats affecting the natural resources under unprotected and with weak governance systems. It lays the groundwork for informed decision-making by the Governments both at the county and national levels, communities, development partners, conservancies owners, and independent commissions to support collaborative and multi-stakeholder inclusive processes, efforts and mechanisms for the sustained management and conservation of vital natural assets in these natural-capital rich areas.

Consequently, this report serves as a vital tool for base-lining and for enhancing **natural resource planning, climate adaptation and resilience building, conflict mitigation, and sustainable land use management practices through landscape connectivity and protection of natural assets**. It aligns with Isiolo County's commitment to inclusive development, devolution, and the recognition of communities as custodians of their landscapes and the resources therein. Let this report be a steppingstone towards better stewardship of Isiolo's dryland ecosystems for current and future generations.

Dr. Abdillahi Saggaf Alawy
Chairman
National Land Commission

Acknowledgments

This report is a culmination of a highly consultative, inclusive and collaborative process that brought together local communities, their leaders, technical experts, and development partners to identify, map and assess Isiolo County's dryland natural assets for purposes of informing their sustainable conservation, use, planning and decision-making. Its completion would not have been possible without the commitment, dedication, sound technical knowledge and financial support, and contributions of many individuals and institutions.

As a Commission, we cherish partnership and leverage strategic opportunities and collaborations to discharge our mandate which is enlisted under the Constitution and relevant land statutes. We extend our sincere appreciation to the **people of Isiolo County**—particularly the elders, youth, women, political leaders, and conservancy representatives—whose deep understanding of the landscape provided the foundation for this mapping exercise. In addition, the National Government through the relevant ministries, departments, and agencies (MDAs), provided immense support in sharing knowledge, data and expertise that guided the Commission in delivering this critical output. Your willingness to share insights, guide field teams, validate data and information, is highly appreciated

We are particularly grateful to **WYSS Academy for Nature** whose financial and technical support became handy in documenting these assets in the face of the on-going community land registration processes and climatic changes; and this report will help the land adjudication team the County and National Governments to secure the assets in the community land registers, spatial plans and institute development control ventures towards their protection and sustainable use.

Special thanks go to the County Government of Isiolo, represented by both the executive and legislature for their invaluable support, availability and providing policy guidance, technical support/guidance, community mobilization and field participation exercises throughout the process. Your leadership ensured that the findings of this report informs the ongoing county spatial planning, community land registration/adjudication and development priorities of the County.

We also acknowledge the valuable input of **national agencies**, including the County Commissioner of Isiolo whose support in mobilizing the national administration, local communities and their elders, helped ensure technical accuracy, embedment of local knowledge and relevance of this project.

We recognize and thank the **technical team that was coordinated by the Commission and included** GIS specialists and field mapping teams for their dedication and rich tapestry of expertise that guided and mid-wifed the entire mapping exercise and the report hereto. Your commitment to this participatory and community-centred processes has helped ground this report in both science and local knowledge.

Finally, we thank CETRAD for the technical support and all those who worked behind the scenes—data collectors, report writers, GIS analysts; and communication teams from both Wyss Academy and the Commission, as well as administrative staff—who ensured the success of this initiative.

This report is not only a record of Isiolo's rich natural endowments but also a testament to the power of collaboration and local stewardship in managing and protecting our dryland resources. The methodology and approaches adopted in this project is highly scalable and will be used to inform other dryland counties natural assets mapping, going forward. I invite everyone to pay keen attention to the findings of this report and ensure the protection and security of dryland assets in this County is guaranteed under various existing legal regimes and that there is a proper balance of rights between nature and people.

Kabale Tache Arero, MBS
Secretary/Chief Executive Officer
National Land Commission

Preface

The arid and semi-arid lands (ASALs) of Kenya, including Isiolo County, are uniquely endowed with natural resources that are central to the survival, resilience, and identity of pastoralist communities. Despite harsh climatic conditions and recurring droughts, the people of Isiolo have for long time, sustained their livelihoods through deep ecological knowledge, mobility, and strong customary resource governance systems.

Over time, however, these natural assets—including seasonal rivers, water pans, wetlands, salt licks, vegetation islands, springs, and rock catchments—have come under increasing pressure from climate change, land use change, population growth, and competing demands. In many cases, the absence of formal data, maps, or recognition of community-managed resources has further hindered planning, protection, and investment. The on-going community land registration process is likely to compound the challenges further by placing the vital community and public assets into private hands/entities. It is therefore important to exercise caution and be proactive, rather than reactive, in the conservation, sustainable use and development of dryland assets and the landscapes in order to prevent current and future natural resource-related conflicts and bad governance, occasioned by unplanned and unsustainable resource use and exploitation.

The Isiolo Dryland Natural Assets Inventory and Participatory Mapping Report was developed in response to this gap. It seeks to document and spatially map key dryland resources while also capturing the diverse management structures, governance gaps and challenges, and opportunities for sustainable use and conservation. The process was designed to be fully participatory and community-centric, informed by indigenous and traditional knowledge systems, and supported by county, national government and technical actors.

This report reflects the outcomes of a rigorous and extensive fieldwork, stakeholder dialogues, GIS mapping, and local and national stakeholder validation exercises. It is intended to serve as a planning and policy tool for the County Government, a resource management guide for conservancies and traditional land governance - including the Dedha system, and a learning resource for development partners and researchers interested in dryland resilience and community-based natural resource management and governance.

We hope that the information and insights contained in this report will help bridge the gap between local knowledge and formal systems, enabling better protection, planning, and restoration of Isiolo's dryland ecosystems.

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List of Abbreviations

ASALs	Arid and Semi-Arid Lands
CSP	County Spatial Plans
LAPSSET	Lamu Port and Lamu-Southern Sudan-Ethiopia Transport
HoAGDP	Horn of Africa Gateway Development Project
MDACs	Ministries, Departments, Agencies and Counties
CETRAD	Centre for Training and Integrated Research in ASAL Development
ESRI	Environmental Systems Research Institute
GIS	Geographic Information Systems
STE	Save the Elephants
NLC	National Land Commission
CIDP	County Integrated Development Plan
MTP	Medium Term Plan
NLIMS	National Land Information Management System
STA	Storytelling Approach
KFS	Kenya Forest Service



1.

INTRODUCTION

1.1 Global Outlook of Drylands

According to UNCCD, drylands cover more than 40% of the world's land area, and support two billion people, 90% of whom live in developing countries.

Found on all continents, but being most prevalent in Africa and Asia, drylands are the foundation for both rural and urban communities. Around one billion people rely directly on dryland ecosystem services for their daily survival, whether through rain-fed or irrigated farming, or through widespread pastoralism. **Table 1** summarizes the global statistics for the four types of dryland.

Table 1: Global figures for the four types of drylands

Dryland sub-habitat	Aridity index*	Share of global area (%)	Share of global population	% rangeland	% cultivated	% other (including urban)
Hyper-arid	<0.05	6.6	1.7	97	0.6	3
Arid	0.05 - 0.20	10.6	4.1	87	7	6
Semi-arid	0.20 - 0.50	15.2	14.4	54	35	10
Sub-humid	0.50 - 0.65	8.7	15.3	34	47	20
Total		41.3	35.5	65	25	10

* The ratio of precipitation to potential evapotranspiration.

Source: Safriel et al. 2005



Dryland degradation costs developing countries an estimated 4–8% of their GDP each year.

Unsustainable land and water use and the impacts of climate change are driving the degradation of drylands. Approximately 6 million km² of drylands (about 10%) bear a legacy of land degradation. Such degradation – sometimes also referred to as ‘desertification’ – can take the form of soil erosion, nutrient depletion, water scarcity, altered salinity or the disruption of biological cycles. Degradation reduces biological productivity and can impact the ability of ecosystems to absorb and use rainwater. Combined with poor crop and soil management, and the use of poorly adapted varieties of crop, this can lead to ‘agricultural droughts’. **Dryland degradation costs developing countries an estimated 4–8% of their national gross domestic product (GDP) each year.** It has been estimated that about 1–6% of dryland human populations live in desertified areas, while a much larger number is under threat from further desertification. Land degradation and poverty are mutually reinforcing, but the former has low political visibility. It is hard to deal with the problem due to cyclical swings in rainfall, land tenure which is not well adjusted to environmental conditions, and regional and global forces driving local management. Inaction would mean a cumulative addition to a long, historical legacy of degradation, from which recovery has already previously proven difficult.

Drylands offer opportunities for local populations and provide regional and global benefits. The biodiversity of drylands provides ecosystem services, which benefit local communities. Dryland forests and woodlands provide shade and moisture, are home to pollinators, protect nutrients, are fire resistant, and reduce water runoff, erosion and flooding. Life in drylands has evolved with the variable and extreme climatic conditions that present here, and includes a relatively high number of endemic species. These species represent genetic resources of importance, in particular, for adaptation to future climate change. Unique ecosystems, such as deserts (e.g. Sinai, Namib and Chihuahua deserts), steppes (e.g. Mongolia), savannas (e.g. East Africa) and drylands wetlands (e.g. Nile Delta and Okavango Delta), represent opportunities for ecotourism.

Drylands can have major global climate benefits: dryland carbon storage (mainly in the form of soil carbon) accounts for more than one third of the global stock. Drylands also have the potential to sequester more carbon than they currently store as they are far from saturated. Yet despite these potential benefits, current projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol are limited to methane capture, waste management and renewable energy. Dryland forests in México store carbon at roughly the same rate as evergreen forests. Thus, the establishment of dryland forests, coupled with dune stabilization, savannization and rain-fed dryland agroforestry, can increase carbon storage. However, the capacity to store carbon depends on many factors including climate, history, past land use, and opportunity for management change.

The potential local, regional and global benefits of drylands have not been fully utilized because of myths, market failures, a lack of public goods, weak incentives, high investment costs and gender inequalities. Dryland ecosystems and populations face a number of risks and costs including tenure insecurity, conflict, variable weather, scarcity of human capital and high transaction costs. In many areas, it is often the women who manage the natural resources and hold knowledge of indigenous production methods, plant species and their various uses (including medicinal uses). However, women rarely own the land that they manage and, without assets, cannot access agricultural credit or extension services. On the other hand, the participation of women in often profitable trade counters this situation to some extent.

Opportunities for increased investments in drylands are coupled with global and regional trends; and these include:

- Fulfilling food security commitments (at least US\$20 billion²), in part, through the rehabilitation of the drylands resource base.

- Targeting private investment – which is often transnational – in food security, natural products, key infrastructure and services towards dryland resources.
- Targeting renewable energy opportunities within drylands, such as the European-Mediterranean thermal solar collectors plan. Utilizing funds for conflict prevention and post-conflict rehabilitation to restore dryland resources.
- Supporting access for women to productive assets.
- Using climate change instruments designed for mitigation (soil carbon, bioenergy) and adaptation (small business development and home gardens and sheep) in vulnerable dryland areas.
- Encouraging research into adaptation.
- Conserving high value dryland biodiversity, such as drought resistant or heat tolerant crop and livestock varieties.
- Targeting cultural and eco-tourism opportunities within drylands as well as mining and the whole potential for ‘secondary’ (e.g. transformation and conservation industries) and tertiary (e.g. micro-credit and banking, telecommunication, market, etc.) sectors.

Opportunities for investment in drylands exist for the public sector, the private large-scale commercial sector, the community sector, and the household or small-scale private sector. As regards to the degradation of drylands, the result of failure to prevent dryland degradation is often the need for relief and aid; this is costly in economic terms, but even more so in terms of human suffering. This cost can be reduced by engaging dryland communities in the development process. Investments can be directed towards areas such as communications; renewable energy; education; health; water; farmland, rangeland and livestock; woodland and trees; land use; conservation and tourism; urban development; markets and innovation. For many investment areas, there are multiple opportunities for different actors and collaborations between actors. Figure 1 shows the Distribution of global drylands.

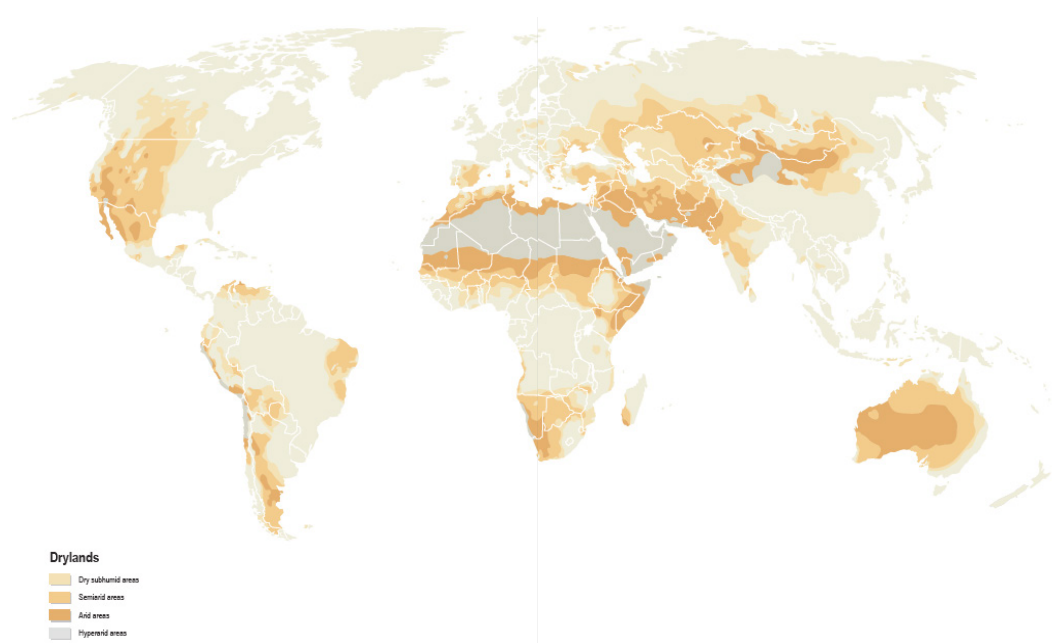


Figure 1: Distribution of global drylands

Source: UNEP World Conservation Monitoring Centre, 2010

1.2 Regional Outlook

According to the Global centre for Adaptation (GCA), nearly a third of global drylands occur in Africa, where they cover 19.6 million square kilometres (km²), and nearly two thirds of southern, western, eastern and northern Africa (Figure 2). This area is home to over 525 million people in Africa (40 percent of the population), growing by about 3% per year (faster than the African average of around 2.5 percent), with a demography firmly skewed toward the young (GCA, 2021).

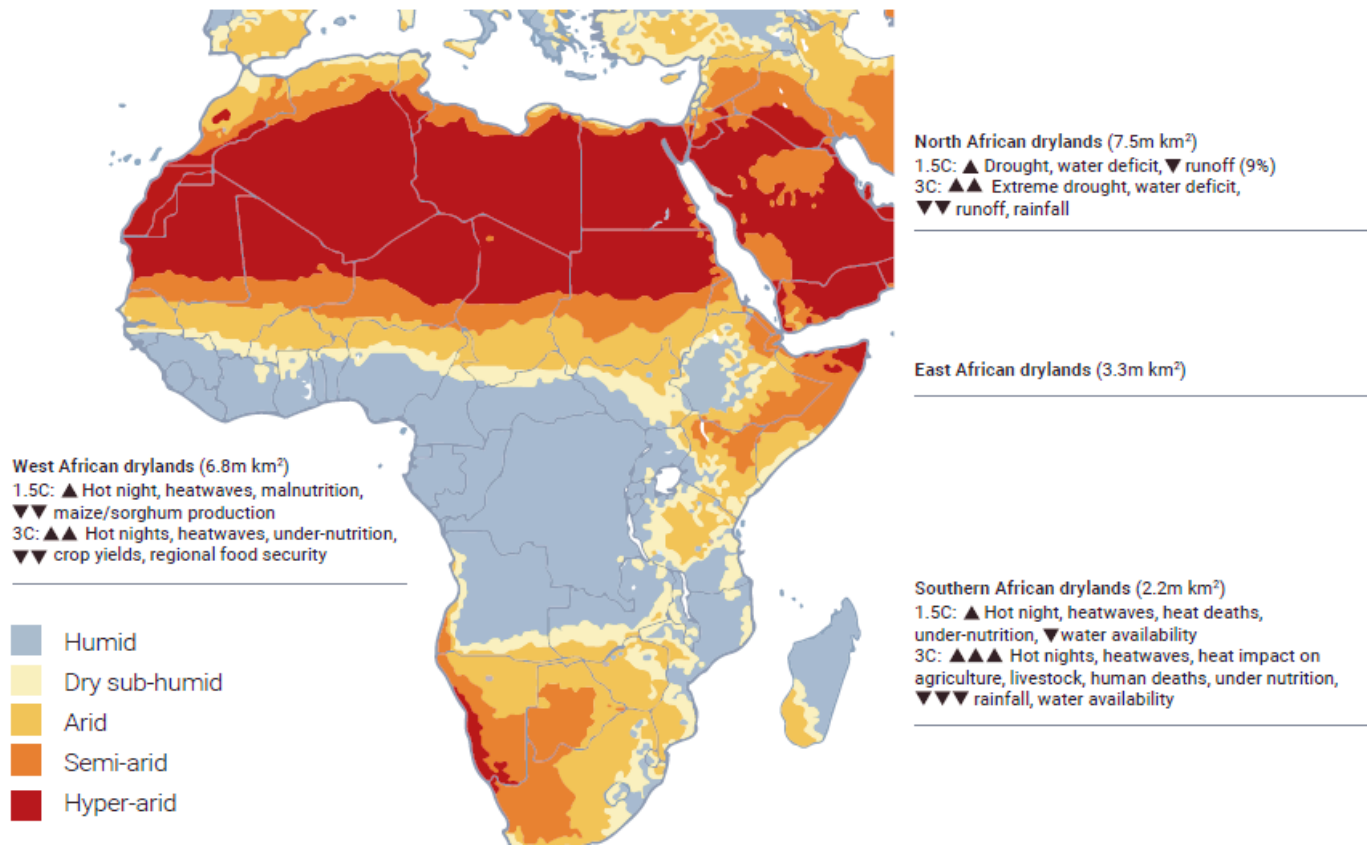


Figure 2: Africa Drylands Cover (Source: IPCC, 2019).

Biophysically and socially, the drylands are diverse (Table 2). Biomes range from woodlands and savannas on either side of central Africa’s equatorial forests, to Mediterranean shrublands in the north and south, and enclosing the hyper-arid Sahara in northern Africa and the smaller Namib in the south. This diversity means that the details of livelihoods are very context specific, but land use is broadly dominated by nomadic, transhumant or sedentary pastoralism, rainfed cropping and agroforestry, and localized areas of irrigated farming; the livelihoods of over 200 million people in Sub-Saharan drylands depend on cropping.

Economically, About 69% of the rangelands in developing countries are used for livestock production and contributes 10% of global meat production. Livestock production in rangelands accounts for between 50% and 80% of agricultural gross domestic product (GDP) in developing countries. Besides supporting most of the livestock population that contribute 10% – 50 % of the individual countries’ agricultural GDP in the Horn of Africa, these areas provide various plant and animal resources, minerals and oil. Because of their global extent and diversity of ecosystem goods and services they supply, often beyond their boundaries, rangelands condition and trends are linked closely to the economic well-being of many communities and hence their sustainable management and conversely their degradation are of critical importance to mankind.

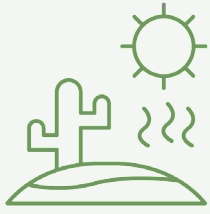
Table 2: Key characteristics differentiating drylands in Africa (FAO, 2019).

North African drylands	
Area: 7.5 million km ² (4.6 million hyper-arid), 99% of region	
Major land uses: Grassland 9%, Wooded 3%, Crops 7%, 'Barren land' 77%, Urban <1%	
Out migration 1970s/2000s: 140,000/319,000 people per year	
West African drylands	East African drylands
Area: 6.8 million km ² (2.1 million arid), 53% of region	Area: 3.3 million km ² (1.1 million dry sub-humid), 47% of region
Major land uses: Grassland 12%, Wooded 24%, Crops 8%, 'Barren land' 51%, Urban <1%	Major land uses: Grassland 25%, Wooded 44%, Crops 6%, 'Barren land' 12%, Urban 1%
Out migration 1970s/2000s: 224,000/508,000 people per year	Out migration 1970s/2000s: 152,000/241,000 people per year
Southern African drylands	
Area: 2.2 million km ² (1.4 million semi-arid), 84% of region	
Major land uses: Grassland 28%, Wooded 59%, Crops 4%, 'Barren land' 7%, Urban 1%	
Out migration 1970s/2000s: 5,000/17,000 people per year	

Further to be above, rangelands in Africa have become the new frontiers for development; as Africa's population grows, rangelands serve as sinks for the immigrant population from the agriculturally high potential areas. In addition, with infrastructure development, and expansion of urbanization, towns located in the rangelands now act as business hubs that link the frontiers to the rest of the countries. Given their immense contribution to local, national and regional economies, achievement of food security and climate change mitigation and adaptation, squarely depend on how best we manage the vast drylands. Despite their economic and ecological importance, rangelands are under constant threat from among other factors, land use and land tenure changes that result in injudicious use and subsequent range degradation, as well as lack of appropriate policies or weak implementation where they exist. Climate change adds another layer of challenges to the problems already facing rangelands.



Economically, About **69%** of the rangelands in developing countries are used for **livestock production** and contributes **10%** of global **meat production**.



Kenya has an area of approximately 582,646 sq. km. comprising **97.8%** dry lands/ASALs and **2.2%** water surface

1.3 The National Outlook

The Republic of Kenya comprises the territory and territorial waters. It has an area of approximately 582,646 sq. km. comprising 97.8% dry lands/ASALs (Fig. 3) and 2.2% water surface (National Atlas, 2024). It is estimated that 20% of the land of the dry land area is medium to high potential land and the rest (80%) of the land is mainly drylands-arid and semi-arid lands (GoK, 2012). The widespread and deeply rooted misconception that drylands are “wastelands” neglects the magnitude of existing social, economic activity and related environmental benefits. Contrary to this misconception, these are some of the region’s untapped potential according to the Vision 2030 Development Strategy for Northern Kenya and other Arid Lands, justified by the following:

- 1. Strategic position:** The region’s geographical location and its social and cultural attributes make it well-positioned to benefit from surplus capital in the Gulf, one of the fastest-growing parts of the world. It is also the bridgehead to a regional economy of more than 100 million people. Countries such as Ethiopia, Sudan and Somalia need outlets for their products, imports of manufactured goods and, in the case of South Sudan and Somalia, materials for reconstruction.
- 2. Domestic trade:** The economies of the lowlands and highlands are complementary. Opening up the north will generate greater demand for Kenyan products. There is already significant movement of capital between parts of the north and Nairobi, which is set to grow.
- 3. Livestock trade:** As populations increase, urbanize and become richer they create more demand for meat and other livestock products. The ASAL regions host 70% of the National Livestock herd with an estimated value of Ksh.70 billion.

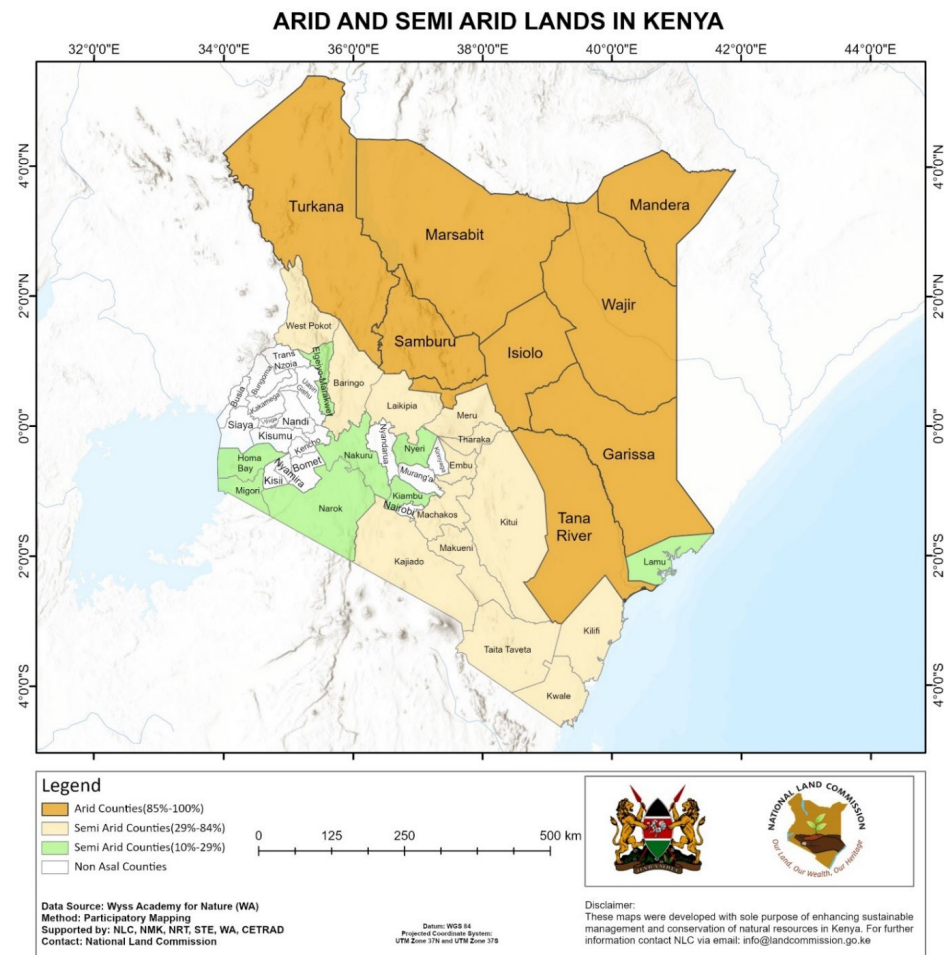


Figure 3: Kenya ASAL Counties

4. **Tourism:** Most protected areas such as game reserves and national parks are found in the ASALs. This gives the region a comparative advantage in tourism, an industry that is usually Kenya's highest foreign exchange earner and contributes approximately 12% to Kenya's GDP. Pastoralism, conservation and bio-diversity are intimately linked.
5. **Natural wealth:** if Kenya has commercial deposits of oil and natural gas they are likely to be found in the ASALs, particularly in the north and east. Other natural resources include sand and gravel for construction, a wide range of precious minerals, soda ash, gums, resins, and medicinal plants. Dryland soils and vegetation store carbon, suggesting that the ASALs have the potential to generate payments for environmental services such as carbon sequestration.
6. **Urban development:** Carefully planned and strategic urban development in the ASALs will benefit the region, particularly in terms of employment creation, while also opening up new economic and investment opportunities for the country as a whole, reducing population pressure in high-density areas and strengthening national cohesion through the inter-mingling of social groups.
7. **Climate change:** Pastoralists have to a large extent successfully managed climate variability for centuries. Their skills and knowledge will become more valuable as the impact of global climate change becomes more pressing.

1.4 Natural Assets Defined

Natural assets, as defined by the Organisation for Economic Co-operation and Development (OECD), comprise the biophysical components of the environment, including biological resources, land and water ecosystems, subsoil resources, and the atmosphere (OECD, 2008). This definition captures the tangible, ecological dimensions of natural systems that support human and non-human life. However, natural resources become assets when people have rights to access their benefits (Boyce, 2001).

In light of decolonial critique, natural assets are understood not merely as biophysical resources with economic value, but as relational entities embedded within Indigenous and local worldviews, cosmologies, and territorial rights (Escobar, 2020). This perspective challenges the colonial and anthropocentric conception of a natural asset as a repository of resources to be owned, extracted, and monetized. When viewed through a cultural lens, however, natural assets embody meanings that go beyond their physical or economic utility. They encompass ecological entities and landscapes—such as land, wetlands, water, biodiversity, forests and minerals—that are valued not merely for their instrumental function, but for their cultural, spiritual, historical, and relational significance, as articulated within indigenous and local knowledge systems (Whyte, 2018). In this context, a natural asset is understood as something that holds value due to its role in sustaining community livelihoods, knowledge systems, cultural identity, and collective wellbeing (Green, 2015; McPherson et al., 2020).

The boundaries between natural resources and culture are often indistinct. Scholars have emphasized that natural and cultural heritage are inextricably linked, co-producing landscapes and meanings that foster a shared sense of place (Cheng et al., 2003; King & Willow, 2011; Speed et al., 2012). Lockwood and colleagues go further to argue that the interdependence of cultural and natural dimensions is so profound that they are best managed as a unified whole (Lockwood et al., 2006). Doing so not only reflects the dynamic interplay between people and their environments but also enhances the efficacy and sustainability of development interventions (Hossen, 2016; Mere-Roncal et al., 2021).

Categorisation of natural assets in participatory approaches often mirrors the cultural landscapes and socioecological realities of the communities involved. In northern Kenya, for instance, participatory mapping exercises conducted with pastoral communities revealed classifications of natural assets that closely reflected the intimate local pastoralist practices and wildlife conservation, and embodied their knowledge systems, mobility patterns, and livelihood strategies.



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1.5 Billion USD,

which is equal to the Country's 5% GDP

1.5 The Need to Map Drylands Natural Assets

1.5.1 Securing Natural Assets for Poverty Reduction & Socio-Economic Development

In Kenya, over 80% of the land surface including the ASALs is fragile and has a population of over 16 Million people, categorized as poor (living below line) and suffer effects of widespread aridity, acute food and water shortage, as well as general insecurity (Mulinge et al. 2016; Range Management and Pastoralism Strategy 2021-2031). The annual cost of land degradation in this areas is estimated to be about 1.5 Billion USD, which is equal to the Country's 5% GDP (Nkonya et al, 2016; UNSD 2016).

Dryland natural assets are intimately linked to poverty. Local communities depend on these assets for their livelihoods and survival. Despite the rich assets hosted in the dryland landscapes and the fact that they constitute important natural assets that spur socio-economic development, these areas continue to face ecological 'marginalization' and neglect from mainstream ecosystems. First, the true worth and full potential of dryland natural assets have not been explored and documented to provide tangible evidence for policy, planning, sustainable management and decision-making. Further, the skewed interpretation of the contribution of natural assets in Kenya's economy is partly attributable to lack of adequate data and research on their economic value and hence their lack of placement in economic and social planning instruments.

This dryland natural assets inventory and participatory mapping report (2026) for the Kenya's drylands, is the first of its kind in Africa that authoritatively documents and inventorizes dryland natural assets. Kenya's drylands are endowed with vast and diverse natural resources including biodiversity and genetic, land and unique ecosystems. These vital assets (hills and mountains, valleys, rivers, lakes, forests and wildlife, varied weather and climatic regimes), are indeed key pillars of socio-economic development in the Country. They are the suppliers of ecosystem services such as water, energy, biomass, medicine, food, income and revenue both at the household and community- level.

Mapping and inventorizing dryland natural assets is the first step towards securing them and achieving posterity by influencing the envisaged land cadastres, plans and policies at county and national level and enhance their protection and survival for continued accruing benefits and creation of wealth and green jobs. In this regard therefore, the National Land Commission (hereinafter referred to as the Commission) with support from her partners - WYSS Academy for Nature and CETRAD alongside other government agencies and non state actors, embarked on county-based mapping and inventory of natural assets of dryland areas in Kenya, with Isiolo, Laikipia and Samburu being pilot counties. The mapping project aimed to provide evidence for instituting measures for their protection and conservation; and in particular, advancing the development of transformative policy changes for natural resources governance, conservation and sustainable use. Therefore, this report presents the outcomes of Natural Assets mapping in Isiolo County.

Box 1: Role of Various Actors

- **National Land Commission (NLC):** Coordination and technical guidance role on the process as well as linking with relevant government institutions for necessary access approvals. The commission is the lead institution with the legal and constitutional mandate regarding land management including asset mapping and inventORIZATION.
- **Wyss Academy for Nature – East Africa and CETRAD:** Provided technical support, facilitated participatory mapping, digitization, and coordinated multi-stakeholder engagement. It also provided the central repository/server for data.
- **County Government:** Played critical roles in local coordination, stakeholder mobilization, data collection assistance and validation.
- **Community Members and Local Leaders:** Participated in asset identification, knowledge sharing, mapping activities, validation and political good will

1.5.2 Shifting Climate Zones in Kenya (1980–2020)

Kenya's climatic zones are significantly changing due to many factors, but majorly, human-driven. Human-induced climate change pressures significantly alters the spatio-temporal characteristics of climate zones, which drives agricultural land use and ecosystem change. However, the detectability of shifting climate zones and the rate and time of the changes is yet to be adequately addressed at the regional and local scale. Studies by Ted et al. , 2023 on the shifting climate zones and expanding tropical and arid climate regions across Kenya (1980–2020) observed an approximate 1 °C increase in average annual temperature over the 40-year period (Fig. 4). Consequently, a total of 76,346 km² shifted from cooler to hotter zones, while 1298 km² shifted from hotter to cooler zones. These dramatic changes are largely experienced in the drylands, increasing their fragility and inability to provide the resources and benefits therefrom; and negatively impacting socio-economic and ecological development in these areas.

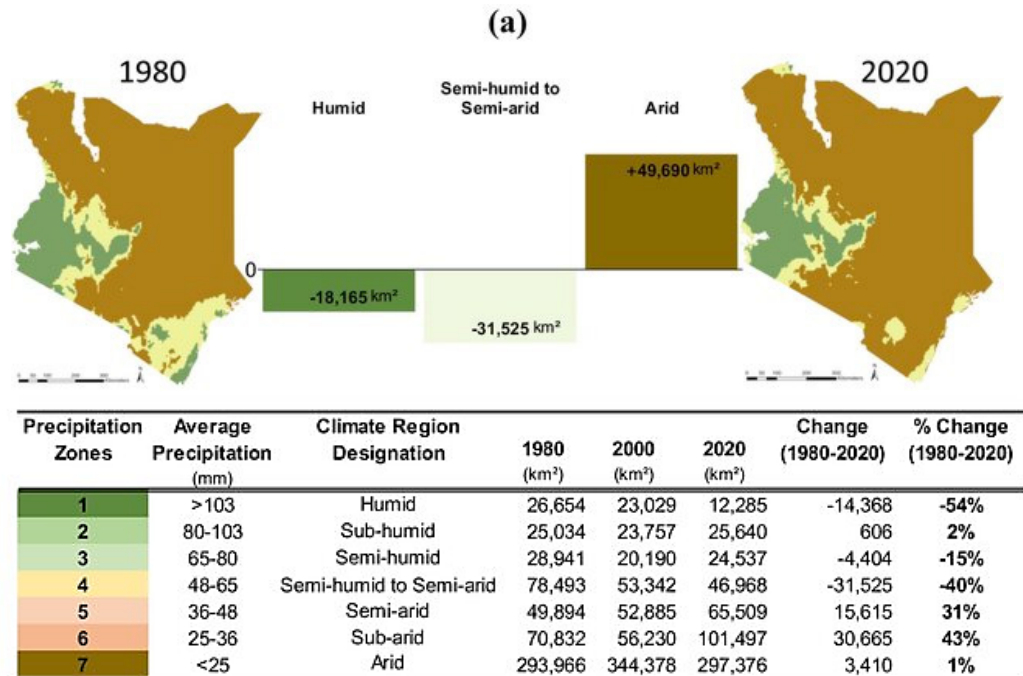


Figure 4: Shifting climate zones and expanding tropical and arid climate regions across Kenya- 1980–2020 (Ted et al., 2023)

1.5.3 Strengthening Natural Resource Governance and Legal Compliance

Kenya's dryland natural resources are governed through overlapping statutory and customary institutions, including county governments, national agencies (e.g., NEMA, WRA, KFS, KWS), community conservancies, WRUAs, and grazing committees. In practice, mandate ambiguities, weak enforcement capacity, and the absence of authoritative spatial baselines frequently undermine effective stewardship and accountability (Lockwood, Worboys, & Kothari, 2006). A comprehensive, geo referenced inventory addresses these gaps by operationalizing constitutional and statutory obligations—explicitly locating ecologically sensitive areas, clarifying tenure and access regimes, and identifying sites eligible for reservation and gazettelement under existing law.

Asset mapping directly supports implementation of key legal instruments, including Articles 60, 62, and 69 of the Constitution of Kenya on sustainable land use and environmental protection (Republic of Kenya, 2010); Sections 8 and 15–16 of the Land Act on inventories and reservation of public land (Republic of Kenya, 2012); EMCA provisions on wetlands and protected environments (Republic of Kenya, 1999); the Wildlife Conservation and Management Act on corridors, conservancies, and endangered ecosystems (Republic of Kenya, 2013); the Water Act on protected catchments (Republic of Kenya, 2016); and PLUPA on County Spatial Planning and Special Planning Areas (Republic of Kenya, 2019). By linking assets to clear spatial extents, tenure classes, and legal pathways, mapping enables enforceable decisions, inter agency coordination, and measurable accountability for dryland governance (GoK, 2009; Lockwood et al., 2006).

1.5.4 Preventing and Managing Resource Based Conflicts

Arid and semi arid counties experience recurrent conflict cycles driven by water scarcity, pasture failures, livestock mobility, fencing, and the conversion of rangelands to cropland or settlements (FAO, 2019; Whyte, 2018). Climate extremes intensify these pressures by increasing temporal and spatial variability in access to water and forage (IPCC, 2019). Spatial inventories that explicitly map grazing reserves, livestock corridors, dry season water points, wildlife routes, and salt licks transform implicit and contested claims into visible planning inputs.

Such baselines support conflict sensitive land use planning by avoiding infrastructure placement across seasonal routes, enabling negotiated access and drought contingency grazing agreements, identifying hotspots where user overlaps are acute, and guiding human–wildlife coexistence zoning near riparian areas and dry season refugia. Evidence from Horn of Africa rangelands shows that formal recognition of mobility corridors and refuge areas reduces conflict incidence and losses, while improving rangeland condition and livestock productivity (FAO, 2019; GCA, 2021).

1.5.5 Unlocking Green Economy Opportunities, Natural Capital Accounting, and Climate Finance

Drylands underpin economies based on livestock production, wildlife tourism, biodiversity assets, renewable energy, and nature based solutions. Rangelands in developing countries support approximately 10% of global meat production and contribute an estimated 50–80% of agricultural GDP in many Sub Saharan African states (FAO, 2019). In Kenya, ASALs host about 70% of the national livestock herd, while ecosystems spanning Laikipia and Samburu sustain some of the highest wildlife densities outside protected areas (GCA, 2021).

Robust spatial mapping enables counties to integrate natural capital values into budgeting and NLIMS, design Payment for Ecosystem Services and wildlife lease schemes, and assemble bankable portfolios for climate finance—such as riparian restoration, wetland rehabilitation, rangeland regeneration, and soil and grassland carbon projects grounded in verifiable baselines and MRV frameworks (IPCC, 2019; Escobar, 2020). Where credible spatial baselines exist, counties are better positioned to articulate investment ready pipelines aligned with Vision 2030, the National Spatial Plan, and Agenda 2063 (GoK, 2015; African Union, 2015).

1.5.6 Protecting Community Rights, Cultural Landscapes, and Indigenous Knowledge

Pastoral and Indigenous communities possess rich and sophisticated Traditional Ecological Knowledge (TEK) related to seasonal grazing, drought refugia, salt lick nutrition, and wildlife coexistence. Yet many cultural sites, sacred groves, migration corridors, and communal water points remain undocumented and are therefore vulnerable to privatization or incompatible land uses (Berkes, 2012; King & Willow, 2011).

Participatory mapping documents TEK identified assets and embeds them within formal spatial plans, safeguards communal tenure and customary access under the Community Land Act (2016), aligns cultural heritage protection with biodiversity and water security outcomes, and elevates women's and youth knowledge—enhancing inclusivity and decision legitimacy (Chan et al., 2012; McPherson et al., 2020). By situating cultural landscapes within official land information systems, counties reduce dispossession risks while preserving place based governance systems that have historically sustained dryland resilience.

1.6 Purpose and Objectives

The overall purpose of the mapping initiative is to inventorize all land-based resources in Kenya's drylands and strengthen their governance. Specifically in Isiolo County, the project aimed to:

1. Take a stock of the county's dryland natural assets.
2. Identify the threats, challenges and opportunities for sustainable management, use, conservation and development of drylands natural capital.
3. Determine the efficacy of the various legal pathways for securing dryland natural assets and resources for posterity and climate resilience.
4. To recommend practical measures for the sustainable management, protection and restoration of dryland natural assets to support long term ecological integrity and community resilience.

1.7 Scope and Limitations

The mapping scope for this initiative covered five assets (Table 3) including water related resources such as ponds, streams, rivers, swamps etc; wildlife corridors, areas of dense vegetation and salt licks among others.

Table 3: Asset Mapping Scope

Natural Asset category	Elements/variables
Water Resources	Rivers/laggas, rock catchment, sand dam, springs and wetland (swamps and marshes)
Wildlife	Corridors and dispersal areas, Wildlife concentration areas/ breeding areas
Island of dense vegetation	Islands of dense vegetation
Livestock	Dry season grazing areas, Livestock Routes
Natural Salt lick areas	Salt Licks areas

Spatially, the mapping exercise was carried out in 46 locations, in 10 Wards within Isiolo County in Kenya. Isiolo County borders Marsabit County to the north, Samburu and Laikipia Counties to the west, Garissa County to the south east, Wajir County to the north east, Tana River and Kitui Counties to the south and Meru and Tharaka Nithi Counties to the south west. It covers an area of approximately 25,700 km² (Figure 3).

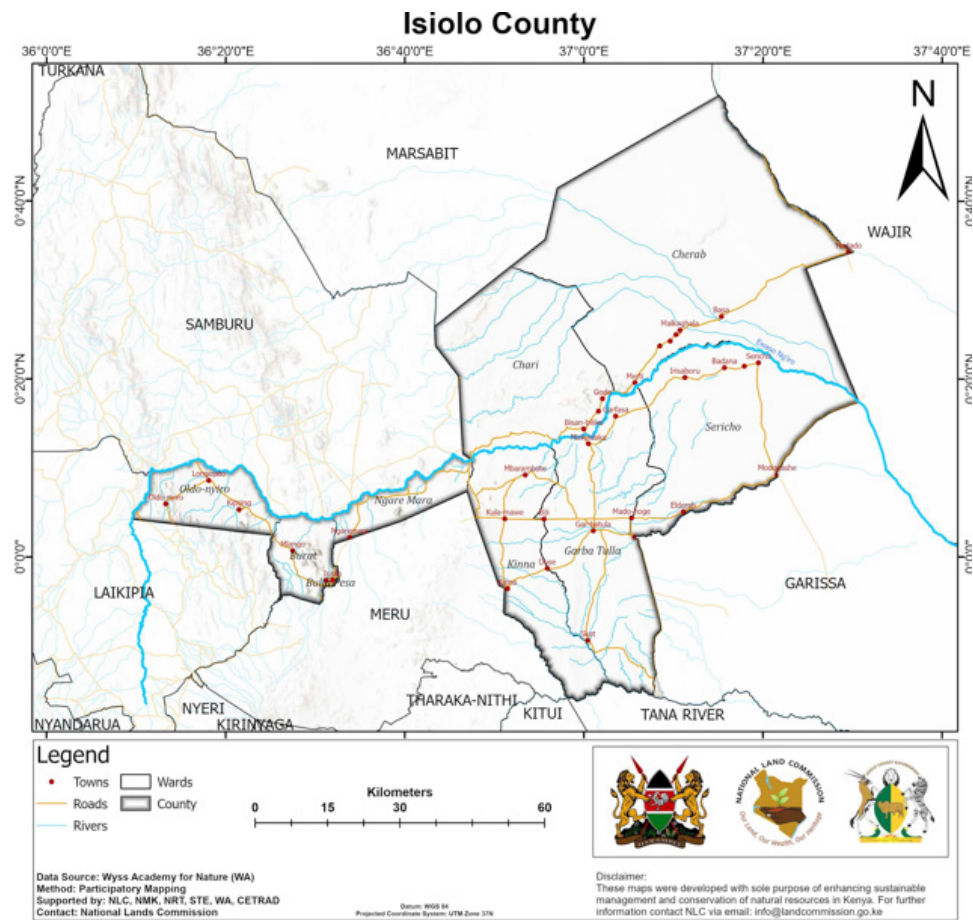


Figure 5: Isiolo County Map

Administratively, the County has two constituencies, three sub-counties and ten wards as provided in presented in Table 3. From the 46, location, 4 locations namely: Skot, Boji, Atan, Ngaremara were visited, assets listed and marked on the hard copy map, but the GPS coordinates were never taken mainly due to insecurity. Further, 8 locations, namely: West,Gotu, Rapsu, Madoyaka,,Eldera, Korobesa, Bassa, Yamicha, were visited, assets listed but GPS coordinates only taken in the safe parts.

Table 4: Administrative and Political Units of Isiolo County

Constituency	Sub-County	Wards
Isiolo North	Isiolo	5 -(Wabera, Bulla Pesa, Burat Ngaremara and Oldonyiro)
	Merti	2 -(Chari and Cherab)
Isiolo South	Garbatula	3 -(Kinna, Garbatulla and Sericho)
Total	3	10

Limitations

While the mapping exercise provides the most comprehensive baseline of dryland natural assets in Isiolo County to date, several limitations were encountered:

1. Geographical scale, remoteness, and terrain constraints:

Isiolo County covers an extensive and sparsely populated landscape, with large distances between settlements and assets, particularly across the Sericho–Merti–Garbatulla corridor and the Oldonyiro–Kinna rangelands. Limited road infrastructure and harsh terrain constrained physical access to some asset locations, potentially resulting in underrepresentation of small, dispersed, or seasonally used resources.

2. Seasonal variability of dryland assets:

Many mapped features—including seasonal rivers and laggas linked to the Ewaso Nyiro system, ephemeral wetlands, dry season grazing reserves, and pastoral mobility routes—exhibit strong seasonal dynamics. Data collection occurred during specific periods, meaning asset condition, extent, and functionality may differ during peak dry seasons or extreme rainfall events. This temporal limitation should be considered when interpreting asset status and reliability.

3. Inconsistent local naming and classification of assets:

Across Isiolo, different communities and livelihood groups (pastoralists, agro pastoralists, conservancy members) apply varied local names and classifications to the same natural assets, particularly grazing areas, salt licks, and seasonal water points. Although community validation meetings helped harmonize terminology, some inconsistencies may persist where customary naming systems differ from administrative or technical classifications.

4. Absence of historical county wide baselines:

Isiolo County lacks previous comprehensive, geo referenced inventories of dryland natural assets. As a result, the analysis could not assess long term ecological trends, degradation trajectories, or recovery patterns. The current dataset therefore serves as a baseline reference rather than a longitudinal assessment.

5. Resource, time, and logistical constraints:

As with most large scale participatory mapping exercises, constraints related to time, budget, logistics, and availability of trained field teams influenced the depth and spatial coverage of data collection. Some assets—particularly those identified during stakeholder validation workshops—may require targeted follow up surveys to improve completeness and precision.

6. Security and access limitations in selected areas:

Periodic insecurity and inter community tensions in parts of Isiolo County restricted movement of field teams, especially in borderland grazing zones and along key livestock movement corridors. These access limitations constrained full coverage of certain high risk or contested areas.

7. Inherent limitations of participatory mapping approaches:

Participatory mapping is essential for capturing Indigenous and local knowledge, particularly for mobile pastoral systems. However, it relies on participant memory, perception, and experience. Consequently, some asset attributes—such as seasonality, intensity of use, or historical change—may reflect community interpretation rather than measured biophysical parameters.

Despite these limitations, the data generated are robust, credible, and sufficiently comprehensive to inform county planning, policy development, and natural resource governance in Isiolo County. The constraints identified do not invalidate the findings; rather, they highlight the need for periodic updates, complementary remote sensing analyses, and sustained community based monitoring. This inventory therefore provides a reliable foundation for decision making while enabling progressive refinement of dryland natural asset mapping and governance over time.

1.8 Justification

1.8.1 Constitutional & Legal Underpinnings

The promulgation of Kenya's Constitution in 2010 brought a paradigm shift in governance, including reform-oriented policies and laws for land and land-based resources management. Both land and natural resources are broadly defined under Article 260 of the Constitution; definitions that clearly depict mutual reinforcement rather than depicting land and natural resources as separate and distinct isolated ecotones. Notably, Chapter 5 of the Constitution demonstrates the close and intimate connectivity between land and environmental resources and hence the need to weave and manage these together as connected variables via a landscape connectivity lens.

Consequently, the National Land Commission (NLC) was birthed by the Constitution of Kenya 2010 and established under Article 67 of the Constitution to perform various functions, including the management and administration of public land on behalf of National and County Government and exercising oversight responsibility over land use planning in the country. Land is broadly defined in Article 260 of the Constitution to include all water bodies, marine waters and natural resources (such as forests, wildlife, minerals, fossil fuels, sunlight and genetic resources), most of which are further categorized as public lands under Article 62 of the Constitution. To effectuate the Constitution in the management of public land, **Section 15(3) of the Land Act 2012, empowers the Commission with the responsibility of undertaking an inventory of ALL land-based resources in the Country.** In addition, Section 8 of Land Act tasks the Commission with the following responsibilities:

- a. Identifying public land, prepare and keep a database of all public land,** which shall be geo-referenced and authenticated by the statutory body responsible for survey.
- b. Evaluating all parcels of public land based on land resources mapping and overall potential for use.**
- c. Sharing data with the public and relevant institutions** in order to discharge their respective functions and powers under this Act; and that the Commission may require the land to be used for specified purposes and subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.

Furthermore, Sections 11 (1, 2 & 3) of Land Act 2012 regarding Conservation of ecologically sensitive public land, requires the Commission to:

- a. Take appropriate action to maintain public land** that has endangered or endemic species of flora and fauna, critical habitats or protected areas.

- b. Identify ecologically sensitive areas** that are within public lands and demarcate or take any other justified action on those areas and act to prevent environmental degradation and climate change.
- c. Consult existing institutions** dealing with conservation.

Apart from these legislative frameworks, other sectoral laws such as EMCA (1999), Wildlife Conservation and Management Act (2013), Water Act 2016, Forest Conservation and Management Act 2016, among others provide vital frameworks for natural resources conservation, sustainable use and management in the Country.

The constitutional, policy and legal contexts provided herein, form the main beacons for the Commission to undertake dryland natural assets inventory and mapping for Isiolo County. This aims to cure an existing lacuna relating to lack of proper land-based natural resources inventory and databases especially in the Kenya's ASALs. This is also consistent with the National Spatial Plan (2015-2045) and the principles of National Land Policy, 2009 that are both geared towards ensuring that land in Kenya is held, used and managed in a manner that is optimal, equitable, efficient, productive and sustainable.

1.8.2 Practical Context

Dryland ecosystems including wetlands (springs and oases, lakes, rivers) and critical habitats such as forests and wildlife parks constitute important natural assets that spur socio-economic development in drylands (Arid and Semi-Arid Land- ASALs). They are not only food, water, and medicine that are consumed by local communities, but equally, play a significant role in supporting livestock production and thus improving human well-being in these dynamic and fragile landscapes. Importantly, drylands are known for playing host to huge biodiversity resources such as wildlife that also contribute immensely to ecological and socio-economic development through tourism and other ventures. Yet these areas continue to face ecological 'marginalization' and neglected from mainstream ecosystems. In fact, very few tourists visit these areas because of historical marginalization, insecurity and poor infrastructure.

The perception and mindset that drylands in Northern Kenya are unproductive often stems from a narrow focus on traditional agriculture, particularly crop farming, that relies on consistent rainfall. However, dryland ecosystems are endowed with natural capital that is unique but are not given much recognition and attention. Thus, recognizing and sustainably utilizing the diverse range of natural resources present is crucial in attaining the socio-economic vision and agenda of the Country.

The natural capital ranges from livestock adapted to arid conditions to renewable energy (wind and solar energy) potential and unique biodiversity. In addition, the diverse land formation and water resources (swamps, springs, rivers) supports flora and fauna as well as livelihood of the communities. The region can indeed unlock significant economic and social development.

The true worth and full potential of dryland natural assets have not been explored and documented to provide tangible evidence for policy, sustainable management and decision-making. Their existence is therefore highly threatened, given that the economy of Kenya has shifted to the North, following discoveries of important assets such as Petroleum, Minerals, wind Power and large scale infrastructural projects including the LAPSSSET Corridor, Horn of Africa Gateway Development Project (HoAGDP) etc. Further, the survival of these critical ecosystems and natural assets is more threatened by the on-going Community Land Registration, within the ambit of Community Land Act 2016, which is led by the State Department for Lands and Physical Planning (SDLPP). If these resources are not properly captured and documented, reserved in the National and County/community land Cadastres/registers, and attendant County Spatial Plans (CSPs), as well as gazetted, they will be wiped away and important ecosystem goods and services will be lost.

This report therefore makes a significant contribution in improving the understanding and appreciation of dryland natural assets, for policy alignments and related potential reforms that will favour improved and sustainable natural assets conservation and governance. Similarly the report provides evidence for situating dryland assets as the heartbeat for livelihoods and community resilience in these fragile landscapes.

1.8.3 Significance

Mapping of drylands ecosystem and natural assets is critical in ensuring that appropriate inventories of natural resources in the country are created to support decisions and actions relating to their management and to streamline their governance. Managing what is known is imperative to the commission as an oversight body on land and natural resources. In addition, natural resources management is a concurrent jurisdiction between National and County Governments in line with Article 186 as read with Schedule 4 of the Constitution relating to distribution of functions and separation of powers.

The inventory will be translated into Atlas of drylands natural assets which provides a synthesized data and information hub on drylands natural capital in a visually orienting format that is easily understandable by the government, private sector, development partners, civil society, researchers and the general public. The atlas will further provide the what, whose, the where and how of the entire natural capital ; the distribution and their contribution to socio-economic development in the country as well as any changing patterns and socio-economic linkages; the need and the mechanics for their protection and sustainable use.

At the strategic policy level, mapping these assets and resources is meant to facilitate and make them public through reservations in the land cadastres and gazette notices for their enhanced and continued protection, conservation, access and use by various local communities among other stakeholders. Thus, this mapping initiative is significant given that it provides:

- a. Reliable information and data for decision and policy makers on the status, trends and contribution and sector linkages of the resources and socio-economic development
- b. Baseline information for research and education framework for advancing in- depth research and progress tracking of the various elements of the country's dry land-based resources within the academia and education portfolios.
- c. Salient information for civic and advocacy programmes for the various population segments and stakeholders at different levels especially the local communities, who are the primary stakeholders and custodians of the assets, that are directly or indirectly affected by decisions regarding natural resources. It visually paints the picture of the state of the natural resources, the threats and opportunities through intersection analysis, for advancing the sustainable development agenda.
- d. As a policy tool and oversight framework, it will inform evidence based transformative policy development and set the pace for important advisories to relevant authorities, Ministries, Departments, Agencies and Counties (MDACs) regarding sustainable management and development of the natural resources including county spatial planning (CSP). In addition, the atlas and inventory data/report provides succinct policy recommendations for various actors. And lastly,
- e. Land and land use data to the National Land Information Management System (NLIMS). Such data will be valuable to inform preparation of physical and land use plans, land use policies, standards and guidelines as well as control and regulation of land and property use in respect of all categories of land.

1.9 Alignment with Government Policies, Priorities and Strategies

The inventory and mapping of critical natural assets in the dryland areas of the Republic of Kenya is in harmony with the County Integrated Development Plans (CIDPs), Medium Term Plan (MTP) of Vision 2030, sectoral strategies and policies. The National Land Policy (2009) and National Land Use Policy (2017), emphasize the importance of mapping natural resources. Specifically, it highlights the need to identify and map trans-boundary natural resources, unified mechanisms for natural resource information and enhancing preparation of strategic spatial development plans. These initiatives aim to improve the management and conservation of natural resources in Kenya by ensuring their sustainable use and protection.

Therefore, intervention (mapping of natural capital) is in line with the Fourth Medium Term Plan (MTP IV) of vision 2030. Kenya prioritizes the management and development of natural resource in the fourth priority sector. The Key focus areas include: Water Harvesting and Conservation, Environmental Protection, Sustainable Waste Management, Infrastructure Development and Natural Resource Management. Thus, the plan acknowledges the importance of natural resources in Kenya's economy and provides anchorage for the sustainable use and management of these resources. The plan is also aligned to international commitments such as the UN Agenda 2030 and Africa Agenda 2063, which emphasize on sustainable development and environmental protection. Further, the mapping and inventory initiative demonstrate the government's commitment to sustainable development and the responsible management of natural resources in Kenya.

Equally, the Isiolo County Integrated Development Plan shows a detailed strategy on how the sector on Water; Sanitation, Energy, Environment, Natural Resources, and Climate Sector will put strategies for the sustainable management of these resources. The plan provides an overview assessment of the major natural resources found within the County. These resources include water and wetland, extractive resources, biodiversity as well as Development of County Spatial Plan to guide in use and management. To enhance data driven development in the county, this mapping and inventory initiative provides the much needed information and data for informed decision-making, planning and sustainable management of the assets.

1.10 Target Users

The report targets the following users:

1. General public
2. National Land Commission
3. Government Ministries, Departments and Agencies
4. County Governments
5. Researchers and Academic institutions
6. Non-Governmental, Community based Organizations and Civil Societies
7. Media



2.

APPROACHES & METHODOLOGY

2.1 Overview

This report is a product of extensive data gathering and rigorous community participation in mapping dryland natural assets within Isiolo County. This section details the approaches and the methodological processes adopted to deliver this mapping initiative.

2.2 Approaches

The mapping of the county assets adopted the following approaches:

- 1. Collaboration-** The initiative is a product of intensive collaboration and partnership between the various state agencies at national, subnational and local level; primarily consisting of NLC, county government of Isiolo, NMK, KWS, KFS, CETRAD, Save the Elephants, NRT, WYSS Academy for Nature and the Ministry of Interior (County Commissioner and Chiefs) and local communities.
- 2. Community Centred Participatory GIS Mapping-**The mapping initiative involved local community members in identifying, mapping and profiling of all their assets. By consulting the community, a wealth of information on known and previously unknown assets were gathered, including personal experiences, knowledge and values attached to them.
- 3. Technology Integration-**The mapping initiative adopted the use of ESRI's ArcGIS Survey123 application to capture data regarding the identified assets.
- 4. Gendered Participation -** The mapping process ensured gender, cultural, social sensitivities and inclusion to enhance diversity in the perspectives of various players.
- 5. Capacity Strengthening and Creation of Green Jobs-** The exercise created a number of green jobs through recruitment, training and involvement of youths (GenZs) in mapping of assets. The youths were trained and participated in this project and are now equipped with the skills and knowledge to conduct similar assignment when need arises.
- 6. Adaptability-** The mapping team for this initiative did not remain static in their thinking and methodology but rather adjusted it to fit the prevailing circumstances, based on new information and unexpected challenges in different communities and landscapes. This was imperative for effective management of uncertainties and maintenance of validity and integrity of the work processes and outputs.

7. The Storytelling Approach (STA)

Storytelling is increasingly recognized as a powerful participatory method in mapping by allowing communities to share place-based knowledge that might otherwise be invisible in traditional GIS or ecological surveys. The approach uses the power of narrative to reveal and highlight the hidden assets of a community, particularly those relating to natural resources and environmental features.

Why STA in Natural Asset Mapping?

- **Participatory Knowledge Creation:** STA is a tool for surfacing “multiple truths” in mapping—especially those rooted in cultural memory or marginalized voices.
- **Natural Assets Beyond Ecology:** Conventional natural asset mapping often relies on scientific assessments of biophysical features (e.g., wetlands, forests). However, narrative-based approaches recognize that natural assets carry emotional, historical, and cultural significance (Chan et al., 2012).
- **Indigenous and Local Knowledge Systems:** In many pastoral communities, stories are the primary mode of ecological knowledge transmission. Storytelling captures Traditional Ecological Knowledge (TEK), enabling planners to better understand land stewardship practices and sacred ecological relationships (Berkes, 2012).
- **Story Mapping Tools and Case Studies:** Digital platforms like ArcGIS StoryMaps and analog techniques like community sketch mapping are increasingly used to document spatial stories. Case studies show how narrative mapping improves environmental justice, conservation planning, and urban greenspace design (Cunsolo & Ellis, 2018).

In this mapping initiative, STA was adopted to tease out the respondents knowledge, understanding and perception on assets that may be hidden. Two (2) main Techniques were adopted during the mapping exercise including:

1. **Story Circles:** Through small group sessions, participants were able to share memories or experiences with natural resources (Plate 1). This method encouraged deep listening, mutual respect, and emotional connection — surfacing place-based knowledge that technical tools such as Arch GIS often miss. Other benefits included: building community cohesion, amplifying marginalized voices, producing emotionally rich spatial data and enhancing trust in planning processes.



Plate 1: Use of Story Circles as Storytelling Technique in the Asset Mapping

- 2. Participatory Mapping:** Community members were invited to interact with printed or digital topographic (topo) maps to identify the natural assets. As stories were shared, pin locations annotated with quotes, photos, or drawings (Plate 2) were captured. This method was a practical and powerful way to blend scientific geography with local knowledge. It allowed participants to locate, annotate, and interpret real-world terrain while layering on personal, cultural, and natural assets insights. Other benefits included: making complex terrain that is understandable and relatable, encouraging people to connect place with memory and identity and supporting evidence-based but locally rooted decision-making.



Plate 2: Use of Topo Maps as Storytelling Technique in the Asset Mapping

Overall, the STA enriched the mapped data with meaning, memory, and identity—producing more inclusive, resilient, and place-sensitive planning outcomes. It aligns with calls for decolonizing planning, advancing social-ecological integration, and valuing non-expert knowledge in natural resources governance.

2.3 Methodological Process

The mapping of dryland assets within Isiolo County commenced in March 2022 and progressed in phases until 2025 through an iterative process as detailed hereunder:

2.3.1 Inception Phase

Step 1: Consultations

This phase mainly involved community penetration through courtesy calls and engagements with the County Commissioner and local administration (the chiefs and assistant chiefs at location level). The facilitation through formal communication from the County Commissioner and local administration provided a clear road map and impetus for the exercise and formed the basis for the next phases.

Step 2: Preliminary Assets Identification:

The second step involved the production of a community asset map of the important resources for their livelihood system. This map was prepared in a community setting to enable the participation and validation from a large group of people. With the aid of google aerial imagery, several maps were produced by smaller sub-groups (women, youth, and elders) and then amalgamated (Plate 3). The final map was then used to develop a preliminary checklist of all ecological assets available in the areas where they operate. It is important to note that the use of Google Earth was only for orientation to enable participants navigate the imagery and cross-reference their key resources against the satellite imagery.



Plate 3: Community Involvement in the Identification of Assets

Step 3: Developing the Survey123 Data Collection Digital Forms

Using the preliminary assets identification checklist and information from secondary sources, a data collection platform was developed online through the Arch GIS 123 connect. Multiple forms were created for the various requirements depending on the asset category. For a given inspection form, fields were specified for completion in form of radio buttons, drop-down selections, checkboxes, or text entry fields. Some of the information that were captured included among others: details of the interviewer, location/place name, assets location, management and governance, main users, land tenure, threats and opportunities. The information that was to be collected was thereafter loaded in an Android tablet and smart phones. Figure 5 illustrates the Survey123 interface showing the data collection digital form.

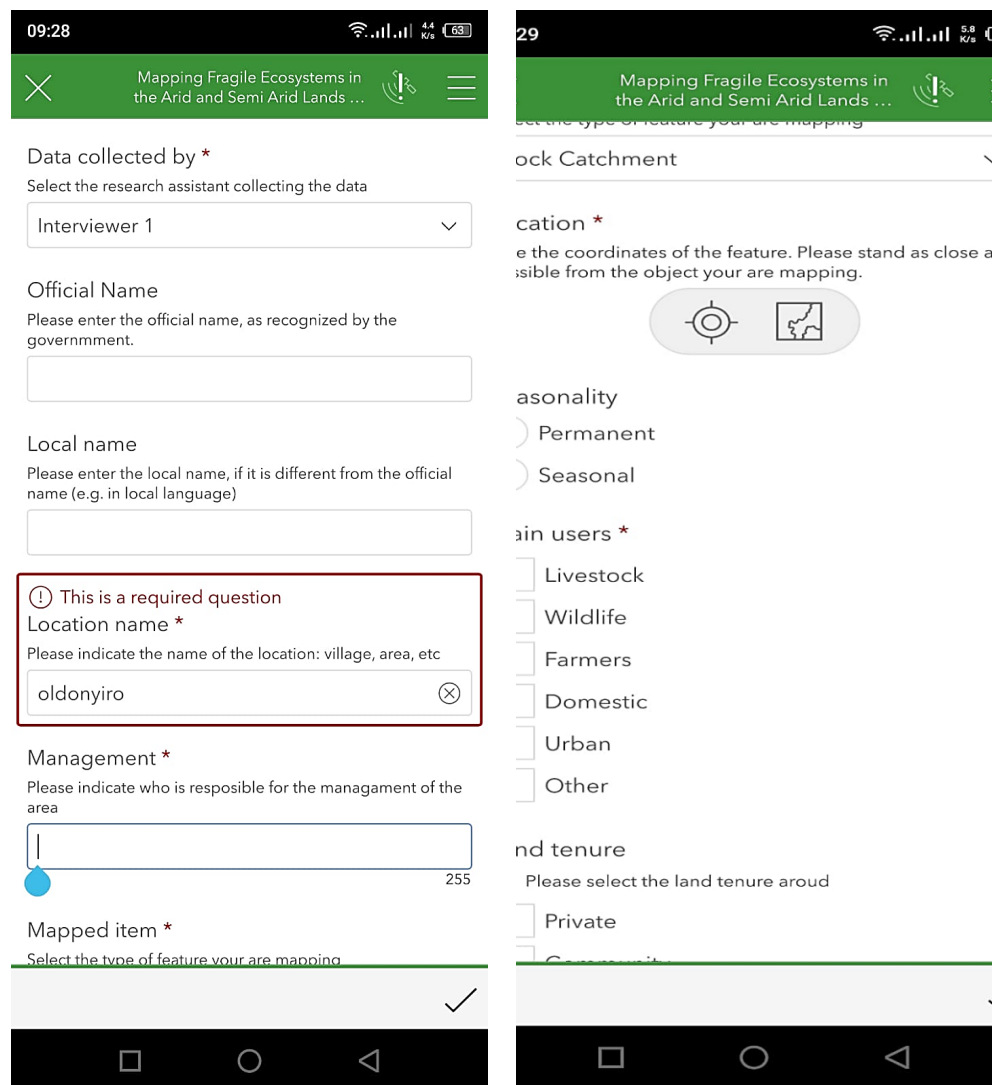


Figure 6: Survey123 interface showing the data collection digital form

Step 4: Recruitment and Training of Data Collection Assistants:

A team of 15 research / data collection assistants were identified, recruited and taken through a 3-day training on the use of ESRI's ArcGIS Survey123 application before they were sent to the field (Plate 4). The Data collection assistants who were recruited had at least past experience in similar exercise and were all graduates in various fields including statistics, rangeland development, Ecology and environmental studies, rural development, GIS and ICT.



Plate 4: Training of Data Collection Assistants

2.3.2 Phase 2: Data Collection

Step 5: Sampling:

The sampling procedure adopted was both stratified and purposive. The stratification was executed at the wards, locations, sub locations, up to the village level. On the other hand, purposive sampling was based on the community's intrinsic knowledge and understanding about the available assets in their localities where they deliberately took the mapping team to pick points and capture data. Further, additional data was also collected through expert-based observations to provide a better understanding on the nature and state of these assets including any threats. The data collection team equally compiled field notes describing what was observed based on an observation matrix. Photography was deployed to capture the key phenomenon of interest.

Step 6: Field Survey

Using the preliminary assets identification checklist and printed satellite imagery, the team proceeded to the field. The data collection team included a mix of the local communities (mainly the data collection team), local level opinion shapers, key resource persons and the technical team alongside government administration officials at the local level. The blend in team composition ensured social security and eliminated anxiety about the field mission.

With the data collection tablets and smart phones already installed with ArcGIS Survey 123 application, the field assistants proceeded to the field to pick the assets and the attendant points (Plate 4). Additionally, the attributes as per the data collection digital form included GPS coordinates and a minimum of three geo-tagged photos per asset. This information was then saved in the digital device's outbox.



Plate 5: Data Collection Team during the Field Survey

2.3.3 Phase 3: Data Mining & Analysis

Step 7: Verification of Facts and Data from the Field:

For purposes of quality control, the team held an end of each day debriefing session for data verification and cleaning as well as address any potential challenges encountered during the day. The data was then transmitted to the WYSS academy's cloud based Arch GIS online server.

Step 8: Data Analysis and Interpretation

Natural assets were categorized into distinct thematic areas (Table 2), based on resource types and aligned with environmental and land management classifications commonly used in ecosystem and resource planning. This thematic grouping also enabled the enumeration of all natural assets within the county. To assess the availability of these assets, we used the frequency of occurrence of each resource type across sub-counties and wards, rather than measuring their physical size. Where applicable, GPS coordinates were collected and mapped to visualize the spatial distribution of the assets according to thematic categories. A thematic analysis was undertaken to determine the frequency and percentage distribution of assets, highlighting sub-counties and wards with relative abundance or scarcity of specific resources.

In addition, the number of data collectors and validation workshop participants was analyzed to assess the integration of indigenous knowledge and gender inclusivity, thereby ensuring a participatory and inclusive approach. This methodology enabled the incorporation of traditional ecological knowledge into the asset mapping process,

enriching both the accuracy and community relevance of the findings. The team also conducted a comprehensive review of relevant policies, the Constitution of Kenya, and other legal frameworks to identify the key laws and provisions that secure and protect specific natural assets.

Finally, a detailed assessment of the management status of natural resources was conducted, with particular attention to water catchment areas, seasonal variability, and salinity levels. The study further examined land ownership and tenure systems, identifying critical challenges and potential threats that may undermine sustainable natural resource management.

Step 9: Continuous Brainstorming and Norming

Throughout the entire process, the team actively engaged in continuous brainstorming and norming sessions, which were integral to the success of the initiative(Plate 6).. Brainstorming provided an open platform for team members to freely share ideas, propose solutions, and explore innovative approaches to address emerging challenges. These sessions encouraged creativity, inclusivity, and collective problem-solving, ensuring that diverse perspectives were considered in decision-making.



Plate 6: Brainstorming and Norming Session

Norming, on the other hand, helped the team to establish and reinforce shared values, norms, and working principles that guided their interactions. Through this process, team members built trust, fostered mutual respect, and aligned their individual efforts towards common objectives. The norming sessions also played a critical role in clarifying roles, expectations, and standards of performance, which minimized potential conflicts and enhanced overall collaboration.

By continuously revisiting and refining their ideas and working relationships, the team was able to maintain a strong sense of cohesion and purpose. This iterative engagement ensured that all members remained focused on the shared vision and that their collective efforts were well-coordinated towards achieving the desired outputs. Ultimately, this process of continuous brainstorming and norming contributed significantly to the clarity of purpose, unity of direction, and overall effectiveness of the team

2.3.4 Phase 4: Public Participation and Validation of the Report

Article 10 of the Constitution, 2010 has already provided for public participation as a fundamental principle in governance. Further Article 232 (1) (d) emphasizes peoples involvement in policy making processes as a fundamental principle and value in public service. The Supreme Court of Kenya's judgement regarding Petition 5 of 2017) [2019] KESC 15 (KLR) provided clear public participation standards and guidelines under paragraph 95. Further, this judgement emphasized on Justice Odunga's judgement (par.75) in *Robert N. Gakuru & others v Governor Kiambu County & 3 others*[2014] eKLR, that public participation ought to be real and not illusory and ought not to be treated as a mere formality for the purposes of fulfillment of the Constitutional dictates.

Equally, validation forms a critical step in ensuring legitimacy, ownership and obedience to the rule of law; and in particular, the democratic principle governing people's participation in governance processes. In addition, the step provides the opportunity to improve the capacity and awareness of the various stakeholders and interested parties to critique and ventilate on the outcome of the mapping process. In this regard, structured engagements and validation sessions were convened with different stakeholders and interested parties. Additionally, validations provide spaces for corroboration, addition or deletions, as the case may be.

For the dryland asset mapping, a rigorous public participation and consultation with various stakeholders was conducted not just to comply with the legal requirements but to promote ownership and social legitimacy of the entire project. Consequently, a total of 67 participants (53 men and 14 women) were consulted and participated in the two rounds of public participation exercises that were convened by the Commission at Saala Hotel, Isiolo. Participants for the public participation exercises were drawn from MCAs, CECMs, Chief officers for lands and wildlife; Directors, land adjudication, registrar, KFS, KWS and WRA (Table 4 and Plate 7 - 8). The stakeholder inputs are consolidated in Appendix 1.

Table 5: Engaged Participants during public participation sessions

Sessions	Stakeholders Category	Engagement Date	No. of Attendants by Gender		TOTAL
			MEN	WOMEN	
1	National Government/Policy makers	Friday 8th November 2024			
			21	8	29
2	County Government of Isiolo	Thursday, 27th February 2025	33	5	38
	Members of County Assembly-Isiolo County Government	Wednesday 2nd April 2025	20	9	29
	TOTAL				96



Plate 7: Mr. Wandera (WYSS Academy For Nature) making a presentation during a validation session with the National Government/Policy makers



Plate 8: Mr. Opa (NLC) making a presentation during a validation session with the Isiolo Members of County Assembly

2.3.5 Ground Truthing and Filling of Data Gaps

Following the public participation and validation sessions, several data gaps and discrepancies were identified in the preliminary natural asset inventory. These included missing asset locations, inconsistencies in classification, unclear management status, and areas with incomplete spatial coverage. To address these issues, targeted ground truthing exercises were conducted in June 2025 (Plate 9) to verify and ascertain the facts regarding the issues raised. Field teams revisited selected sites to verify the existence, condition, and classification of assets that were flagged out during the public participation and validation sessions. The process involved direct observation, GPS point verification, and follow-up consultations with local stakeholders, including community elders, resource users, and county officials.

This step not only helped to correct and update the data but also incorporated additional insights provided by participants during the validation process—such as seasonal availability, cultural significance, and emerging threats to specific assets. Where new or previously undocumented assets were reported, they were mapped and integrated into the final database. Equally, the ground truthing exercise ensured that the revised dataset was accurate, inclusive, and reflective of both technical assessments and local knowledge, thereby strengthening the reliability and validity of the natural asset mapping and planning outputs.



Plate 9: Ground Truthing Exercise at Badha Bisan Hajaho (Forest of Smelly Water) – Kulamawe Location, Kinna Ward

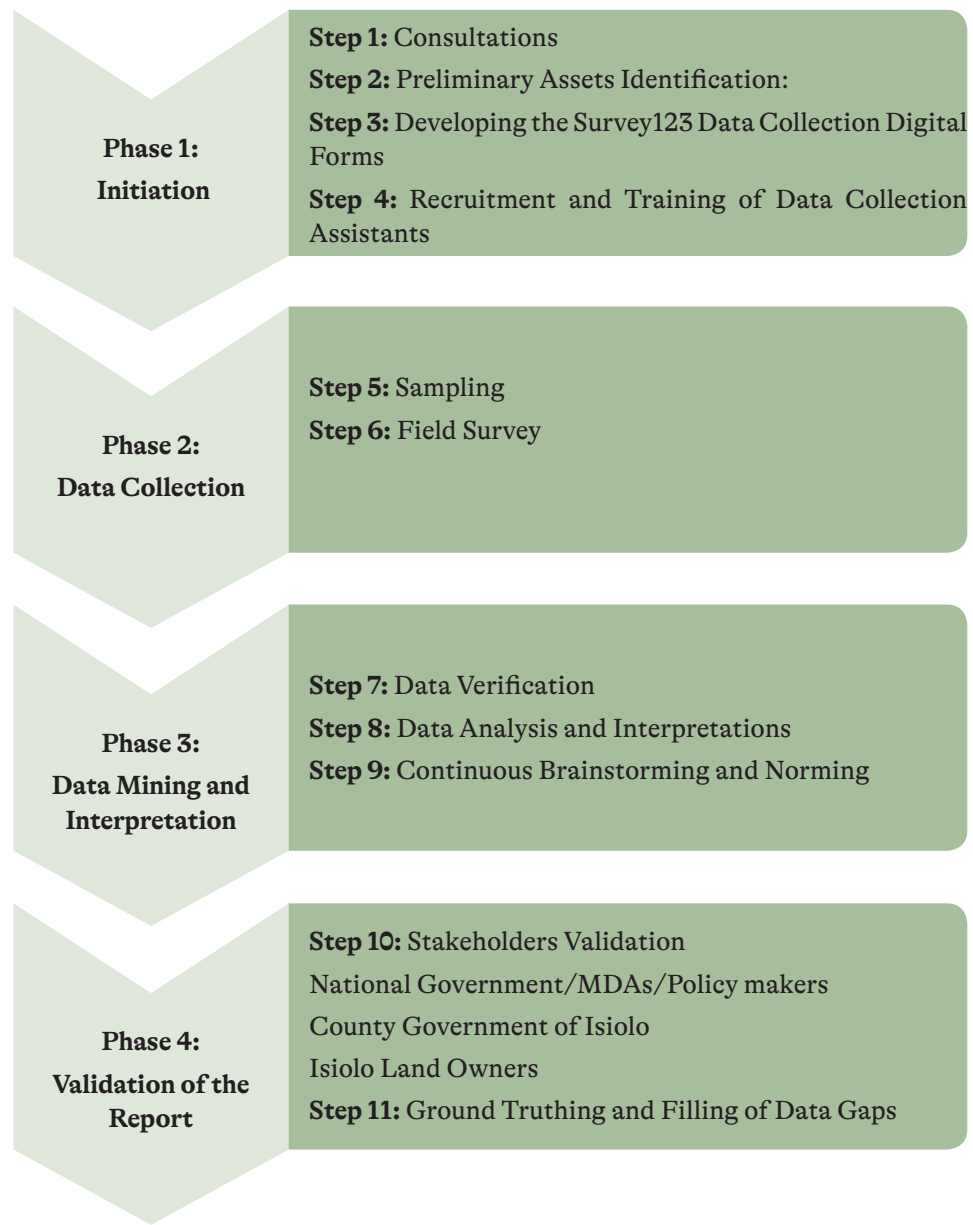


Figure 7: Methodology Adopted in the Assets Mapping Process

2.4 Summary of Challenges Encountered and the Mitigation Measures

While this community participatory asset mapping was a powerful approach to identify local resources, skills, and capacities, it did not fail to encounter challenges, including insecurity and vastness of the landscapes. Table 6 summarises the Challenges Encountered and Mitigation Measures applied during the exercise.

Table 6: Summary of Challenges Encountered and Mitigation Measures

Challenge	Mitigation strategy
Communities had fear of losing land when they heard of natural assets mapping.	Leveraging on NLC as the driver of the process to gain trust and provide clarity on land issues based on the law and constitutional provisions. The commission was able to manage expectations and demystify the underlying controversies around land and ownership issues.
Higher expectation from the community around short term benefits when organizations involved are mentioned	Clarifications made on roles and responsibilities alongside the anticipated benefits for the various parties involved in the exercise. This helped to cure the challenge relating to wild expectations from the various stakeholder groups
Language barrier during ground truthing exercise	Involvement of the local administration, village and clan elders, data gatherers drawn from local areas who speak local language
Administrative boundary conflict due to expansive nature of this kind of counties therefore making it difficult for the local communities to delineate their boundaries with some degree of specificity and precision	This provides an opportunity for the national government to collaborate with local elders to establish and demarcate local context boundaries for the purpose of achieving peace and sustainable development. This was also an important take away for the NLC and other relevant stakeholders to advance effective land administration including land delineation
Vastness, ruggedness and remoteness of the landscapes	This was cured through procuring 4WD vehicles that were capable of managing and enduring such harsh terrain and distances. In addition, the use of motorbikes by data assistants to penetrate and reach some of the hard -to- reach remote areas helped in enhancing maneuverability and access. Utilization of local communities who understand the terrain and are able to avoid where necessary and navigate such terrains.

<p>Inadequate resources- Manifested in both adequacy and timeliness. This caused delay in execution of project implementation</p>	<p>Heightened resource mobilization through fundraising including development of bankable project proposals alongside partnerships and collaborations. In addition, increased networking and pitching of concept idea notes and and marshaling donor goodwill and confidence through accountability and transparent systems and approaches</p>
<p>Security related challenges. The project areas are generally conflict prone, triggered by both political and natural induced pressures including changing climatic regimes as occasioned by extreme and prolonged drought</p>	<p>There is need to strengthen local level natural resource governance such as committees to manage and regulate access and usage of resources and bolster security through national government including disarmament operations in those regions. Integration of local communities in initiatives and projects e.g. Police reservists and clan elders in field missions is critical.</p>
<p>Failure to geolocate some asset locations, weather and internet issues to transmit data to the repository.</p>	<p>Survey 123 issues were reported, solutions provided and adopted.</p>
<p>Differing interpretations and terminologies of various asset locations and names.</p>	<p>This was reconciled through joint validation meetings and oral histories.</p>



3.

KEY NATURAL ASSETS IN ISIOLO COUNTY

3.1 Overview

Natural assets are the myriad forms of wealth created by nature, which forms an integral part of society. This section provides the inventory of the existing natural assets mapped in Isiolo County as at the time of the mapping exercise.

3.2 Water Resources

Isiolo County is endowed with various water resources that are spatially distributed over the landscape. The water resources in the County include rivers and laggas (seasonal water channels), swamps, ponds, rock catchments, springs, sand dams. From the mapping exercise, the County recorded total of 594 water resources which composed of 29 wetlands, 134 ponds, 40 rock catchments, 74 springs, 78 sand dams, 40 rock catchment, 134 water ponds and 239 laggas. Additionally a total of 90 water resources were listed during the stakeholders engagements but not mapped/ground truthed (Table 7 and Fig. 8).

Table 7: Surveyed and Listed Water Resource per Ward in Isiolo County

Type Of Asset	Kinna	Sericho	Garbatula	Burat	Ngaremara	Oldonyiro	Bulla Pesa	Cherab	Chari	Wabera	Total Mapped	Listed (Not Mapped)	Grand Total
Ponds	6	30	32	10	8	5	0	40	3	0	134	22	156
Rock Catchments	3	1	4	2	4	26	0	0	0	0	40	2	42
Sand Dams	4	12	11	9	0	21	0	13	8	0	78	16	94
Springs	2	0	5	14	17	29	6	0	1	0	74	16	90
Wetlands (Swamps)	1	8	6	3	2	0	0	9	0	0	29	10	39
Laggas	20	47	46	27	8	41	0	32	18	0	239	24	263

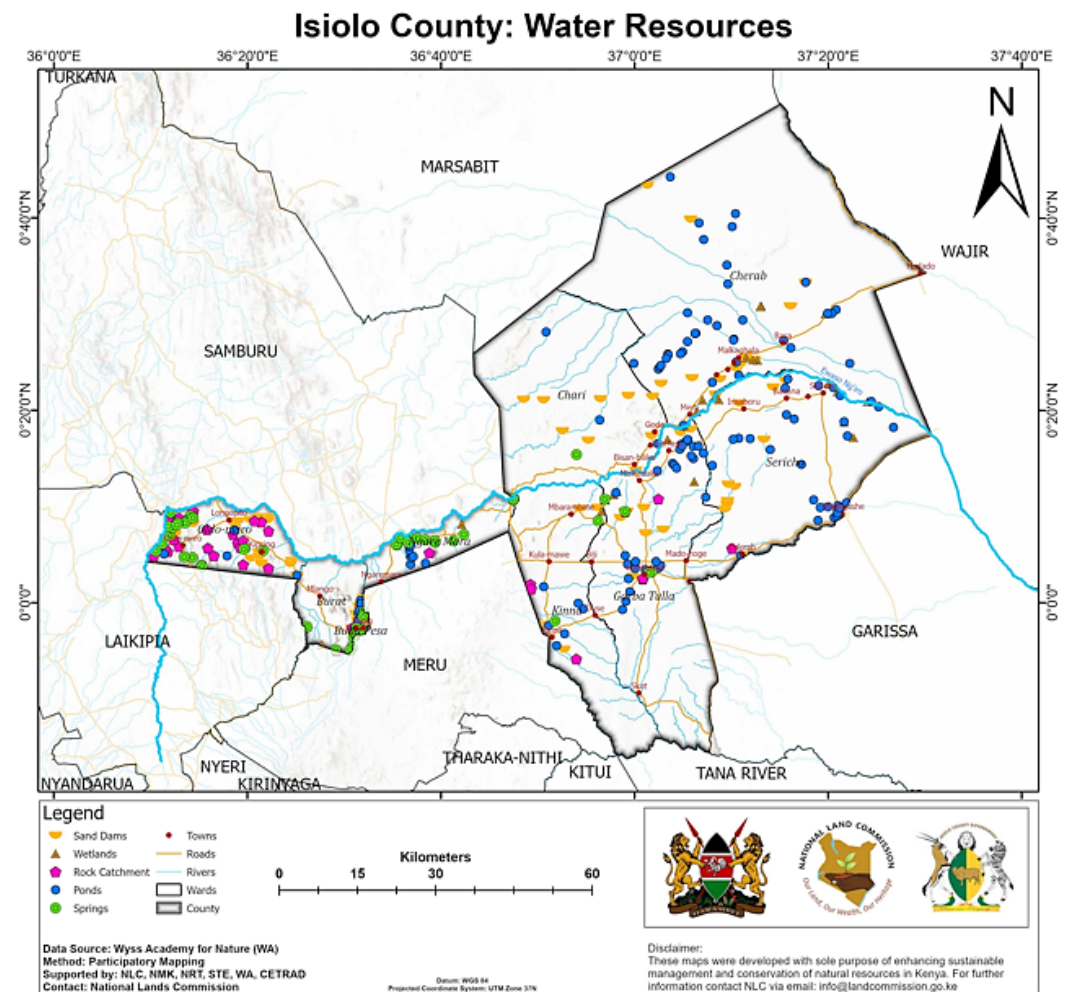


Figure 8: Isiolo County Water Resources

3.3 Rivers and tributaries (Laggas)

3.3.1 Numbers and Spatial Distribution

The Isiolo County's main river is the Ewaso Nyiro River (Plate 10), also known as Ewaso Ng'iro (Fig. 9). It originates in the western slopes of Mount Kenya and flows north, then east, and finally southeast, passing through Isiolo County. While the Ewaso Nyiro is the most prominent, Isiolo County also has two perennial rivers: Isiolo River (A tributary of Ewaso Nyiro) and Bisanadi River located in the eastern border near Merti (Largely seasonal but retains perennial pools in certain sections near Kinna and Malkadaka due to groundwater seepage and protected catchments).

Plate 10: Ewaso Nyiro River



Feeding into the above rivers are the laggas. A lagga is a shallow, dry channel that only carries water during periods of heavy rainfall, typically during flash floods. For the rest of the year, the channel remains dry or holds isolated water pools. A total of 239 laggas (water courses) were mapped with Garbatulla ward recording the highest at 48 due to a combination of its landscape features, hydrological conditions, soil properties, land use patterns, and catchment size. (Table 7).

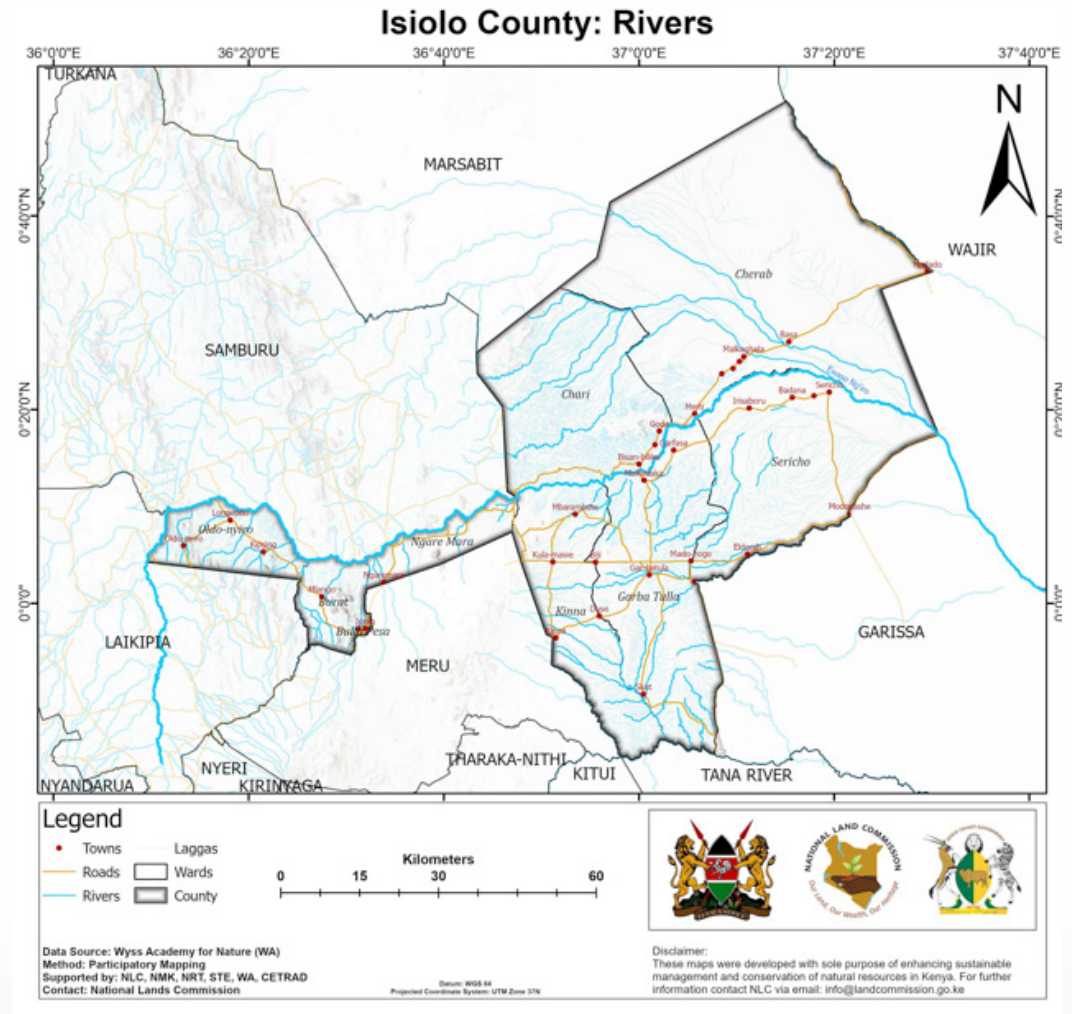


Figure 9: Surveyed Isiolo County Rivers and Laggas

3.3.2 Uses

The Ewaso Nyiro River and other perennial rivers in Isiolo County are a vital source of water for the region, supporting wildlife, livestock, and the local population as detailed in Table 8.

Table 8: Role and Uses of Ewaso Nyiro River in Isiolo County

Role	Description
Water Source and Livelihoods:	<ul style="list-style-type: none"> Agriculture: The River provides a reliable water source for irrigating crops and supporting agricultural activities, leading to increased crop yields and improved livelihoods for local farmers. Livestock: The river supports livestock grazing and watering, which is a crucial aspect of the agropastoral practices of many communities in this region. Human Communities: It provides a source of drinking water for human populations, supporting domestic needs and overall well-being.
Ecosystem Support	<ul style="list-style-type: none"> Wildlife Habitat: The river attracts a wide variety of wildlife, including elephants, rhinos, giraffes, and various bird species, making it an important habitat and contributing to the biodiversity of the area. National Reserves and Conservancies: The river's waters are essential for supporting wildlife in national reserves and conservancies like Samburu, Shaba, and Buffalo Springs. Riparian Ecosystems: It supports a unique riparian ecosystem, providing habitat for various plant and animal species.
Economic Development:	<ul style="list-style-type: none"> Tourism: The river and its associated wildlife and landscapes attract tourists, contributing to the local economy through tourism-related businesses like lodges, safari tours, and guiding services. Agropastoral Practices: The River supports agropastoral practices, which contribute to the local economy through the production of livestock and crops.
Cultural Significance	<ul style="list-style-type: none"> Heritage and Traditions: The River is a source of heritage for the communities, being central to many rituals, traditions, and cultural ceremonies.

3.3.3 Management

Constitutionally, all water resources belong to the people of Kenya collectively as a nation. These resources are national goods/assets that are under the direct control/ custody of the National Government, represented by Water Resources Authority (WRA). Specifically, the Ewaso Nyiro River Basin, located in Kenya, is managed by two River Basin Development Authorities: the Ewaso Ng'iro North River Basin Development Authority (ENNDA) and the Ewaso Nyiro South River Basin Development Authority (ENSDA). These authorities focus on promoting sustainable and equitable development within the basin, including water resource management, catchment conservation, and community development.

3.3.4 Threats and Challenges

The Ewaso Nyiro River in Isiolo county faces significant threats and challenges including water scarcity, climate change, and unsustainable agricultural practices. These challenges are exacerbated by factors like deforestation, overgrazing, and inadequate water management. The river's flow is also affected by upstream activities and the construction of dams as summarised in Table 9.

Table 9: Threats and Challenges Facing Ewaso Nyiro River in Isiolo County

Threat/Challenge	Description
Over-Abstraction and Unregulated Water Use:	<ul style="list-style-type: none"> Over-extraction: Increased water extraction for agriculture and other uses has led to declining river flows and water scarcity. Illegal abstractions: Uncontrolled water connections and illegal irrigation practices contribute to water wastage and pollution from agricultural chemicals. Water conflicts: Competition for water resources, particularly between upstream and downstream users, has escalated due to declining river water.
Degradation of the Catchment Area:	<ul style="list-style-type: none"> Deforestation and overgrazing: Loss of forest cover and excessive grazing pressure on rangelands have led to soil erosion and reduced water infiltration, impacting river recharge. Poor land use practices: Unsuitable agricultural practices and land clearing contribute to soil erosion and siltation of riverbeds, reducing water storage and flow. Sand harvesting: Uncontrolled sand extraction from riverbanks further destabilizes the river and contributes to its erosion.
Climate Change Impacts:	<ul style="list-style-type: none"> Erratic rainfall and drought: Changing rainfall patterns and increased frequency of droughts have reduced water availability in the basin. Drying up of springs: Climate change-related drying of springs and reduced groundwater recharge exacerbate water scarcity in the area. Increased temperature: Higher temperatures can lead to increased evaporation rates and further reduce water availability.
Other Challenges	<ul style="list-style-type: none"> Pollution: Agricultural runoff and industrial waste contaminate the river, impacting water quality and ecosystems. Insecurity: Insecurity in some areas can hinder water resource management and conservation efforts. Invasive species proliferation especially <i>Prosopis Juliflora</i> impeding access to the river and other resources insitu.

3.3.5 Opportunities

The Ewaso Nyiro River in Isiolo offers various opportunities for development, particularly through the Ewaso Ng'iro North River Basin Development Authority (ENNDA) and related projects. These include water harvesting, storage, and development projects, as well as catchment conservation efforts. Additionally, the river supports community capacity building initiatives and feasibility studies for large-scale infrastructure projects like the Ewaso Ng'iro North Multi-Purpose Dam (Table 10).

Table 10: Opportunities Presented by Ewaso Nyiro River in Isiolo County

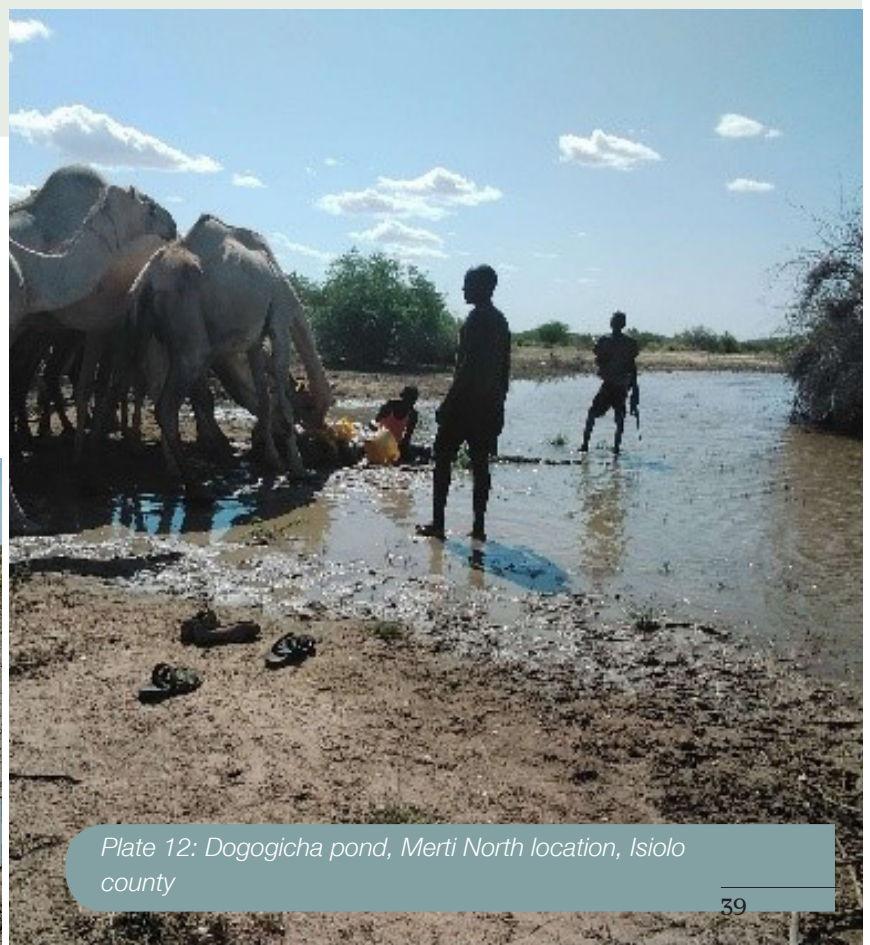
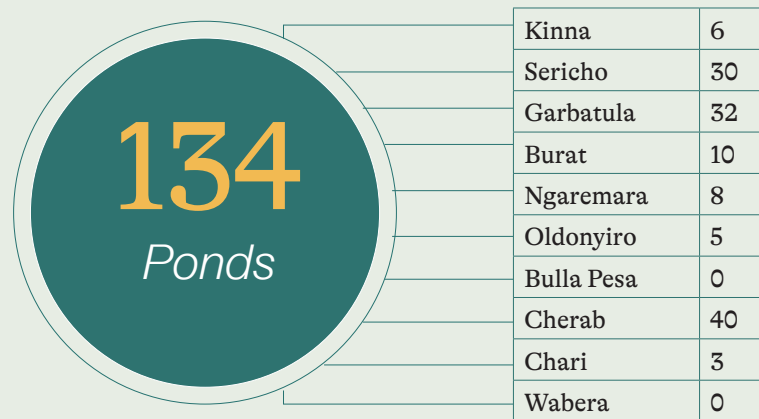
Opportunity	Description
Water Resources Development:	<ul style="list-style-type: none"> • Water Harvesting and Storage: ENNDA is developing water points, harvesting structures, and boreholes to ensure a reliable water supply for various purposes. • Dams and Infrastructure: The feasibility study for the Ewaso Ng'iro North Multi-Purpose Dam aims to provide hydropower generation, irrigation, and water supply for a growing population. • Drought Resilience: Initiatives like the Walda Integrated Agro-Pastoralism Development Project aim to improve livestock management and support pastoral communities in areas prone to drought. • Boreholes: Isiolo County is also focusing on drilling boreholes to tap groundwater.
Community Development and Empowerment:	<ul style="list-style-type: none"> • Capacity Building: ENNDA is implementing sensitization and capacity-building initiatives to empower local communities to actively participate in conservation efforts and promote sustainability. • Livelihoods Transformation: The Ewaso Ng'iro North Integrated Sustainable Livelihoods Transformation Programme aims to improve the livelihoods of communities through various initiatives. • Community Involvement: Projects like the Community Participatory Action Plans (CAPs) ensure community involvement in identifying and implementing projects.
Catchment Conservation:	<ul style="list-style-type: none"> • Reforestation: on rehabilitating degraded areas and riparian zones through reforestation and increasing vegetation cover. • Protection of Critical Areas: The project aims to protect these areas to ensure long-term sustainability.

3.4 Ponds

3.4.1 Numbers and Spatial Distribution

A defining feature of a pond is the presence of standing water formed by pooling inside a depression, either naturally or artificially (Plate 11 and 12). Of the total 134 ponds in Isiolo County, Cherab, Garbatula and Sericho had the highest number of ponds at 40, 32 and 40 respectively. No pond was mapped at Bulla Pesa and Wabera wards (Fig. 10 and Table 11). This distribution reflects the predominance of pastoralism and the acute need for water harvesting structures in these arid and semi-arid wards, where communities depend heavily on such ponds for livestock and domestic water supply during dry seasons. The absence of ponds in Bulla Pesa and Wabera wards can be attributed to their urban setting within Isiolo town, where alternative water sources such as piped water, boreholes, and county supplies are more common.

Table 11: Surveyed pond Resources per Wards in Isiolo County



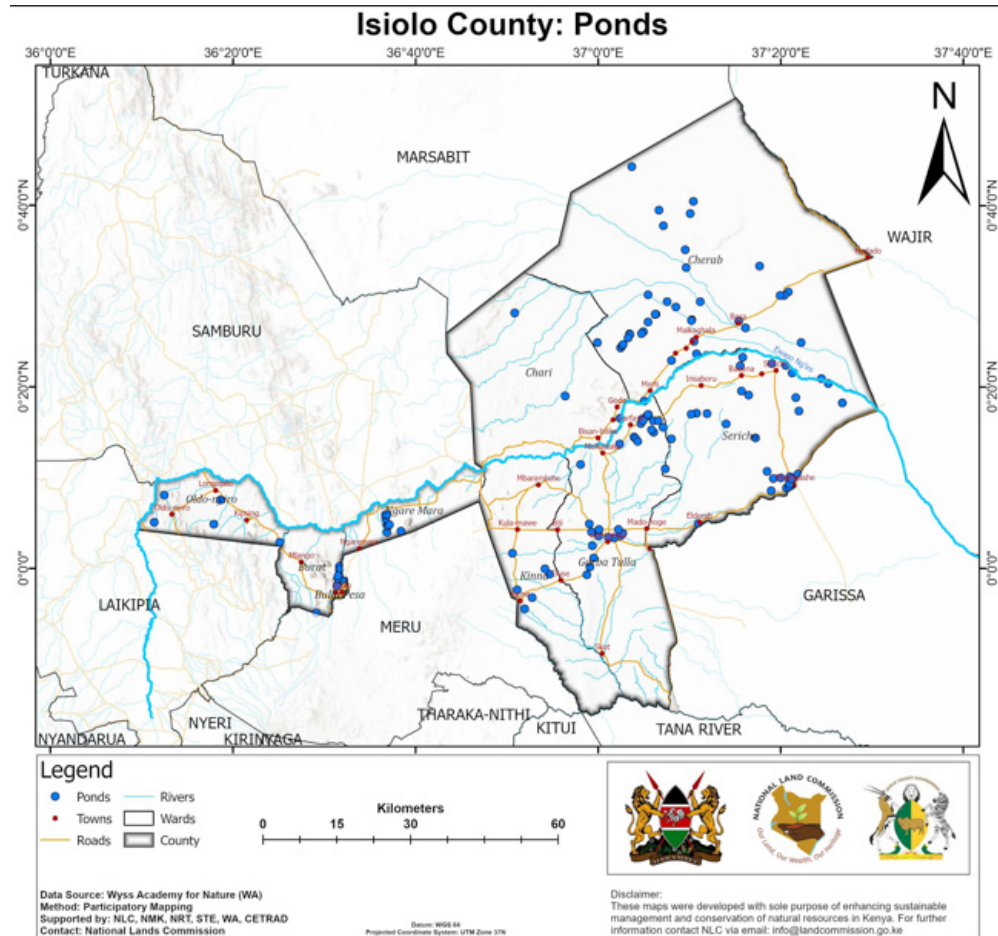


Figure 10: Spatial Distribution of Ponds in Isiolo County

3.4.2 Uses

Ponds in Isiolo County play a crucial role in water storage and utilization, especially during the dry season. They are used for livestock watering, household water needs, and can contribute to groundwater recharge. Additionally, water ponds are being developed as part of nature-based solutions to enhance water security and resilience in the arid and semi-arid region.

3.4.3 Management

Ponds management, especially in dryland regions such as Isiolo County is critical for ensuring water security, livelihood resilience, and environmental sustainability as well as sustainable access to water for both livestock and people, particularly during dry seasons. From the mapped water ponds, 42 are under community, 70 under community Conservancy, 12 under community water project, 1 under private management while 9 had no any management structures in place (Table 12).

Table 12: Management structures for ponds in Isiolo County

Management Type	Count	% of Total	Key Implications
Community	42	31%	Strong traditional structures to build upon
Community Conservancy	70	52%	Hybrid conservation-development role expanding
Community Water Project	12	9%	Under-investment in formalized systems
Private	1	<1%	Very limited private sector engagement
None	9	7%	Urgent need for intervention and governance

3.4.4 Threats and Challenges

In Isiolo County, water ponds face significant threats and challenges related to water scarcity and access, dynamic ecosystems, and institutional issues. Water scarcity, especially in arid areas, is a major concern, impacting water access and use efficiency. Climate change and erratic rainfall patterns further exacerbate these challenges, affecting ecosystem productivity and water security. Institutional limitations, such as underfunding and capacity gaps, also hinder effective water ponds management in the county.

3.4.5 Opportunities

Isiolo County has significant opportunities for developing water ponds due to its arid and semi-arid climate, fluctuating water availability, and potential for rainwater harvesting and groundwater recharge. Water ponds, along with other 3R measures-Recharge, Retention and Reuse- (such as road water harvesting and sand dams), can help buffer water supply during dry seasons. Specific opportunities include:

- **Water Pans:** The landscape offers natural depressions that can be enhanced or created as water pans to store rainwater.
- **Underground Tanks and Infiltration Ponds:** These offer potential for both storing rainwater and recharging groundwater, making it available during drier periods.
- **Groundwater Recharge:** The county also has potential for sustainable groundwater extraction, but further assessment is needed to determine volumes, recharge rates, and aquifer depths and quality.
- **Nature-Based Solutions:** The county's strategy recognizes the importance of natural water storage areas like ponds, as well as artificial recharge systems like agroforestry and conservation agriculture, which can enhance soil health and water retention.
- **Upstream Interventions:** Projects can focus on landscape restoration, promoting agroforestry, and water-filled barriers to control water availability and enhance water infiltration.

3.5 Rock Catchments

3.5.1 Numbers and Spatial Distribution

In arid and semi-arid lands with large rock outcrops, a lot of runoff is generated after rains where the runoff can be harvested and stored for domestic and livestock use (Plate 13-15). Rock catchments play a significant role in water storage and release especially in the drylands. A total of 40 rock catchments were recorded in Isiolo county, with Oldonyiro ward taking the larger share at 26. This is largely due to the ward's rocky terrain and arid conditions, which make rock catchments a practical and sustainable option for water harvesting to support pastoralist communities. (Table 13 and Fig. 11).

Table 13: Rock Catchments per Ward in Isiolo County



Plate 13: Ngiburin ekume rock catchment, Nakuprat Location



Plate 14: Lokiyoto Rock catchment, Nakuprat location

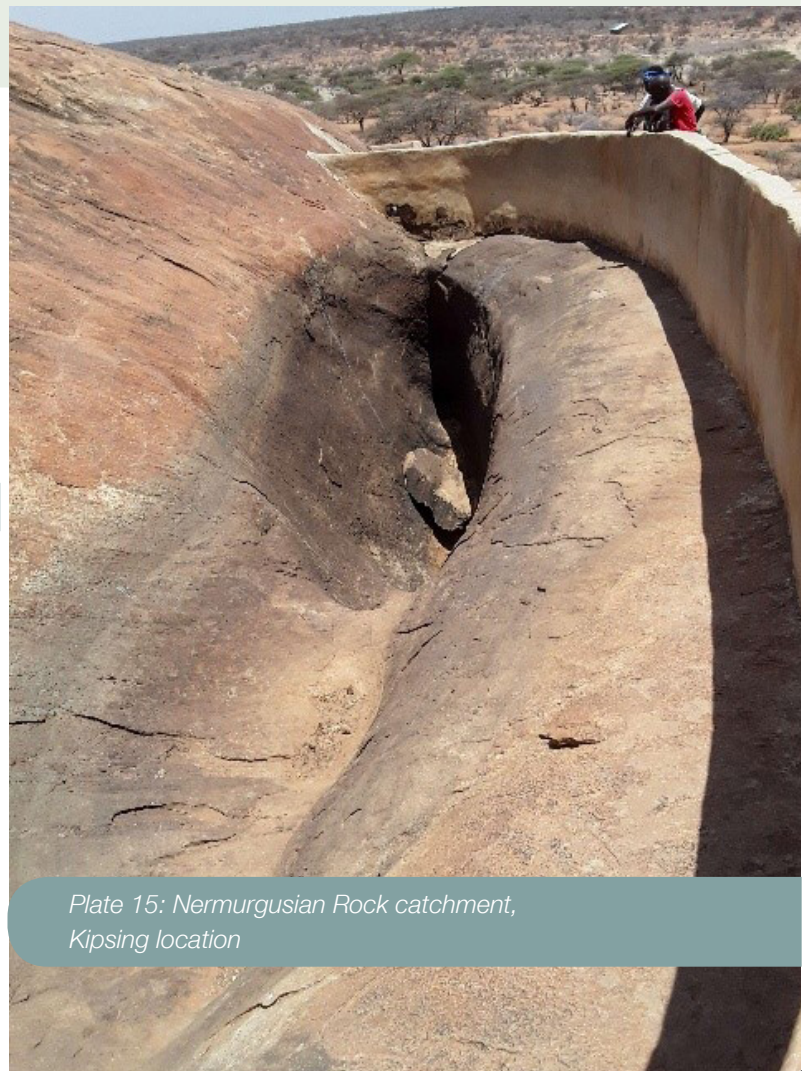


Plate 15: Nermurgusian Rock catchment, Kipsing location

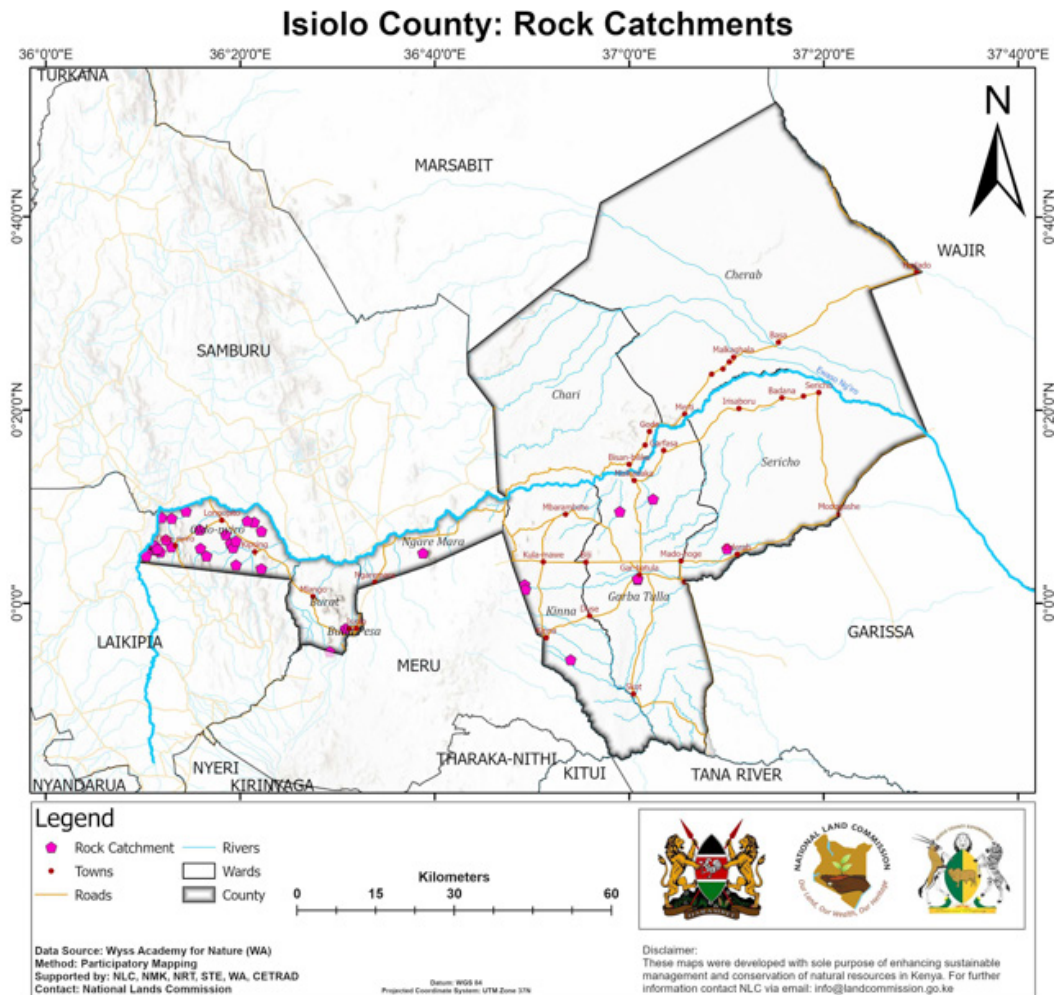


Figure 11: Spatial Distribution of Rock Catchments in Isiolo County

3.5.2 Uses

In Isiolo County, rock catchment systems, which leverage naturally occurring rock outcrops to harvest rainwater, are used primarily for water storage and to improve water security, particularly during drought periods. These systems divert runoff from the rocks to a central collection area, often a concrete tank, for later use. The specific role these rock catchment systems play in the County include:

- **Water Harvesting:** Rock catchment systems are an effective method of rainwater harvesting, especially in areas with rocky terrain where traditional methods like sand dams may not be suitable.
- **Drought Resilience:** They play a crucial role in enhancing water security and resilience, especially during drought periods when water sources are scarce.
- **Community Involvement:** The construction of rock catchment systems often involves community participation, with residents providing labour and locally available materials.
- **Sustainable Solutions:** These systems are considered a sustainable and cost-effective way to address water scarcity, aligning with the Isiolo County Water Strategy's focus on nature-based solutions.

3.5.3 Management

Rock catchments are an important rainwater harvesting technology in arid and semi-arid areas (like Isiolo County), especially where surface runoff from exposed rock outcrops can be harvested into tanks, ponds, or shallow reservoirs. Proper management ensures they function efficiently and sustainably. From the mapped rock catchments, 2 are under community (C), 21 under Community Conservancy (CC), 4 under community water project (CWP), 3 jointly under CWP-CC management while 9 had no any management structures in place (Table 14).

Table 14: Management structure for Rock Catchment in Isiolo

Management Type	Count	% of Total	Key Implications
Community (C)	2	~5.1%	Very limited use of traditional community-led management; potential underutilization.
Community Conservancy (CC)	21	~53.8%	Conservancies are the dominant managers ; critical actors in water governance.
Community Water Project (CWP)	4	~10.3%	Low institutional presence suggests limited technical oversight and funding access.
Joint CWP-CC	3	~7.7%	Promising collaborative model ; blends technical and customary knowledge.
Unmanaged	9	~23.1%	High vulnerability: urgent need for integration into governance structures.

3.5.4 Threats and Challenges

- **Construction and Design Problems:** Many rock catchments suffer from poor construction, improper design, and lack of adequate spillways and silt traps, leading to water loss and reduced effectiveness.
- **Improper Siting:** Rock catchments may be built in unsuitable locations, making them vulnerable to siltation and contamination.
- **Siltation:** Sediment buildup can clog the catchments, reducing their capacity to store and supply water.
- **Lack of Protection:** Without proper protection, rock catchments are susceptible to contamination from livestock and wildlife, as well as human activities.
- **Contamination:** Livestock and wildlife can contaminate water sources, posing health risks to communities.
- **Climate Change Impacts:** Increased drought frequency and severity due to climate change can reduce water availability in rock catchments, leading to water scarcity and food insecurity.

3.5.5 Opportunities

Isiolo County, characterized by its unique geography and climate, presents various opportunities for developing rock catchment systems to enhance water security and improve livelihoods. These systems can be crucial for harvesting rainwater and providing water access, especially during dry periods. Below is a breakdown of these opportunities:

- **Geographic Advantages:** Isiolo's landscape, with its rocky terrain and diverse ecosystems, is well-suited for rock catchment systems.
- **Water Harvesting:** Rock catchments can effectively collect rainwater runoff and store it for later use, providing a reliable water source, especially during droughts.
- **Economic Benefits:** The construction and maintenance of rock catchments can create local employment opportunities and generate income through water sales, contributing to community development.
- **Community Empowerment:** Local communities can actively participate in the planning, construction, and management of rock catchments, fostering a sense of ownership and responsibility for water resource management.
- **Improved Livelihoods:** Reliable access to water can improve livelihoods by supporting livestock watering, agriculture, and other essential activities, enhancing the quality of life in Isiolo.
- **Climate Change Adaptation:** Rock catchments are a nature-based solution that can help communities adapt to the impacts of climate change, particularly the increasing frequency and intensity of droughts.
- **Water Quality Enhancement:** The use of rock catchments can improve water quality by filtering out sediments and other contaminants, reducing the risk of waterborne diseases.

3.6 Sand Dams

3.6.1 Numbers and Spatial Distribution

Sand dams are built across impervious sandy streambeds in drylands that experience sporadic and high intensity rainfall (Plate 16-17). In total, 78 sand dams were identified and mapped in the county with Oldonyiro ward recording the highest number at 21. The concentration of sand dams in areas such as Oldonyiro Ward can be attributed to a combination of environmental, hydrological, and socio-economic factors. Oldonyiro’s terrain is characterized by numerous seasonal rivers (laggas) with sandy beds and underlying impervious layers, making it ideal for the construction of sand dams. The area also experiences sporadic, high-intensity rainfall, which sand dams are designed to capture and store by trapping water within accumulated sand, reducing evaporation losses.

Additionally, Oldonyiro’s arid conditions and frequent droughts have driven both community demand and development partner investments in sand dams as a sustainable water harvesting solution. The technology is well suited to support the pastoralist livelihoods in the ward, providing critical water supplies for both livestock and domestic use during dry seasons. In contrast, wards with fewer or no sand dams may lack suitable riverbeds, have alternative water sources, or face different development priorities (Table 12 and Figure 10).

Table 15: Surveyed Sand Dams per Ward in Isiolo County

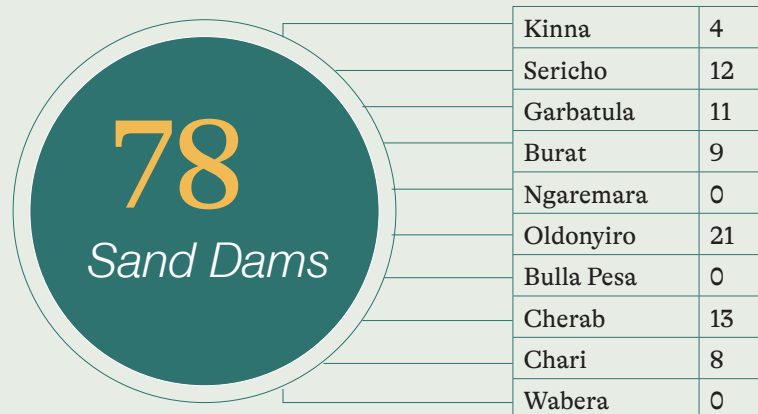
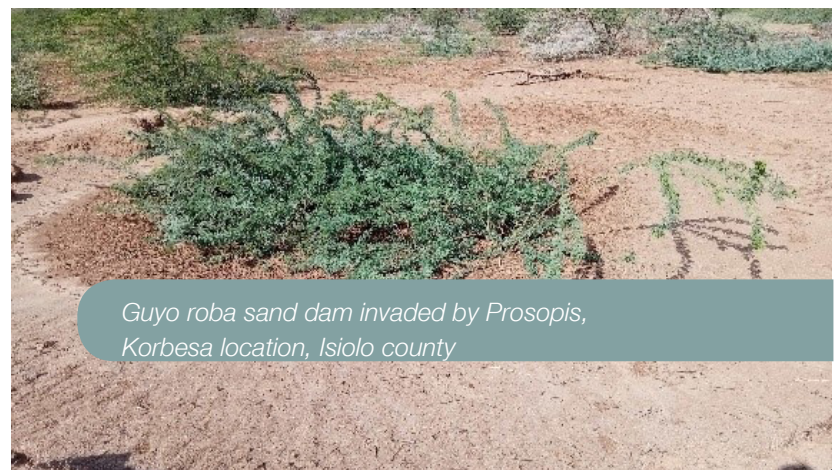


Plate 16: Koroftu sand dam, Merti location



Plate 17: Kotikore sand dam, Basa location



Guyo roba sand dam invaded by Prosopis, Korbasa location, Isiolo county

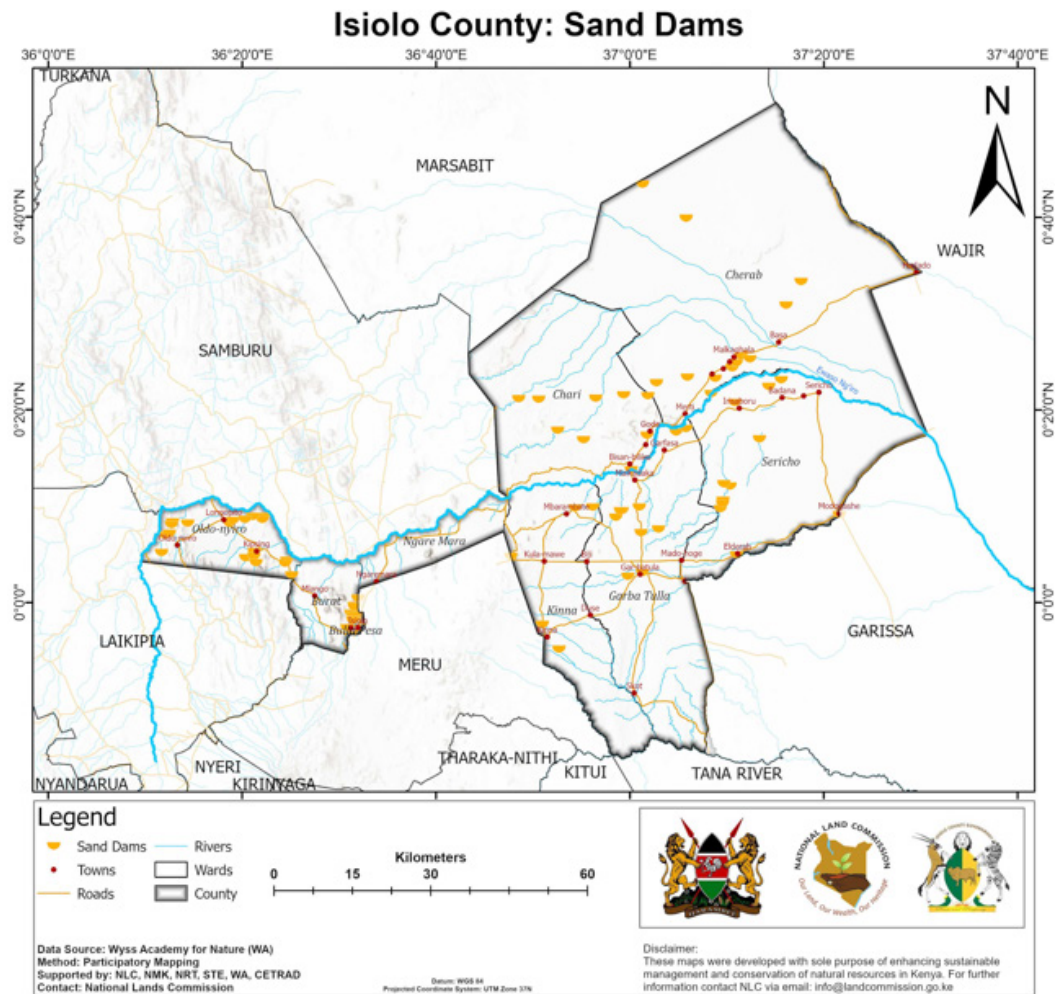


Figure 12: Spatial Distribution of Sand Dams in Isiolo County

3.6.2 Uses

Isiolo County utilizes sand dams, a low-cost water storage technique, to address water scarcity, particularly in areas with seasonal rivers. These structures, essentially walls built across riverbeds, trap water during the rainy season and hold it through dry periods, providing a reliable water source for communities, livestock, and wildlife.

3.6.3 Threats and Challenges

Sand dams in Isiolo County, a region facing severe water scarcity and climate change impacts, are threatened by several factors, including poor construction, inadequate maintenance, and the effects of climate variability. Additionally, challenges arise from sedimentation, lack of protection, and contamination as detailed below:

- **Poor Siting and Construction:** poor siting decisions, leading to insufficient water yield and project failure. Improper construction, lack of spillways and silt traps, and inadequate infrastructure maintenance also contribute to these challenges.
- **Sedimentation:** Sand dams accumulate sediment, which can reduce their water holding capacity and effectiveness over time.
- **Lack of Protection and Contamination:** Sand dams may lack proper protection from livestock and wildlife, leading to contamination.
- **Climate Variability:** Isiolo County experiences drought, unpredictable rainfall, and flooding, all of which impact the performance of sand dams.
- **Water Quality:** In Isiolo County, water quality can be affected by factors like surface runoff and animal waste, reducing the usability of the water collected from sand dams.
- **Community Management:** Lack of community involvement in the construction, maintenance, and management of sand dams can lead to their degradation.
- **Over-extraction:** Over-extraction of water from sand dams, especially during drought periods, depleting their water storage and impact the sustainability of the project.

3.6.4 Opportunities

In Isiolo County, there are opportunities for sand dam construction, rehabilitation, and maintenance. Other key opportunities include:

- **Water Security:** Sand dams provide a year-round water supply, reducing reliance on seasonal rainfall and improving water access for domestic use and agriculture.
- **Improved Agriculture:** Farmers can utilize the stored water for irrigation, increasing crop yields and diversifying agricultural practices.
- **Economic Empowerment:** Increased agricultural productivity and access to a reliable water source can lead to increased incomes for local communities.
- **Community Development:** Sand dams can free up time previously spent collecting water, allowing individuals to focus on education, healthcare, and other developmental activities.
- **Environmental Benefits:** Sand dams can help reduce soil erosion, improve soil health, and enhance biodiversity.
- **Climate Resilience:** By providing a reliable water source, sand dams can help communities adapt to the impacts of climate change, such as increased droughts.
- **Job Creation:** Sand dam construction and maintenance provide employment opportunities for local communities.
- **Peace and Security:** Sand dams can help reduce conflicts over water resources, promoting stability and peace in the region.

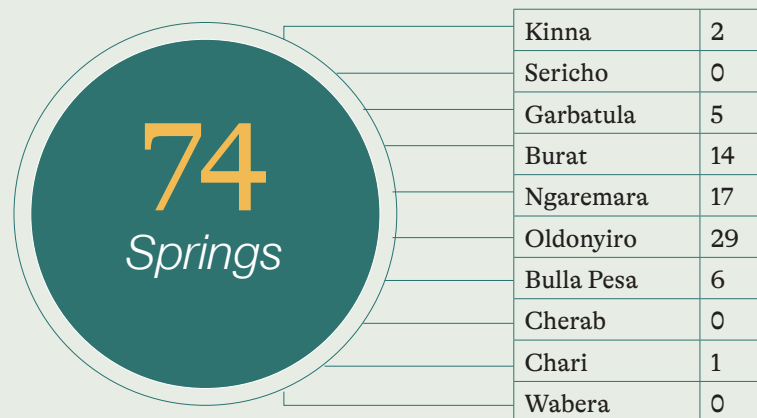
3.7 Springs

3.7.1 Numbers and Spatial Distribution

Springs are natural outflows of groundwater to the Earth's surface. They are formed when underground water pressure forces water to emerge from cracks and fissures in the ground (Plate 18). Springs have long been important for humans as a source of fresh water, especially in the drylands, which relatively receive scanty rainfall. They can also be indicators of the health of the groundwater system.

Springs in Isiolo County were recorded in all the wards except Sericho. Wabera and Cherab wards, which had none. A total of 74 springs were mapped within the county with Oldonyiro ward recording the highest share at 29. This can be attributed to the ward's varied topography, including hilly and rocky areas that enhance groundwater recharge and the emergence of springs. Given Oldonyiro's arid conditions, these springs provide critical water sources for both people and livestock, and their protection and utilization have been prioritized to support local pastoralist communities. The presence of more springs in Oldonyiro also reflects natural hydrological patterns, where water emerges along fault lines and at the base of rocky escarpments common in the ward. (Table 16 and Figure 19).

Table 16: Surveyed Springs per Ward in Isiolo County



1. Plate 18: Maradho dadacha spring, Malkadaka location, Isiolo county
2. Ngare spring in Shaba national reserve
3. Kurombarata spring, Modoyaka location

3.7.2 Uses

In Isiolo County, springs such as Kinna Kanchoradi, are vital for a variety of uses, including water supply for livestock, crops, and human consumption, and they play a crucial role in the local ecosystem. They are also important for maintaining river flows, improving water quality, and driving the water cycle as detailed in Table 17.

Table 17: Role and Uses of Springs in Isiolo County

Role	Description
Water Source for Livestock and Humans:	<ul style="list-style-type: none"> • Springs provide a reliable source of water for livestock, especially during the dry season when other water sources may dry up. • They also serve as a primary water source for human use, particularly in rural areas where access to other forms of water infrastructure is limited.
Supporting Agriculture:	<ul style="list-style-type: none"> • Springs can be used for irrigation, allowing farmers to grow crops even during dry periods. • In some cases, springs may be the only source of water available for agricultural activities.
Ecosystem Support:	<ul style="list-style-type: none"> • Springs are crucial for maintaining the health of the local ecosystem, as they provide a consistent source of water for various plants and animals. • They contribute to the overall water balance of the area, influencing river flows and groundwater levels. • Springs can also improve water quality by filtering water as it flows through the ground.
Community Management and Conservation:	<ul style="list-style-type: none"> • Communities in Isiolo County are actively involved in the management and conservation of springs, recognizing their importance for livelihoods and the environment.
Supporting Infrastructure:	<ul style="list-style-type: none"> • Springs can be used as a source of water for various infrastructure projects, such as water tanks and boreholes

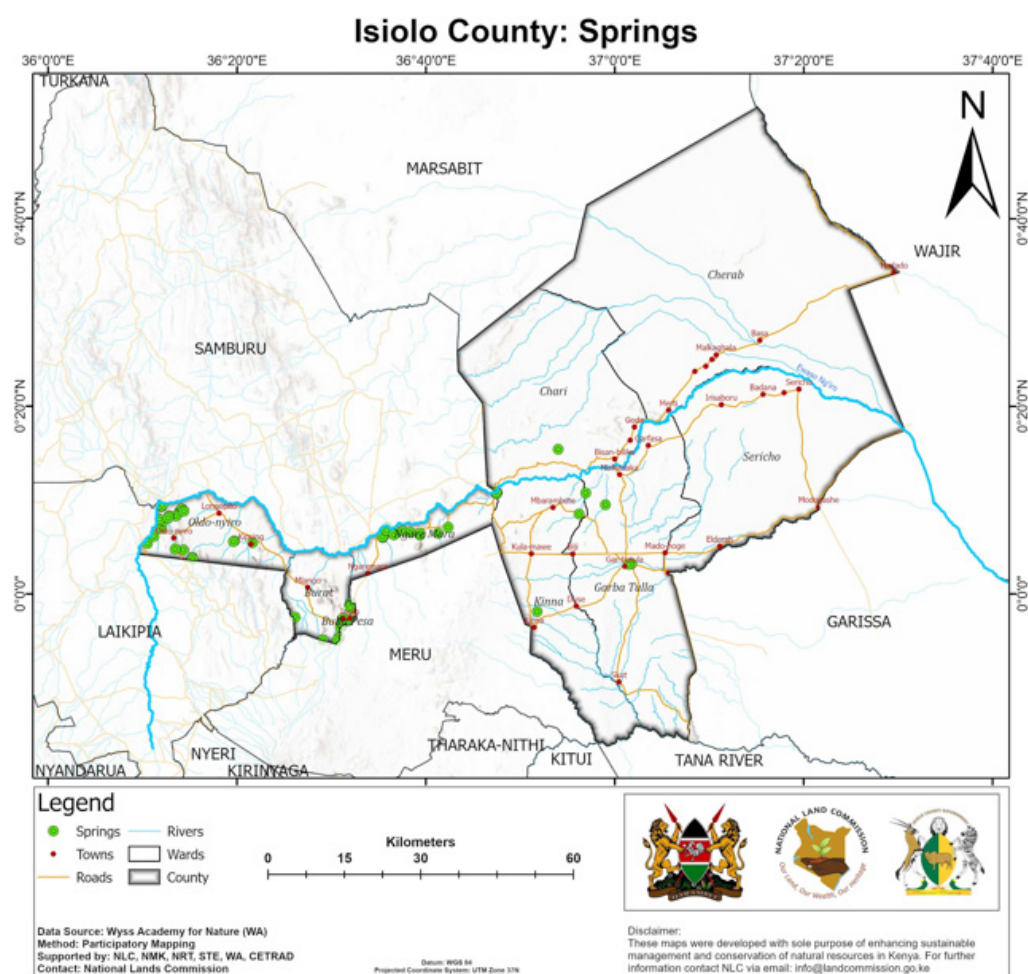


Figure 13: Spatial Distribution of Springs in Isiolo County

3.7.3 Management

Springs are vital and often perennial water sources that emerge naturally from underground aquifers. In ASAL regions such as Isiolo, springs are rare, highly valued, and often located in foothills, rocky escarpments, or riverbank aquifers. Their sustainability depends on strong community management, protection from degradation, and regular maintenance. From the mapped springs, 9 are under community (C), 42 under Community Conservancy (CC), 7 under community water project (CWP), 1 under county government and Kenya Red cross while 14 had no any management structures in place (Table 18).

Table 18: Management structure for springs, Isiolo

Management Type	Count	% of Total	Key Implications
Community (C)	9	~12.3%	Modest use of traditional community management; potential for strengthening Dedha system of land governance and management
Community Conservancy (CC)	42	~57.5%	Conservancies are primary managers; they play a central role in spring governance.
Community Water Project (CWP)	7	~9.6%	Few formalized WUAs; suggests need for more structured technical oversight.
County Govt + Kenya Red Cross	1	~1.4%	Very limited external institutional investment; more collaboration is needed.
Unmanaged	14	~19.2%	High-risk springs lacking protection, prone to degradation and conflict.

3.7.4 Threats and Challenges

In Isiolo County, springs face significant threats and challenges including climate change, drought, pollution, and water scarcity (Table 19). These challenges lead to water scarcity, long trekking distances, and high costs for accessing water. The county’s arid and semi-arid environment, along with erratic rainfall, exacerbate these issues, impacting livelihoods and food security, particularly for pastoralist communities

Table 19: Threats and Challenges facing Springs in Isiolo County

Role	Description
Climate Change and Drought:	<ul style="list-style-type: none"> • Droughts: Frequent and intense droughts are a major concern, leading to water scarcity and impacting livestock and agriculture. • Unpredictable Rainfall: Erratic rainfall patterns make it difficult to predict water availability, disrupting water supply and agriculture. • Increased Temperatures: Rising temperatures can lead to increased evaporation and heat stress, further reducing water resources.
Water Scarcity and Accessibility:	<ul style="list-style-type: none"> • Water Quality: Water sources may be contaminated, raising concerns about water quality and the spread of waterborne diseases. • Competition for Water: Competition between different users, including pastoralists, agricultural communities, and urban populations, can create tension over water resources.
Pollution and Degradation	<ul style="list-style-type: none"> • Pollution: Water sources can be polluted by runoff from agricultural activities, waste disposal, and industrial discharge, impacting water quality. • Over-extraction: Inadequate management of water resources, including over-extraction from boreholes and rivers, can deplete groundwater supplies and reduce river flow. • Land Degradation: Soil degradation and deforestation in catchment areas can reduce infiltration and runoff, impacting water availability.
Infrastructure and Management Challenges:	<ul style="list-style-type: none"> • Inadequate Infrastructure: Lack of proper water infrastructure, such as storage tanks and pipelines, can limit water availability and distribution. • Poor Management: Insufficient planning and coordination between different stakeholders, including government agencies, community groups, and private entities, can hinder effective water management. • Lack of Community Ownership: Lack of community participation in water resource management can lead to a lack of accountability and sustainability.

3.7.5 Opportunities

Isiolo County has significant opportunities for spring protection and sustainable development among other opportunities as detailed in Table 20. By combining these opportunities with innovative water management strategies and community participation, Isiolo County can enhance water access and improve livelihoods, particularly in the dry season.

Table 20: Opportunities for Springs in Isiolo County

Role	Description
High Groundwater Potential:	<ul style="list-style-type: none"> Isiolo Central: Isiolo town and the western parts of the county exhibit high groundwater spring potential, making them ideal for borehole and spring development.
Community-Based Water Management:	<ul style="list-style-type: none"> Spring Conservation through local stewardship in water conservation. Water Harvesting: The biophysical landscape of Isiolo offers opportunities for low-cost water harvesting solutions, such as road water harvesting, water pans, and sand dams. Community Participation: Community involvement is crucial for the sustainability of rural water projects, ensuring that water development efforts are aligned with local needs and priorities.
Addressing Challenges:	<ul style="list-style-type: none"> Water Scarcity: About 65% of Isiolo is classified as “very arid,” highlighting the need for sustainable water resource management. Water Quality: While many water sources are found in Isiolo, a few of them have fresh water, limiting the availability of palatable water for human consumption, especially in the dry season.
Technological Solutions:	<ul style="list-style-type: none"> Solar-powered pumping systems, improving access to water and reducing reliance on diesel generators.

3.8 Wetlands (Swamps/Marshes)

Numbers and Spatial Distribution

Swamps/Marshes are wetlands that are frequently or continually flooded with water, characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions (Plate 19-21). The Lorian Swamp is the largest wetland in Isiolo County, forming part of the Ewaso Ng'iro River basin and serving as a critical ecological zone (Plate 14). The Ewaso Ng'iro River flows for about 700 km before emptying into the Lorian Swamp.

Another important wetland identified during the mapping exercise is the Marire Swamp in Central Location, Isiolo Town. As a permanent wetland, it plays a significant role in the ecological, socio-economic, and hydrological landscape of this semi-arid urban environment, including supporting fish farming.

In total, the mapping initiative identified 29 additional wetlands distributed across all wards, with Cherab Ward recording the highest number at 9. This is attributed to Cherab's extensive low-lying terrain, proximity to seasonal watercourses, and its location within flood-prone zones of the Ewaso Ng'iro basin, all of which favor wetland formation and persistence. (Table 21 and Fig. 12).

Table 21: Wetlands per Ward in Isiolo County



Plate 19: Marire wetland/ swamp in Central Location

Plate 20: Kuro Takari wetland, Modoyaka location

Plate 21: Rake wetland, Malka Galla location

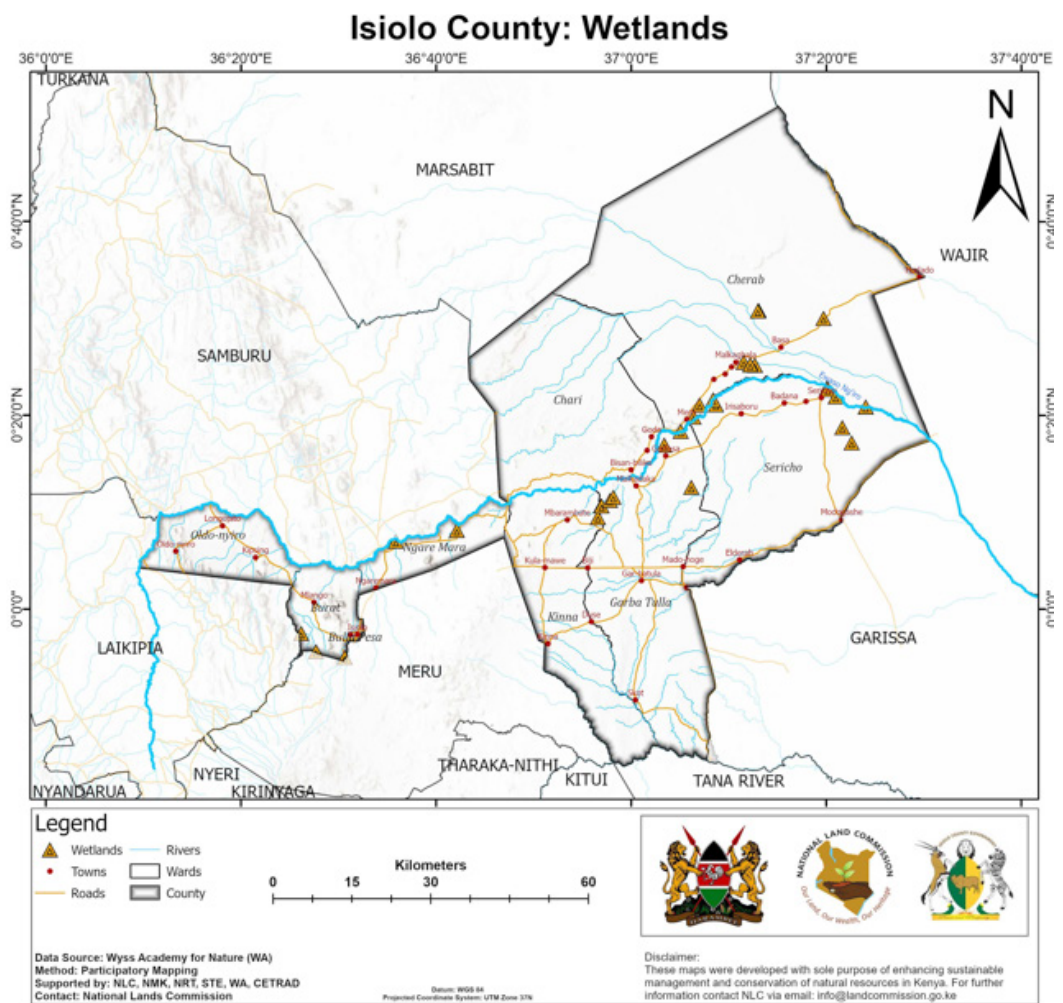


Figure 14: Surveyed Wetlands (Swamps/Marshes) in Isiolo County

3.8.2 Uses

Wetlands in Isiolo County offer numerous benefits, including water regulation, supporting biodiversity, and serving as a livelihood source for local communities. They also play a crucial role in water purification, flood control, and nutrient cycling within the ecosystem as detailed in Table 22.

Table 22: Role and Uses of Springs in Isiolo County

Role	Description
Ecological Importance:	<ul style="list-style-type: none"> Water Source: Wetlands in Isiolo, like Lorian swamp, act as vital water sources for human, livestock and wildlife populations. Flood Control: They help regulate water flow, reducing flood risks during heavy rains. Water Filtration: Wetlands act as natural filters, removing pollutants and sediments from water, improving water quality. Biodiversity: They support a wide variety of plant and animal species, contributing to the region's rich biodiversity. Carbon Storage: Wetlands store significant amounts of carbon, helping to mitigate climate change. Nutrient Cycling: They play a role in nutrient cycling, ensuring the health of the surrounding ecosystem.

Role	Description
Livelihood Support:	<ul style="list-style-type: none"> • Farming and Livestock: Local communities utilize wetlands for crop cultivation and grazing livestock, particularly during the dry season. • Fishing: Wetlands provide a source of fish, contributing to food security and income for some communities. • Tourism: Some wetlands, like Lorian Swamp, attract tourists due to their wildlife and scenic beauty, generating income for local communities. • Traditional Practices: Wetlands are often associated with traditional knowledge and practices related to resource management.

3.8.3 Management

Wetlands in ASAL regions like Isiolo County are rare but critical ecosystems, often tied to seasonal rivers, springs, or groundwater-fed basins. They provide year-round water, support biodiversity, act as drought buffers, and are crucial for pastoral livelihoods. From the mapped wetlands, 14 are under community (C), 11 under Community Conservancy (CC), 2 under community water project (CWP), 2 private management while 10 had no any management structures in place (Table 23).

Table 23: Management structures for Wetlands in Isiolo

Management Type	Count	% of Total	Key Implications
Community (C)	14	~35.9%	Strong local ownership; however, may lack formal protection or technical support.
Community Conservancy (CC)	11	~28.2%	Indicates growing integration of wetlands into rangeland and wildlife governance.
Community Water Project (CWP)	2	~5.1%	Very limited formal water project engagement; suggests technical underinvestment.
Private	2	~5.1%	Raises concerns on access equity; may restrict communal use in dry seasons.
Unmanaged	10	~25.6%	High risk of degradation, overuse, and conflict; urgently need governance structures.

3.8.4 Threats and Challenges

Wetlands in Isiolo County face numerous threats and challenges, including climate change impacts like droughts and floods, unsustainable land use practices, and a lack of awareness and coordination in wetland management. These issues lead to biodiversity loss, reduced water availability, and socio-economic challenges for local communities as detailed below:

- **Encroachment:** Rapid urban growth in Isiolo Town has led to illegal land reclamation and construction in and around the wetland.

- **Pollution:** Solid waste dumping and wastewater discharge degrade water quality and ecosystem health.
- **Lack of Protection:** Most wetlands such as Marire is not formally gazetted or recognized in urban land use planning, making it vulnerable to development.
- **Overgrazing & Degradation:** Livestock grazing within the wetland causes trampling, erosion, and nutrient loading.
- **Climate Change:** Isiolo County is highly vulnerable to climate change, experiencing extreme droughts, unpredictable rainfall, and floods.
- **Unsustainable Land Use:** Deforestation, overgrazing, and other unsustainable land use practices contribute to land degradation and desertification, impacting water availability and wetland health.
- **Inadequate Awareness:** Limited knowledge among local communities about the ecological and economic benefits of wetlands hinders conservation efforts.
- **Weak Governance and Policy Gaps:** A lack of coordinated wetland management approaches due to multiple sectoral laws hampers effective resource management.
- **Unsustainable Water Use:** Increased water extraction for irrigation, livestock, and domestic use puts pressure on wetland water resources.
- **Socio-economic and Cultural Threats:** Activities like crop and livestock production, reed harvesting, and fishing can impact wetland ecosystems if not managed sustainably.
- **Biodiversity Loss:** The natural habitat surrounding wetlands is diminishing, leading to a decline in plant and animal species.
- **Social and Economic Challenges:** Water scarcity and climate-related disasters affect pastoralists and agro-pastoralists, leading to reduced livestock productivity, income, and food security.

3.8.5 Opportunities

Isiolo County has significant opportunities related to wetlands, particularly for water security and resilience, biodiversity conservation, and carbon sequestration including via carbon credit schemes. These opportunities are especially important given its arid and semi-arid environment as detailed below:

- **Water Security and Resilience:** Wetlands can act as natural water storage areas, helping to mitigate water scarcity, especially during dry periods, according to the Isiolo County Water Strategy.
- **Biodiversity Conservation:** Wetlands are crucial habitats for various species, including wildlife that utilize migratory corridors connecting different parks and conservancies.
- **Carbon Sequestration:** Wetlands can help absorb carbon dioxide from the atmosphere, contributing to climate regulation.
- **Ecosystem Services:** Wetlands provide essential ecosystem services like natural water filtration, helping to maintain the health of surrounding ecosystems and reduce pollution.
- **Agroforestry and Conservation Agriculture:** Promoting these practices can enhance soil health and water retention, complementing natural wetland processes.
- **Groundwater Recharge:** Wetlands can contribute to groundwater recharge, providing a sustainable water source for various uses.
- **Sustainable Livelihoods:** Wetlands can support livelihoods through activities like agriculture, fishing, and ecotourism, especially in areas where alternative sources of income are limited.
- **Climate Change Adaptation and resilience:** Wetlands play a vital role in adapting to climate change by providing flood control and other climate-related ecosystem services and benefits.

3.9 Water Availability/Seasonality

Water availability in Isiolo County is highly variable and closely tied to seasonality, climatic patterns, and geographic features. From the mapping data, water availability in Isiolo County shows remarkable changes due to the erratic and spatial variation of rainfall during the months and seasons. The months of January-March exhibiting water scarcity occasioned by dry spell. As the rainy season sets in during the months of April, May and June (AMJ), the water becomes available in the county for various purposes. A similar pattern is exhibited during the short rainy session consisting of October, November and December (OND). The general pattern and seasonal variation of water availability in Isiolo County visually depicted in Fig.13.

Understanding the seasonal and spatial variations in water availability in Isiolo County is critical for effective water resource planning, ecosystem management, and livelihood resilience in this predominantly arid and semi-arid environment. The mapping data highlights how erratic rainfall patterns and prolonged dry spells (particularly between January and March) contribute to water scarcity, increasing vulnerability for pastoralist communities and urban settlements. Conversely, the periods of enhanced water availability during the long (AMJ) and short (OND) rainy seasons provide vital opportunities for water harvesting, agricultural production, and ecosystem restoration. Recognizing these patterns enables informed decision-making on the design and timing of interventions such as water storage infrastructure, drought preparedness measures, and sustainable land use practices.

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Understanding the seasonal and spatial variations in water availability in Isiolo County is critical for effective water resource planning, ecosystem management, and livelihood resilience in this predominantly arid and semi-arid environment

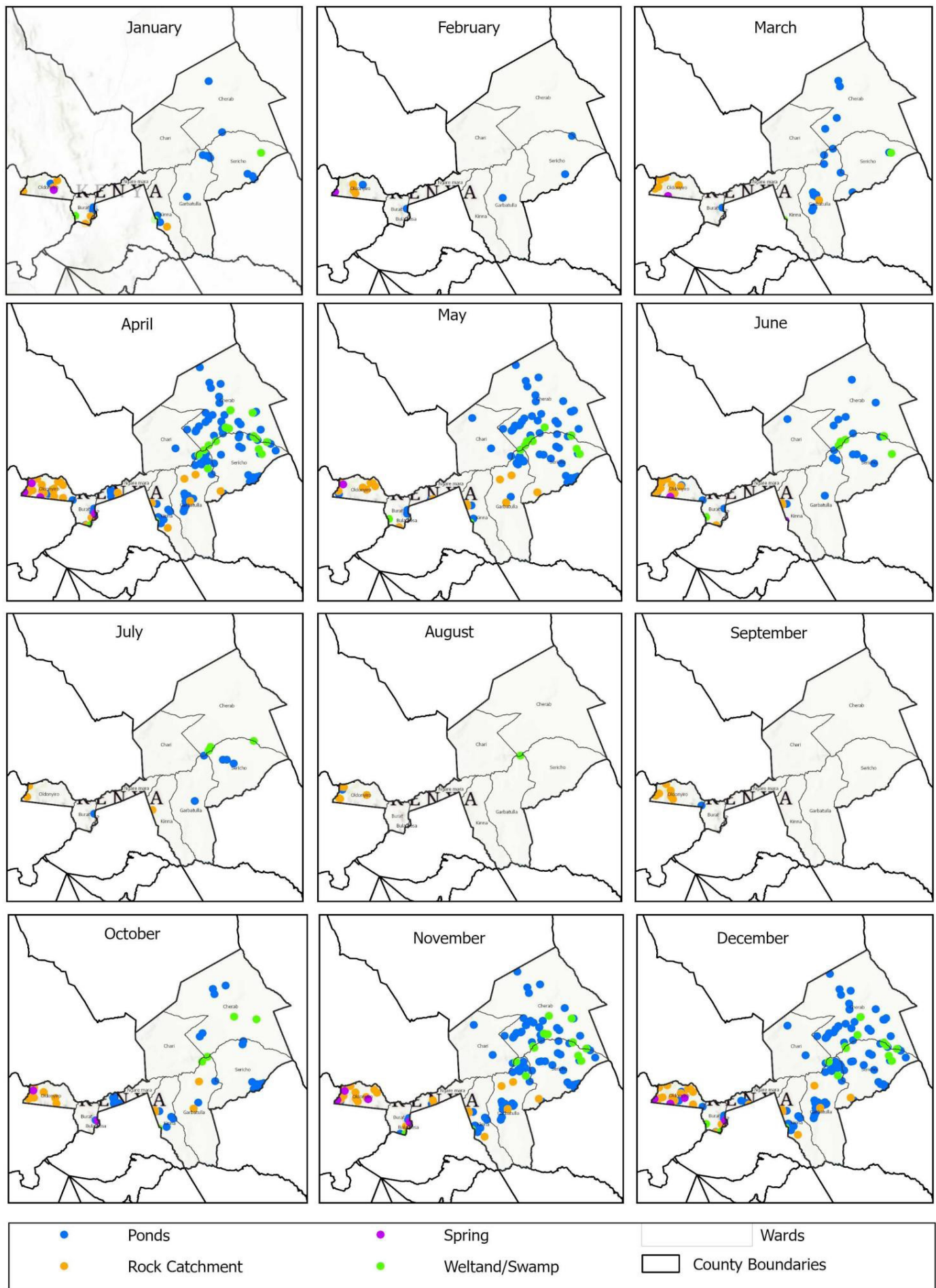
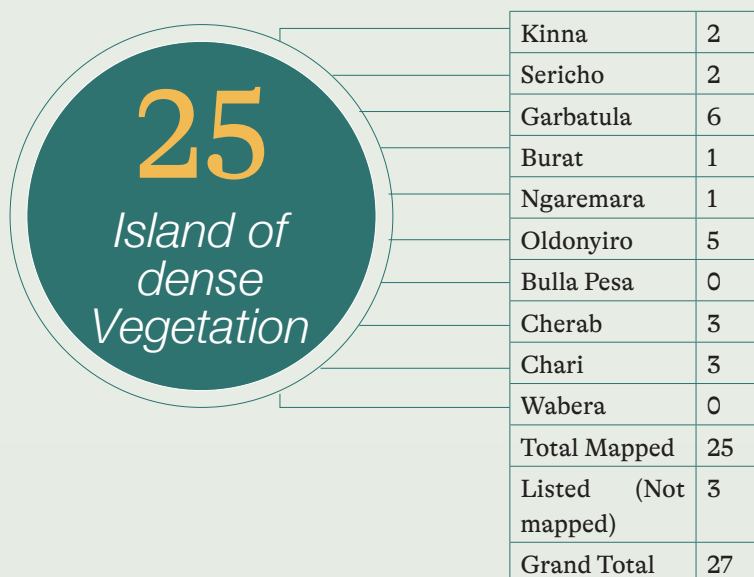


Figure 15: Seasonal Water Availability in Isiolo County

3.10 Islands of Dense Vegetation

In the largely arid and semi-arid landscape of Isiolo County, dense islands of vegetation refer to isolated pockets or clusters of relatively lush and green vegetation that stand out from the surrounding dry and sparsely vegetated areas. These islands are ecologically and socio-economically connected and significant due to their role in biodiversity conservation, water retention, and livelihood support. They are typically located in areas with favorable microclimatic conditions, higher soil moisture, or permanent/seasonal water availability. A total of 25 islands of dense vegetation were identified and mapped in all the wards except in Bulla Pesa and Wabera wards (Table 23 and Figure 16). The absence of such vegetation islands in Bulla Pesa and Wabera wards can be attributed to their predominantly urban and peri-urban land use, where built-up areas, infrastructure development, and intensive human activity have limited the persistence of natural vegetation unlike other wards

Table 24: Surveyed Islands of Dense Vegetation in Isiolo County



The key islands of dense vegetation mapped include:

- The Awoi Anok Ngitukoi and Nataruk islands of dense vegetation in Ngaremara ward stood out as a communal island of dense vegetation in Ngaremara Ward that is used for grazing by livestock, pastoralists, and wildlife. Access to Nataruk Island of Dense Vegetations restricted by Buffalo Springs Reserve management.
- The Badha Bisan Hajaho (*Forest of Smelly Water*) in Kulamawe Location, Kinna Ward: Badha Bisan Hajaho, meaning “Forest of Smelly Water” in the local Borana dialect, is a unique wetland–woodland mosaic located in Kulamawe Location, Kinna Ward within Isiolo County. This site holds ecological, cultural, and hydrological significance and is one of the few naturally vegetated seasonal wetlands in the arid northeastern landscape of Kenya.
- **Badha Sotewesa (Forest of Giraffes) – Kulamawe, Kinna Ward:** This unique patch of indigenous woodland serves as an important ecological and cultural landscape within the wider Isiolo drylands. The name itself is derived from the area’s historic and seasonal role as a preferred habitat and browsing ground for reticulated giraffes, which frequently congregate here during certain times of the year. **These forests/areas of dense vegetation also act as wildlife corridors connecting Shaba and Meru National Park.**



Badha Bisan Hajaho (Forest of Smelly Water) in Kulamawe Location

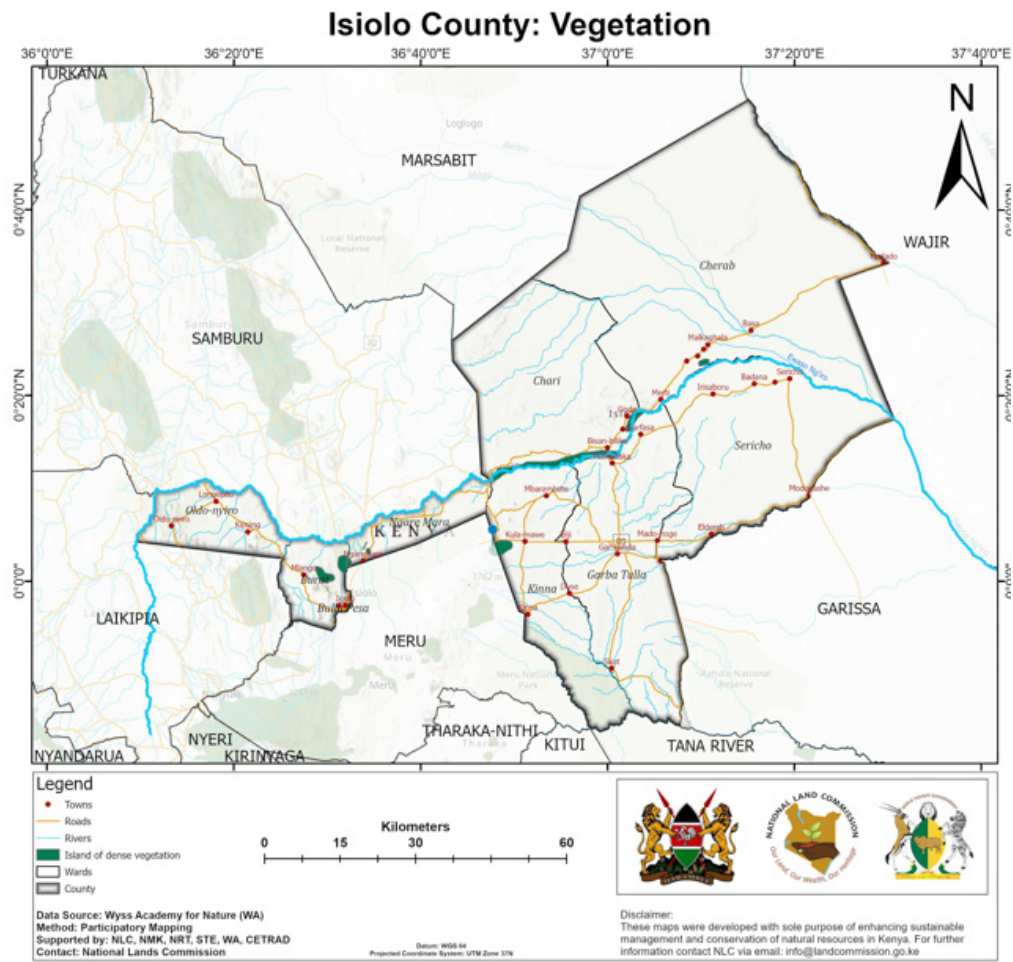


Figure 16: Spatial Distribution of Island of Dense Vegetation in Isiolo County

3.10.1 Uses

These areas are characterized by a high density of perennial vegetation, including trees and shrubs, which can withstand longer periods without rainfall and play the following role as detailed below:

- **Drought Resilience:** The dense vegetation provides crucial grazing resources during times of drought when other areas are dry.
- **Pastoralism:** Pastoral communities utilize these areas as a “last resort” during severe dry spells, moving their livestock to them when other pastures are depleted.
- **Habitat:** The dense vegetation supports a variety of wildlife and provides habitat for a range of species.
- **Potential for Restoration:** In some cases, these dense vegetation areas can be used as a base for reforestation or other restoration efforts in degraded areas.
- Enhancing Wildlife connectivity and dispersal and mitigating in-breeding and genetic vigour

3.10.2 Management

Dense Vegetation Islands (DVI) are ecological and livelihood hotspots in otherwise dry landscapes. Though often overlooked, they play critical roles in supporting ecosystem services, climate resilience, and community survival—especially during dry seasons. Mismanagement or neglect leads to rapid degradation, with ripple effects on water availability, pasture security, and biodiversity. From the DVIs mapped, 11 are under community (C) management, 11 under Community Conservancy (CC) management while 2 had no any management structures in place (Table 25).

Table 25: Management structures of DVIs in Isiolo

Management Type	No. of DVIs	% of Total (24)	Key Implications
Community (C)	11	~45.8%	Indicates strong reliance on traditional governance; may lack formal support.
Community Conservancy (CC)	11	~45.8%	Shows that conservancies are increasingly integrating DVIs into broader land-use management.
Unmanaged	2	~8.3%	These are ecologically vulnerable and risk degradation; urgent need for governance inclusion.

3.10.3 Threats and Challenges

Dense vegetation islands in Isiolo County face threats and challenges related to climate change, habitat fragmentation, and human activities. These challenges can impact biodiversity, ecosystem services, and local communities as detailed below:

- **Historical and Boundary Conflicts** such as the case of Badha Bisan Hajaho (Forest of Smelly Water); and The Magadho Igombe Crater – claimed by Borana but situated in Meru County, provides opportunities for reconciling boundary issues and challenges while respecting ecosystem based approaches to their protection and sustainable use. They are used for pastoralism and water by Borana; and salt extraction by Meru communities.
- **Climate Change:** Increased temperatures, altered rainfall patterns, and more frequent droughts can stress vegetation, making it more susceptible to pests, diseases, and fires.
- **Habitat Fragmentation:** Development, agriculture, and infrastructure projects can isolate these islands, reducing the ability of species to move between them and potentially leading to genetic isolation and reduced biodiversity.
- **Human Activities:** Overgrazing, fuelwood collection, and unsustainable land use practices can degrade the vegetation islands, reducing their ability to support wildlife and provide ecosystem services.
- **Invasive Species:** Introduction of non-native species, both plant and animal, can outcompete native species, alter ecosystem structure, and disrupt ecological processes.
- **Water Scarcity:** Droughts and reduced water availability can stress vegetation, impacting its ability to thrive and provide essential services.
- **Soil Degradation:** Erosion, compaction, and loss of organic matter can reduce the soil's ability to support healthy vegetation.
- **Loss of Biodiversity:** The fragmentation and degradation of vegetation islands can lead to a decline in plant and animal species diversity.
- **Conflicts over Resources:** Increased pressure on limited resources, such as water and pasture, can lead to conflicts between communities and individuals.

3.10.4 Opportunities

Dense vegetation islands, also known as riparian vegetation or gallery forests, within Isiolo County present several opportunities for the local community and the wider environment. These areas, typically found along watercourses, offer a unique combination of resources and potential for various livelihoods and ecological benefits as detailed hereunder:

- Gum & Resin Production:
 - » *Gum Arabica* (from *Acacia Senegal*) – medicinal use by Borana community (treatment for worms, appetite stimulation)
 - » *Myrrh* (from *Commiphora holtziana* – *Algaisa*) – used in perfumes and traditional medicine
 - » **Tourism Potential such as the Badha Bisan Hajaho (Forest of Smelly Water) island of dense vegetation that features** WWII-era French military trenches, Baobab trees with colonial-era carvings, Scenic hills suitable for ziplining and Proximity to Magadho Igombe Crater (within Meru boundary, but historically Borana)
 - » **Scientific Research:** Studies on indigenous plant biodiversity, including species like the ‘*pillow plant*’ and *Sodom apple*; their socio-economic and cultural significance and traditional systems of their management and governance.
 - » **Cultural Systems:** Traditional **Borana Dedha system of land governance and** management system and effectiveness to natural resources conservation and resilience
 - » **Wildlife Connectivity:** Part of the **Yaq Bute Elephant Corridor** (Kulamawe → Kinna → Meru National Park) and hence enhancing wildlife dispersal and genetic vigour.

Other opportunities include:

- **Livelihoods:** The vegetation within these islands can provide valuable resources for local communities, including fodder for livestock, timber for construction, and medicinal plants.
- **Agriculture:** The presence of water in these areas can support agriculture, providing opportunities for cultivating crops and raising livestock.
- **Tourism:** The unique landscape and wildlife within these islands can attract tourists, creating opportunities for ecotourism and related businesses and nature-based enterprises (nbs).
- **Wealth, employment creation and Income Generation:** The resources from these islands can be sold or processed, generating income for local communities. Industries can be established in Isiolo for gum and resin production etc to process these products and create jobs
- **Water Conservation:** Dense vegetation along watercourses helps to stabilize riverbanks, reduce erosion, and improve water quality.
- **Biodiversity:** These areas often harbor a high diversity of plant and animal species, serving as a biodiversity hotspot.
- **Wildlife Habitat:** The vegetation provides habitat and food sources for various wildlife species, contributing to the overall ecosystem health and integrity of the region.
- **Water Source Protection:** Dense vegetation along watercourses helps to protect water sources from pollution and degradation.

3.11 Wildlife Resources

Isiolo County is renowned for its rich diversity of wildlife species, which not only underpin its status as a key tourist destination but also play a vital role in ecological balance and sustainable development. The county's wildlife resources — including a significant elephant population — contribute to national and regional conservation goals, while supporting community livelihoods through tourism and related enterprises. Mapping of wildlife assets identified three main types of wildlife resources, with Oldonyiro Ward emerging as a critical wildlife breeding area due to its expansive rangelands and relatively intact habitats. Wildlife concentrations were recorded across all wards except Ngaremarara and Wabera, where increasing human settlement and land use pressures have reduced suitable habitats. In addition, the identification of eight major wildlife corridors highlights the importance of landscape connectivity for species movement, genetic exchange, and resilience to environmental pressures. (Table 26 and Figure 15).

Table 26: Wildlife Resources in Isiolo County

Type Of Asset	Kina	Sericho	Garbatula	Burat	Ngaremarara	Oldonyiro	Bulla Pesa	cherab	Chari	Wabera	Total
Wildlife Breeding areas	0	0	0	0	0	2	0	0	0	0	2
Wildlife concentration	7	13	10	7	0	3	1	10	7	0	58
Wildlife corridors	1	1	0	2	0	1	0	3	0	0	8
Total	2	5	6	5	0	6	1	6	2	0	33



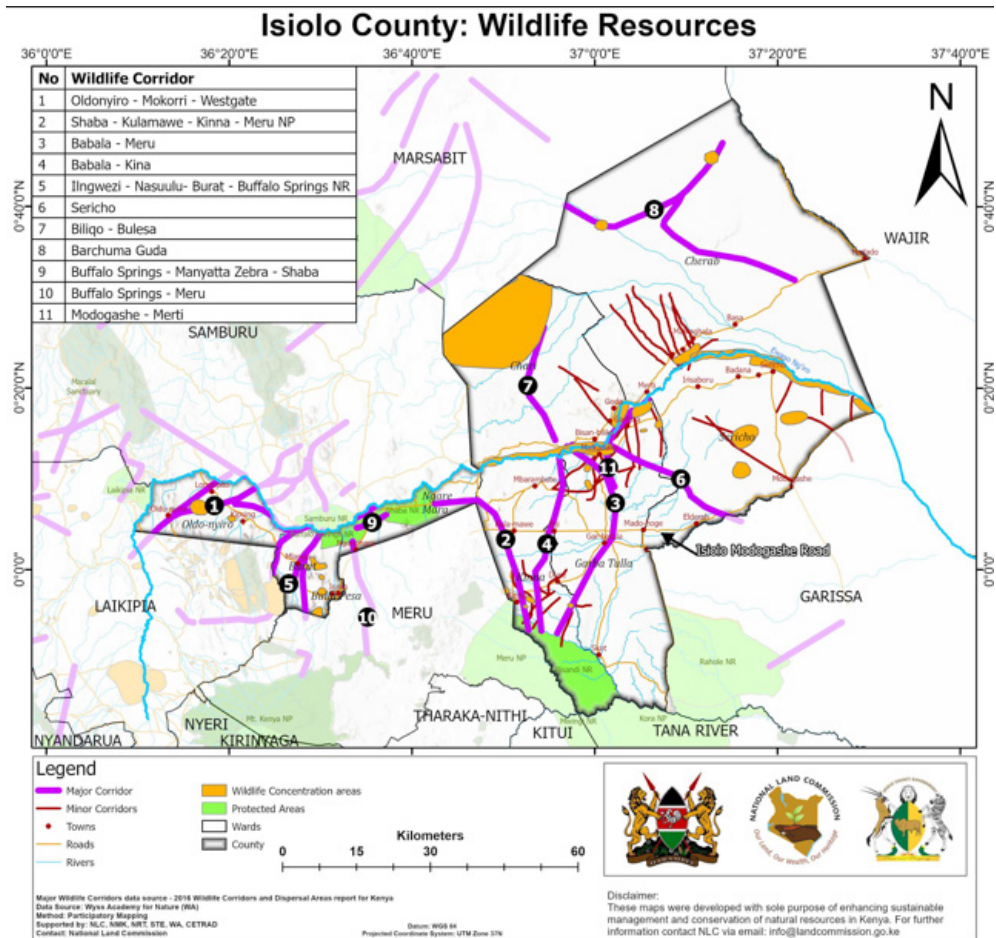


Figure 17: Wildlife Resources in Isiolo County

3.11.1 Wildlife Corridors and Dispersal Areas

Isiolo County lies at the heart of northern Kenya’s rangelands and is a critical landscape for wildlife conservation, especially outside protected areas. From the mapping initiative, Isiolo county serves as a convergence zone for migratory wildlife moving between Samburu, Laikipia, Meru, and Marsabit ecosystems. The mapped wildlife corridors and dispersal areas in the county included:

- The Oldonyiro-Mokerri corridor:** The Oldonyiro–Mokerri Corridor is a critical dryland wildlife corridor located in northern Isiolo County, linking the Oldonyiro area (at the Isiolo–Laikipia–Samburu intersection) with Mokerri and further northeast toward the Merti plateau and Biliqo-Bulesa Conservancy. This corridor forms part of the broader northern rangeland migratory system, enabling seasonal movement of wildlife across community lands, conservancies, and key grazing landscapes (Figure 18). However, the Oldonyiro elephant corridor is facing threats from human population growth, infrastructural developments and the effects of environmental degradation.

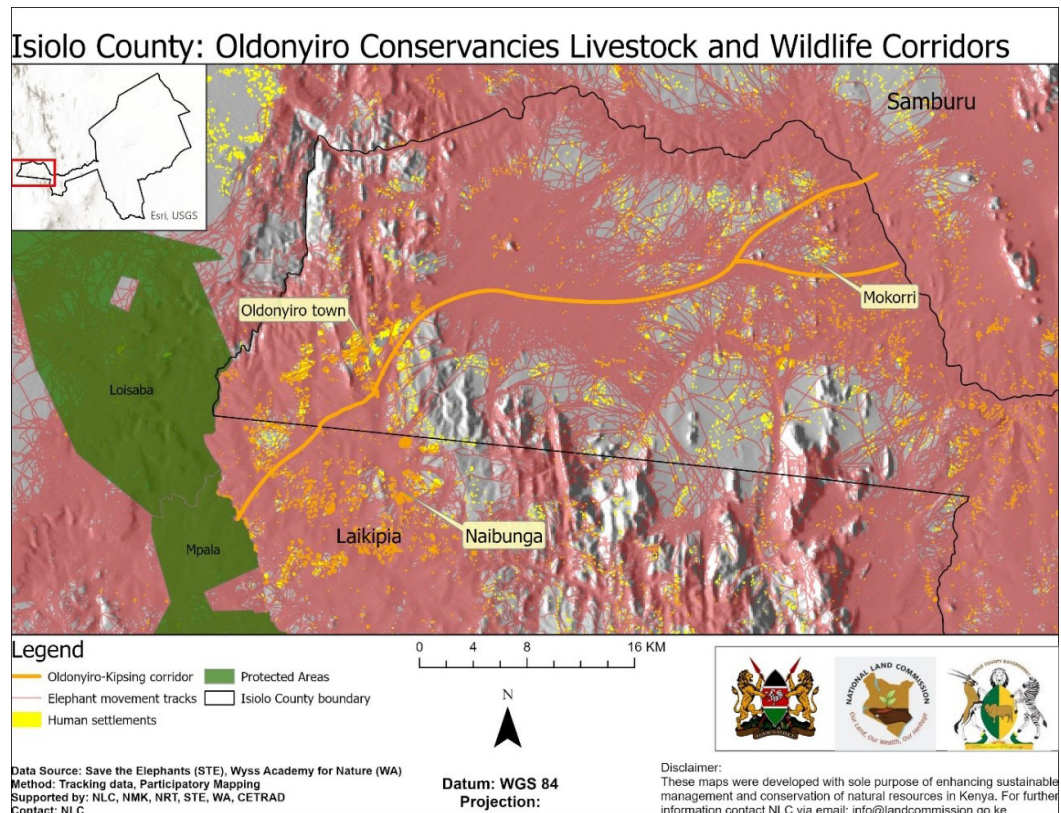


Figure 18: The Oldonyiro/Mokorri corridor

2. **Shaba-Meru NP Corridor-** The Shaba–Meru National Park wildlife corridor serves as a critical ecological linkage between Shaba National Reserve and Meru National Park in northern Kenya. This corridor facilitates seasonal wildlife movements, particularly for elephants, reticulated giraffes, Grevy’s zebras, and large carnivores, ensuring gene flow and access to essential resources such as water and forage. However, the corridor faces increasing threats from expanding human settlements, agricultural encroachment, and infrastructural development—including roads and fencing—which fragment habitats and disrupt migratory pathways.
3. **The Babala–Meru National Park wildlife corridor** is a vital dispersal and migration route connecting the Babala area with Meru National Park. This corridor enables the free movement of key wildlife species, including elephants, lions, and various antelope species, between community lands and the protected park ecosystem. It plays an essential role in maintaining ecological processes, supporting seasonal movements, and reducing human–wildlife conflict by providing a natural passage for wildlife. However, the corridor is increasingly threatened by settlement expansion, small-scale farming, and the spread of infrastructure such as fences and roads.
4. **The Babala–Kina corridor-** corridor forms an important ecological link between the Babala area and the broader rangelands around Kina, facilitating wildlife movement across community lands and towards Meru National Park and surrounding ecosystems. This corridor supports migratory routes for elephants, Grevy’s zebras, and other key species, allowing access to water points, grazing areas, and refuge during dry seasons. It also plays a role in mitigating human–wildlife conflict by guiding animal movements away from densely settled zones. However, the corridor’s viability is increasingly compromised by agricultural expansion, charcoal production, settlement growth, and infrastructural barriers such as fencing.
5. **The Ingwesi–Buffalo Springs wildlife corridor** serves as a crucial linkage between community lands around Ingwesi and the Buffalo Springs National Reserve in northern Kenya. It facilitates seasonal wildlife movements, particularly for elephants, Grevy’s zebras, giraffes, and carnivores, between communal rangelands and protected areas. The corridor supports ecosystem connectivity across the Ewaso ecosystem, enabling

animals to access critical resources such as water, salt licks, and dry-season grazing grounds. Despite its ecological significance, the corridor is under growing pressure from land subdivision, infrastructural developments (including roads and fencing), and incompatible land uses such as intensive agriculture and charcoal production. Encroachment not only fragments habitats but also escalates human–wildlife conflict, especially in areas near water sources.

6. **Sericho Corridor**-The Sericho wildlife corridor is a key dispersal route linking wildlife habitats in Isiolo County to the broader northern rangelands, including the Ewaso ecosystem. The corridor enables the seasonal movement of elephants, Grevy's zebras, and other wildlife between critical dry-season refuges and grazing areas. However, increasing settlement, overgrazing, and unplanned infrastructural developments, including fencing and road expansion, are fragmenting this corridor, threatening its ecological function.
7. **Biliqo-Bulesa** corridor connects community conservancies and pastoral landscapes to the north of Isiolo, forming part of the larger northern rangelands wildlife dispersal system. It is especially important for elephants and other migratory species moving between water points, salt licks, and grazing areas. The corridor also supports pastoralist movements. Emerging threats include land tenure changes, sedentarization, and resource-based conflicts, which are undermining the corridor's functionality.
8. **Ngarchuma-Guda**-wildlife corridor provides an essential link for wildlife traversing between communal rangelands and key resource areas in northern Isiolo. The corridor supports elephant migrations and movements of other large herbivores, ensuring ecological connectivity within the dryland landscape. Yet, the corridor faces mounting challenges from expanding agriculture, settlement encroachment, and infrastructural barriers.
9. **Buffalo Springs (Ashnil Lodge) to Meru (Ngare Mara River) Wildlife Corridor**: anchored along the Ngare Mara River, is a critical east-west ecological linkage in northern Kenya. It connects the Buffalo Springs and Shaba National Reserves in Isiolo County with Meru National Park in Meru County, traversing through Ngare Mara, Kinna, and adjacent community lands. This corridor lies within the larger Ewaso Ng'iro ecosystem, enabling seasonal wildlife movement across protected and unprotected areas, and serves as a key dispersal zone for both endangered and wide-ranging species.
10. **Buffalo Springs to Meru Wildlife Corridor (Main Route)**: is a vital ecological passage in northern Kenya that facilitates seasonal and long-distance wildlife movement between two major protected areas: Buffalo Springs/Shaba National Reserves in Isiolo County and Meru National Park in Meru County. This corridor follows the general course of the Ngare Mara River, forming a natural and historical migratory route for several iconic savanna species. Ecologically, the corridor supports gene flow, population resilience, and dry season dispersal for endangered and wide-ranging species. It also sustains local ecosystem services tied to river function, biodiversity, and grazing systems.
11. **Modogashe –Merti Corridor** functions as a significant dryland dispersal route connecting the rangelands around Modogashe with those near Merti. It facilitates wildlife movements between seasonal water points and grazing lands, with elephants and Grevy's zebras among the key species using this corridor. The corridor is increasingly threatened by human settlement, land degradation, charcoal burning, and resource-use conflicts, all of which jeopardize its role in maintaining landscape connectivity.
12. **Corner Wildlife Corridor – Ngare mara to Archers Road Corner**: The Corner Wildlife Corridor, stretching from the Ngare Mara area toward the Archers Post Road Corner, is a vital but increasingly fragile wildlife movement pathway in northern Kenya. Positioned at the interface between Isiolo County and Samburu County, this corridor links the broader Ngare Mara plains with the greater Samburu ecosystem, including Buffalo Springs, Shaba, and Samburu National Reserves, through a mosaic of community lands, riparian zones, and rangelands. This corridor serves as a strategic

east-west and north-south linkage, used by migratory species such as African elephants, Grevy's zebra, reticulated giraffe, and lions moving from the Meru-Ngare Mara landscape toward the Archers Post region and onward into Laikipia and northern Samburu. The movement is guided by natural features such as seasonal watercourses, open grazing lands, and the Ngare Mara River, which provide refuge and resources during both wet and dry seasons.

- 13. Buffalo Springs - Shaba Corridor:** The Buffalo Springs - Shaba corridor is north of Isiolo town close to the Waso River (Fig. 19). This corridor connects the protected areas of Buffalo springs and Shaba game reserve. Wildlife such as elephants, Zebras, lions and the gazelles use the corridor to access food and water. Due to the tarmac A2 Isiolo-Marsabit highway, it is facing threat of blockage by expanding human settlements along

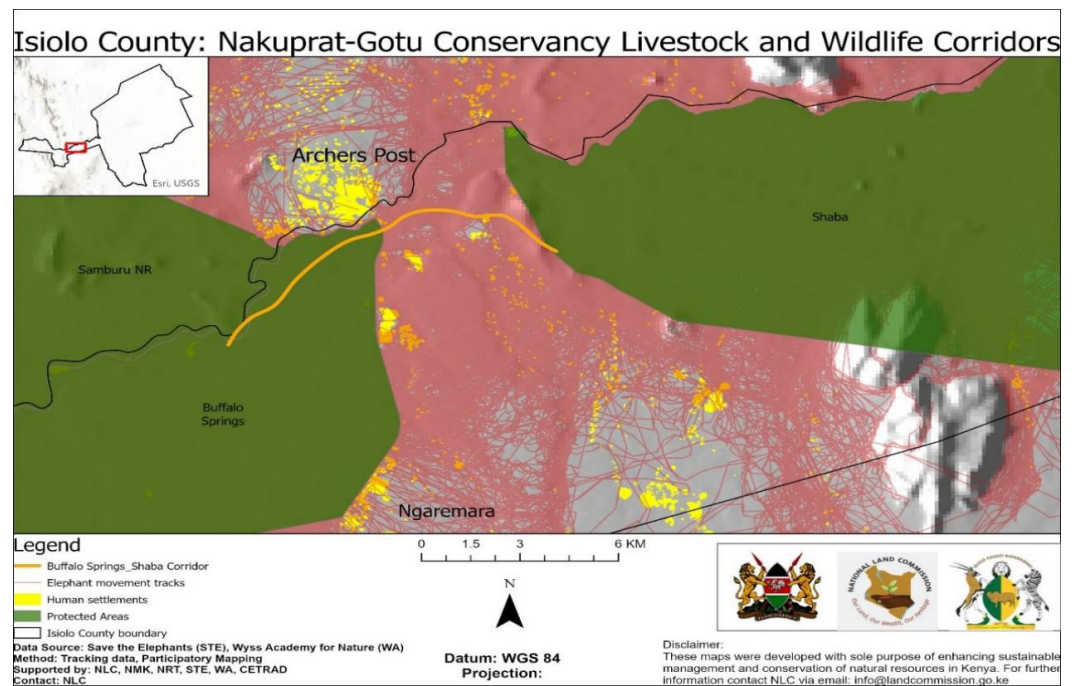


Figure 19: The Buffalo Springs - Shaba corridor

the highway from Ngaremara to Archers Post. The corridor is used during dry months (January, February, August, September) and faces human-wildlife interactions, livestock losses-related conflicts

- 14. Oldonyiro-Kipsing corridor choke points:** The Oldonyiro-Kipsing corridor cuts across the four Oldonyiro conservancies i.e. Naapu, Nanapisho, Nanapa and Narupa (Figure 20). This is a critical corridor that connects the Samburu and Laikipia ecosystem. The corridor crosses the Waso River from Westgate conservancy and into Isiolo County where it facing high threats of blockage at four crucial village areas. These are Mokorri/Lpusi villages at Naapu conservancy, Lagaaman that covers both Naapu and Narupa conservancies, Mlima Chui and Ngorika both cross Narupa and Nanapa conservancies and the Oldonyiro town centre. These choke points have significant importance in protection of the Oldonyiro-Kipsing corridor and its importance to connectivity across northern Kenya. The corridor covers approx. 45km between Mokorri and Oldonyiro centre. The highest point of blockage is the town centre but it's paramount to secure and open the other critical points before the town. The communities play a vital role in conserving the corridors and zonal planning education is one of the major lessons to tackle the rising population pressures at various stages of the corridor.

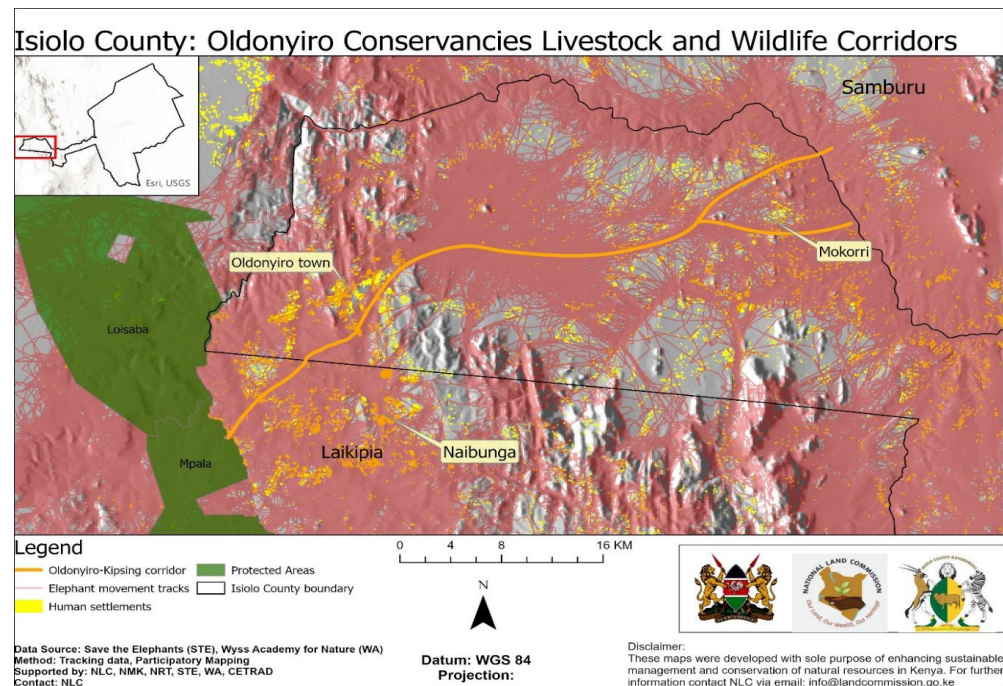


Figure 20: The Oldonyiro-Kipsing corridor choke points

15. **Nasuulu-Burat Corridor :** This corridor is critical in connecting the Isiolo Mlango areas to Samburu and Laikipia, Leparua areas to Borana. It is mostly used by elephants, giraffe and the grevys zebra. Lions are also known to move along this corridor from Samburu to Laikipia, IIngwezi areas.
16. **Kula Mawe-Kinna Corridor:** This corridor connects the Waso River to the southern side of Kinna, Bisanadi and into Meru National Park. It is a critical corridor majorly used by elephants during dry seasons to access Isiolo Babala areas and to the vast north of Isiolo and Samburu counties.
17. **Mado Gashi-Merti Corridor:** This corridor is vital in connecting the far east of Waso River to the Lorian swamps. A key resource for wildlife during dry seasons. It also connects towards the North of Kom open spaces. The minor wildlife corridor are used by the resident species to get food and water and sometimes in connecting to the greater corridors for migrations. Figure 28 shows the spatial distribution of the county wildlife corridors, concentration and protected areas.

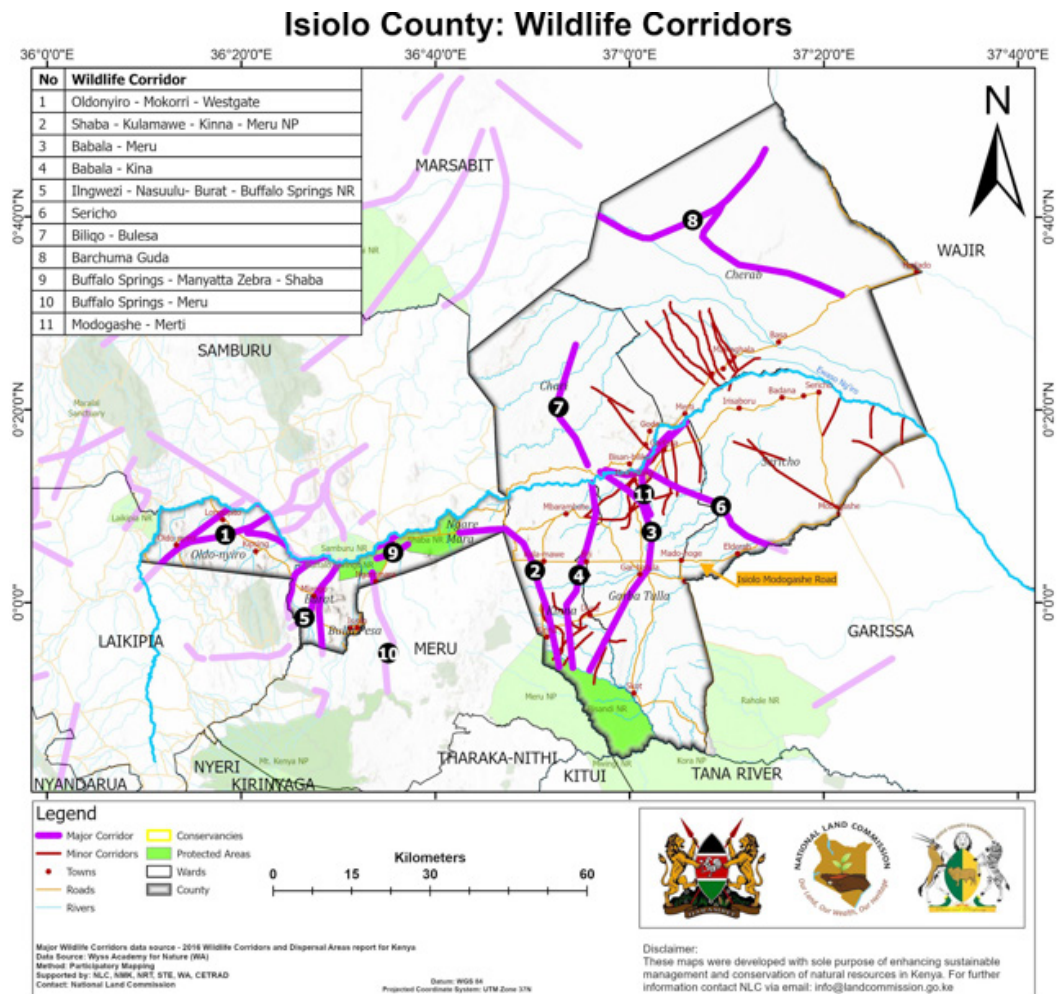


Figure 21: Spatial Distribution of Wildlife Corridors in Isiolo County

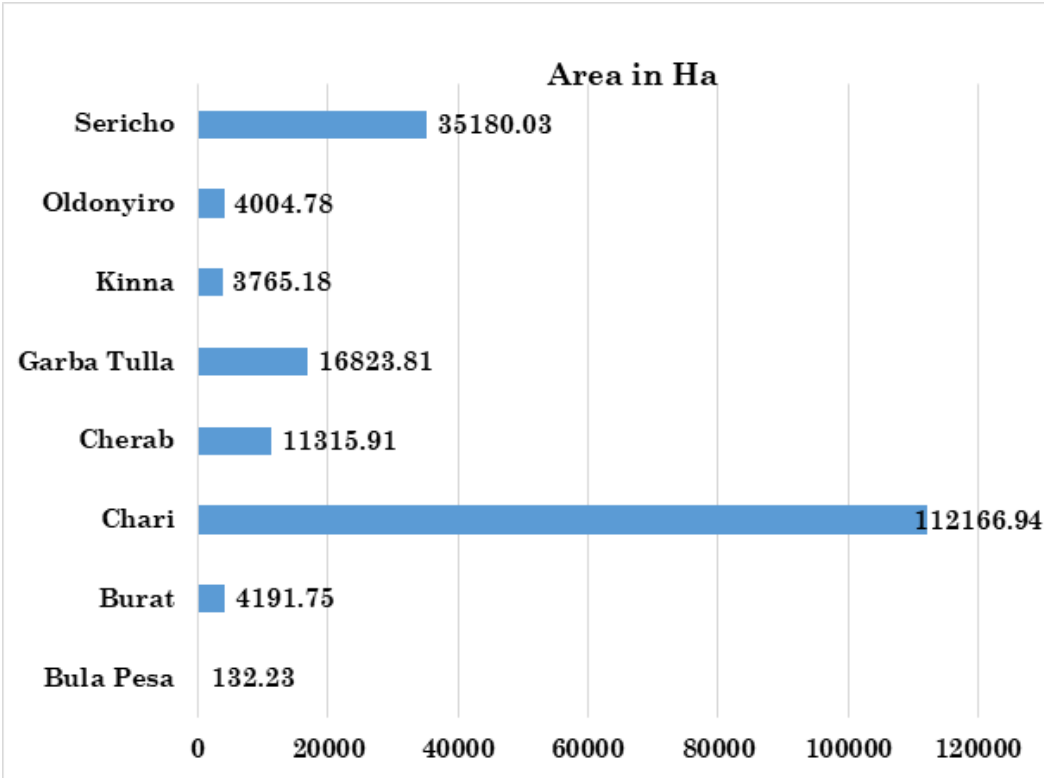
3.11.2 Wildlife Breeding/ Concentration Areas

Wildlife breeding and concentration areas refer to locations where animals congregate for breeding or where there's a high density of wildlife (Plate 22). Isiolo County lies at the heart of a semi-arid rangeland ecosystem that supports free-ranging wildlife populations. While much of the region is outside gazetted protected areas, it remains critical for wildlife breeding and seasonal concentration, especially due to its open landscapes, limited human settlement in key zones, and the presence of reliable water sources such as the Ewaso Nyiro River and Ngare Mara River.



Plate 22: Wildlife concentration Area in Leparua location

Wildlife breeding and concentration areas in Isiolo County are essential for the sustainability of regional wildlife populations, especially for endangered species such as Grevy's zebra and African elephants. These zones need to be recognized as ecologically sensitive areas and integrated into development planning to balance biodiversity conservation with community livelihoods. Safeguarding them is central to Isiolo's identity as a landscape of coexistence and ecological value. Spatially, a total of 187580.6 ha of land were mapped with Chari ward recording the highest area (Figure 22).



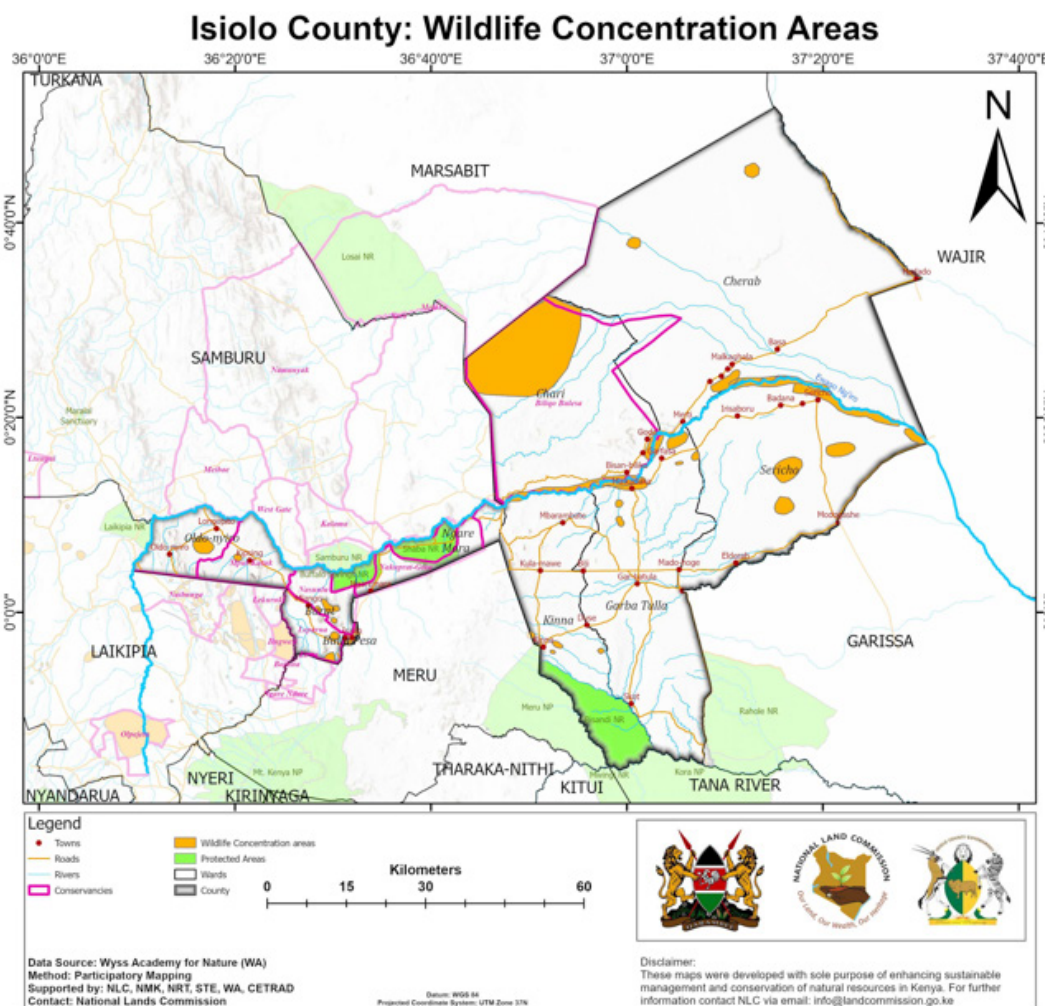


Figure 22: Isiolo County Wildlife Concentration Areas

3.11.3 Key Issues on Wildlife resources

Wildlife species are facing threats to their natural habitats. This is placing increasing pressure on people, livestock and wildlife as they share space and available resources. A data science analysis of elephant radio collar tracking, using data collected by Save the Elephants from elephants who have moved through the corridors between the years 1998 and 2021, combined with knowledge from local communities has revealed key corridors. Together with other datasets such as human settlements, it has shown how corridors are facing blockage by rising human population pressures. Pastoralists rely on seasonal migration to get grazing and water for their livestock. Many species of wildlife also migrate seasonally, and they have to manoeuvre their way through a landscape increasingly altered by the effects of climate change, population growth and land degradation.

The future of major movement corridors seems dire, hence the urgent need to make sure there is proper awareness and understanding from the communities to reopen and protect the blocked parts of the migratory corridors. The local communities are the key decision makers on what happens in the landscape, and they are further supported by the conservancies. Their involvement is paramount to avoid internal politics and wrangles that may drive conflict and put up unnecessary barriers. Issues involving land matters are significant and sensitive, so holistic agreements are needed to ensure a smooth process with clearly defined conservation goals.

3.12 Livestock Resources

Isiolo County's economy is significantly driven by its livestock sector, which is a primary source of livelihood for many residents. The county has a high number of cattle, sheep, and goats, with meat goats being the most common livestock kept. Milk and beef, products of cattle farming, are the most valuable commodities in the region. The livestock sector plays a crucial role in the local economy, contributing to food security and income for a large portion of the population. The two main livestock resources mapped included as presented in Table 27 and Fig. 23).

Table 27: Livestock (Routes and Dry season Grazing Areas) in Isiolo County



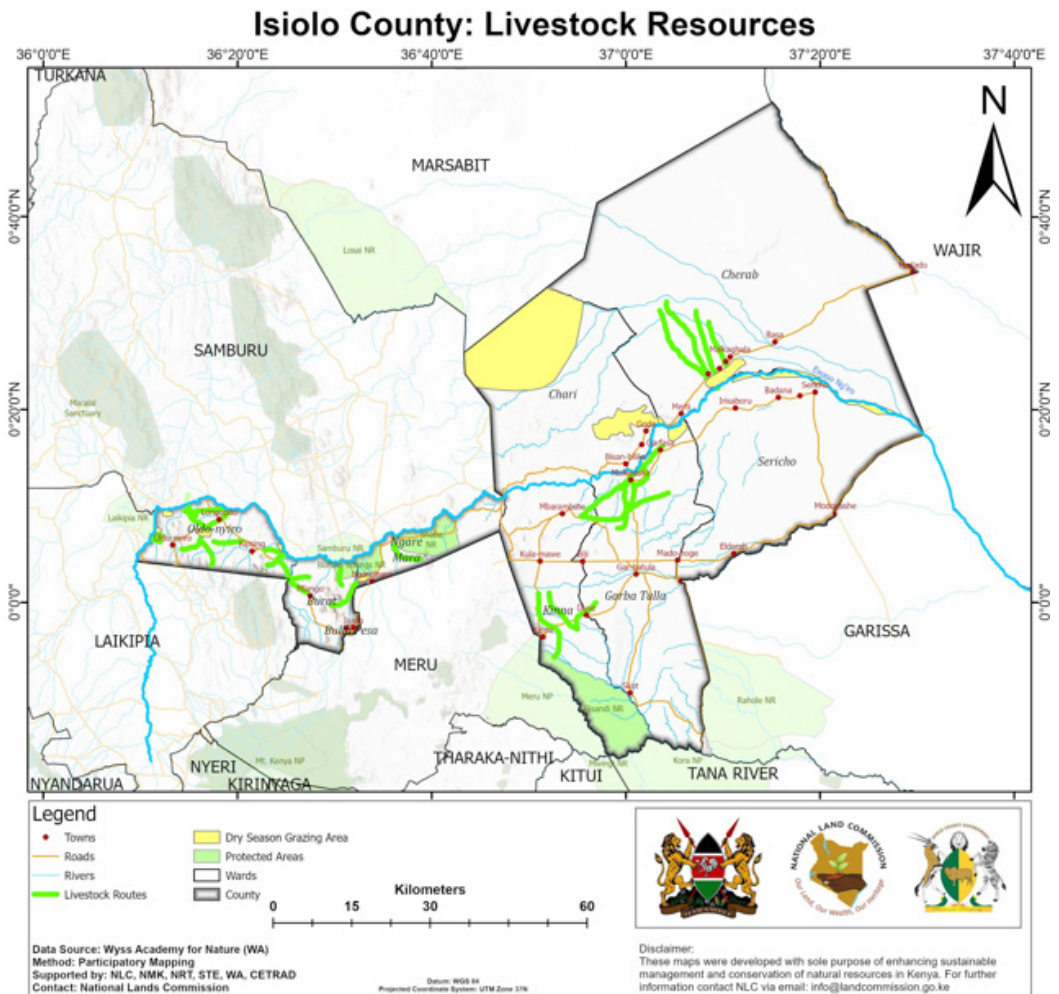


Figure 23: Surveyed Livestock Resources (Routes and Dry season Grazing Areas)

3.12.1 Livestock Routes

Livestock routes in ASAL counties such as Isiolo are crucial for pastoralist communities, facilitating the movement of livestock between different grazing areas to find water and pasture, particularly during the dry season (Plate 23). These routes are often established over time through experience and knowledge of the landscape, and they can be influenced by factors like rainfall patterns, water availability, and the type of livestock. Livestock routes are essential for the livelihoods of pastoralists, allowing them to maintain their herds and access resources in these challenging environments. Spatially the main county livestock routes are mainly found and linked to River Ewaso Nyiro (Fig. 23). This reflects the critical role of the river as a key source of water and pasture, guiding traditional grazing patterns and livestock movements across the county.



Plate 23: Kibashataa to Lomerr Livestock route, Lodungokwe location

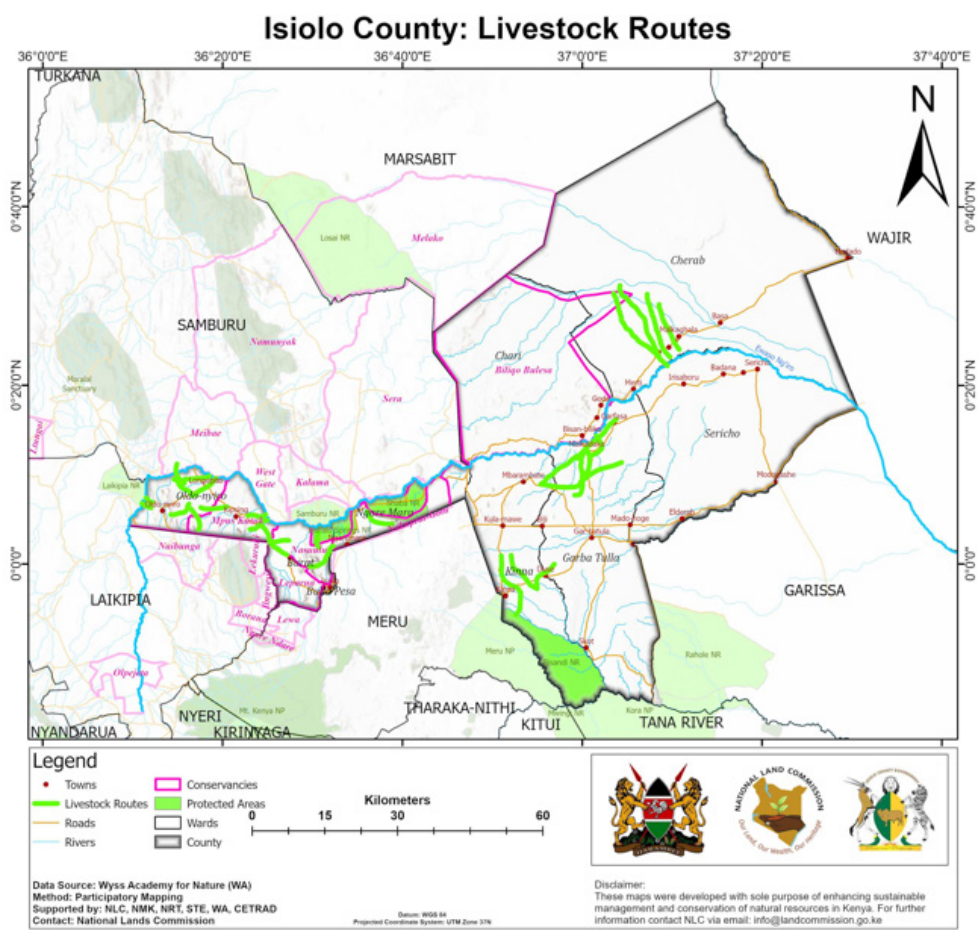


Figure 24: Spatial Distribution of Livestock Routes in Isiolo County

3.12.2 Livestock Dry Season Grazing Areas

In ASAL counties such as Isiolo, livestock dry season grazing areas are vital for pastoral communities during drought periods (Plate 24). These areas, often identified as “dry season grazing reserves,” provide critical resources and shelter when forage becomes scarce. They are used seasonally, sometimes by multiple ethnic groups, and are managed under customary governance practices. Spatially, Isiolo, livestock dry season grazing areas include traditional and drought grazing reserves like Sericho, Cherab, Yamicha, Dogogicha, and Urura. Pastoralists move to these areas as dry conditions worsen and browse becomes scarce. (Fig. 25).

Koom (Kom) dry season grazing area stands out as one of the most important dry season grazing reserves in Isiolo County. Located primarily within Oldonyiro Ward, Koom is a traditional dry season grazing reserve strategically located along the borders of Isiolo, Samburu, and Marsabit counties. It is a critical shared rangeland that supports the mobility of pastoralist communities from these counties during times of drought and pasture scarcity. Koom comprises expansive communal rangelands that serve as critical grazing grounds during periods of drought and dry spells. The area is valued for its relatively reliable pasture availability during the dry season, thanks to its remoteness, low human settlement pressure, and management under customary systems that restrict access during wet seasons to allow pasture regeneration. Koom supports the mobility strategies of pastoralist communities, providing refuge for livestock when other areas are depleted. The area is also significant for sustaining both livestock production and wildlife, as it lies along key migratory corridors and overlaps with wildlife habitats.

The shared use of Koom reflects long-standing customary agreements and traditional governance systems that regulate access, timing of use, and conflict resolution among pastoralist groups such as the Samburu, Rendille, Borana, and Somali communities. However, the shared nature of Koom also makes it a hotspot for resource-based conflicts, especially during prolonged droughts when competition for pasture and water intensifies.



Plate 24: Lekuru Dry season grazing area, Waso Rongai Location

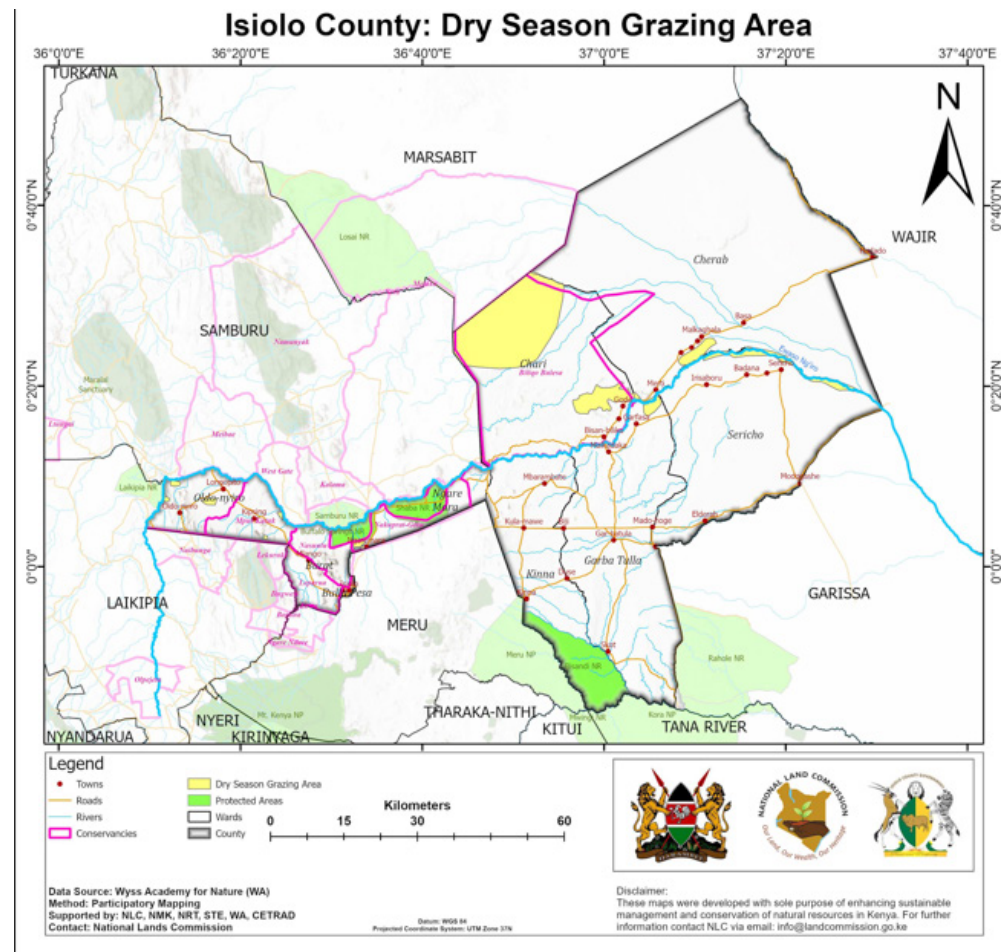


Figure 25: Spatial Distribution of Livestock Dry season Grazing Areas in Isiolo County

3.12.3 Key Issues on Livestock Resources

In Isiolo County, several factors threaten livestock grazing routes and dry grazing areas, including increased drought frequency, overgrazing, land alienation, and resource-based conflicts. These threats impact the livelihoods of pastoral communities, who depend on grazing for their survival as detailed in Table 28:

Table 28: Key Issues on Livestock Resources in Isiolo County

Role	Description
Climate Change and Drought:	<ul style="list-style-type: none"> Increased Drought Frequency: Isiolo County is experiencing more frequent and intense droughts, which reduces pasture availability and water resources. High Temperatures: Higher temperatures exacerbate the effects of drought, further stressing livestock and vegetation. Erratic Rainfall: Changing rainfall patterns make it difficult for pastoralists to predict grazing availability and water sources.
Overgrazing and Land Degradation:	<ul style="list-style-type: none"> Overgrazing: Excessive grazing pressure, especially during dry seasons, can lead to soil erosion and degradation, reducing the carrying capacity of rangelands. Land Alienation: Large-scale investments and conservation projects can restrict grazing access, leading to land alienation and competition for resources.


Resource-Based Conflicts:	<ul style="list-style-type: none"> • Competition for Resources: Increased competition for grazing and water resources, especially during dry seasons, can lead to conflicts between pastoral communities and other land users. • Conflict with Migrant Herders: Increased influx of herders seeking grazing and water during drought periods can strain local resources and exacerbate conflicts. • Agro-Pastoralist Conflicts: Conflicts can arise between pastoralists and farmers, especially when livestock damage crops.
Infrastructure and Development:	<ul style="list-style-type: none"> • LAPSSET Corridor: The LAPSSET corridor, which includes a road and rail project, is planned to pass through Isiolo County, may lead to land fragmentation and displacement of pastoral communities. • Expansion of Conservancies: The expansion of conservancies, while aimed at wildlife conservation, can also restrict pastoral grazing access and water resources.
Other Factors	<ul style="list-style-type: none"> • Loss of Customary Institutions: Weakening of traditional resource management systems can lead to over-exploitation of resources and disputes. • Disease Outbreaks: Droughts can increase the risk of livestock diseases, further impacting livelihoods.

3.13 Natural Salt Lick Areas

Isiolo County is known for having natural salt lick areas, which are crucial for local communities, wildlife and livestock. Salt licks are characterized by transient subsurface water resources, abundant grasses, and specific soil types (Plate 25-28). They provide many species of wildlife and livestock beneficial health minerals for food digestion, assimilation and other body metabolisms. Saltlicks are vital in providing biometals such as sodium, calcium, iron, zinc, phosphorus and the trace elements the local livestock and wildlife needs for bone and muscle development and healthy growth by supplying the essential minerals required. Further, communities use these assets for body cleansing and de-toxicification processes (facilitate removal of germs and pathogens ingested into the gut system).

From asset mapping initiative, natural salt licks mapped are largely common in Oldonyiro ward that recorded the highest count at 30 largely due to its extensive rangeland coverage, unique geology, and soil mineral composition (Table 23 and Fig. 26). The ward’s landscape includes exposed mineral-rich soils and rock outcrops that contribute to the natural formation of salt licks, which attract wildlife and livestock. In addition, the low levels of human settlement and land conversion in Oldonyiro have allowed these natural features to persist, unlike in more urbanized or intensively used parts of the county. The concentration of salt licks in Oldonyiro is significant for supporting wildlife and pastoralist herds, providing essential minerals that contribute to animal health and productivity.

Table 29: Surveyed Salt Lick Areas

	Kinna	3
	Sericho	0
	Garbatula	4
	Burat	13
	Ngaremara	10
	Oldonyiro	30
	Bulla Pesa	0
	Cherab	0
	Chari	1
	Wabera	0

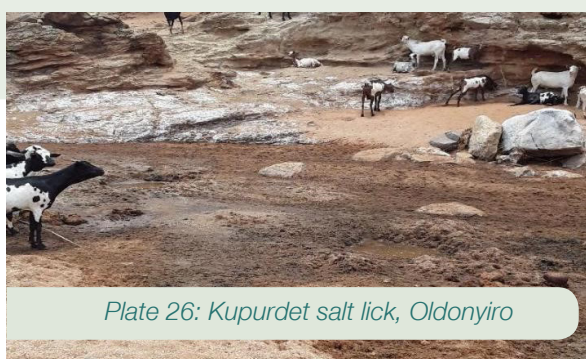


Plate 26: Kupurdet salt lick, Oldonyiro



Plate 25: A Saltlick in Oldonyiro, Isiolo



Plate 28: Edoot Lafunaan, Nakupurat location



Plate 27: Nakwaber Salt lick, Nakupurat

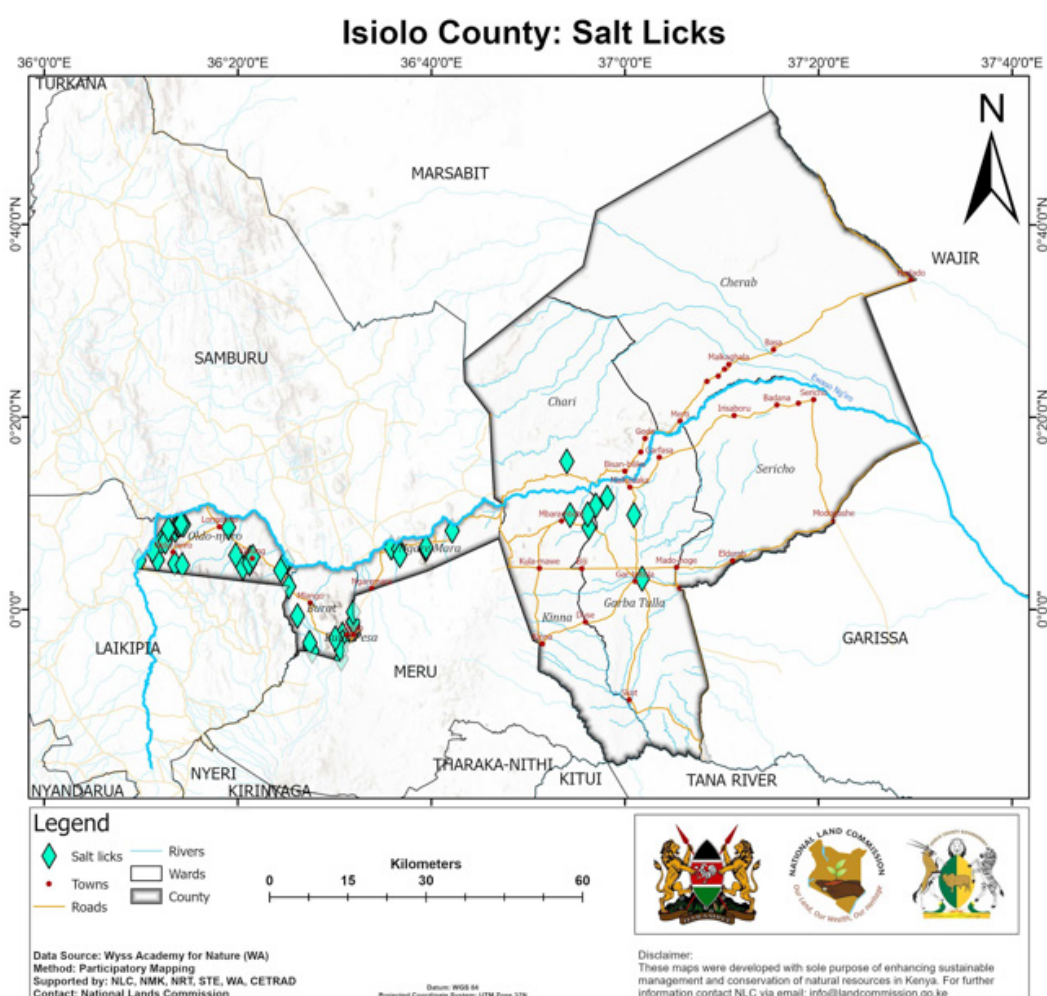


Figure 26: Isiolo County Salt Lick Areas

3.13.1 Management

Natural salt licks are essential mineral sources for people, livestock and wildlife. Found as exposed soils or deposits rich in salts and minerals (e.g., sodium, calcium, magnesium), they are often scarce, heavily used, and ecologically sensitive. In pastoral and semi-arid areas like Isiolo, these sites become critical during dry seasons, making their management vital for both livelihoods and ecosystem sustainability. From the natural salt licks areas mapped, 5 are under community (C) management, 40 under Community Conservancy (CC) management, 1 under WRUA, 1 under private management while 10 had no any management structures in place (Table 30).

Table 30: management structures of salt lick areas in Isiolo County

Management Type	No. of Salt Licks	% of Total (57)	Key Implications
Community (C)	5	~8.8%	Indicates limited reliance on systems for salt lick oversight.
Community Conservancy (CC)	40	~70.2%	Dominant management; shows that conservancies are critical actors in mineral site governance.
Water Resource Users Association (WRUA)	1	~1.8%	Minimal involvement; suggests WRUA integration potential for water-linked licks.
Private	1	~1.8%	Raises questions about access for community and public benefit

3.13.2 Threats and Challenges

Natural salt lick areas in Isiolo face numerous threats that can negatively impact their ecological significance. These threats include habitat loss and degradation due to human activities, increased predation at concentrated animal populations, and the spread of diseases and parasites as detailed below:

- Local climate patterns play a crucial role in the formation and persistence of salt licks. In arid or semi-arid regions such as Isiolo, with limited water, high evaporation rates concentrate salts in specific areas, such as depressions or dried-up water bodies.
- Seasonal rainfall or flooding events can contribute to the formation of temporary salt licks by washing salts from surrounding areas and depositing them in lower-lying regions. These climatic factors greatly influence the concentration and availability of salts, attracting herbivores in search of essential minerals. In other words, climatic changes can facilitate formation, modification and or loss of these vital assets.
- Animals have species-specific preferences and specific habitat requirements when it comes to salt licks. Different animal species may favour salt licks with varying mineral compositions, depending on their dietary needs and physiological requirements.
- Many salt licks are currently found along riverine areas, and when these ecosystem are destroyed, the availability of salt licks for both wildlife and livestock can be reduced. Deforestation within the county also alters natural water flow patterns, which can affect the formation and maintenance of salt licks. Hence the need for conservation.
- Intensive grazing by livestock can also alter the vegetation composition, reducing the availability of nutrient-rich plants that contribute to salt lick formation.
- Human developmental imperatives such as building roads, settlements and other infrastructure within Isiolo County are likely to disrupt natural drainage patterns and alter water availability, which consequently have adverse effects in the formation, availability and accessibility of salt licks. Additionally, the disturbance caused by construction can deter wildlife from accessing or using existing salt licks within the county hence the need for conservation planning to provide access to these vital resources.

3.13.3 Opportunities from Salt Lick Areas

Natural salt lick areas in Isiolo County offer various opportunities, including tourism, economic development, and resource management. These areas, characterized by transient water sources and salt-tolerant vegetation, are important for local communities and wildlife. Isiolo's arid landscape, with its pastoralist communities, relies heavily on these resources for livelihoods, food security, and sustainable practices. These opportunities are further detailed below:

- **Human health and well-being** - ingesting salt licks cause occasional de-toxification and removal of unwarranted and excess germs from body; which has potential for better health and well-being
- **Tourism and Eco-tourism:** Salt lick areas can attract tourists interested in wildlife viewing and unique natural landscapes. Salt Lick Safari Lodge in the Taita Hills Wildlife Sanctuary is an example of a lodge utilizing salt lick viewing as a draw.
- **Economic Development:** Salt licks can be a source of income for local communities through the sale of salt or related products, as well as through tourism-related activities.
- **Pastoralism and Livestock Grazing:** Salt licks provide essential mineral sources for livestock, which are crucial for the livelihoods of pastoralist communities.
- **Resource Management and Conservation:** Sustainable management of salt licks is vital for maintaining biodiversity, ensuring access for local communities, and mitigating environmental risks.

- **Research and Monitoring:** Salt licks can be valuable sites for research on ecological processes, biodiversity, and the impact of climate change.
- **Community Empowerment:** Local communities can be empowered to participate in the management and conservation of salt licks, fostering sustainable practices and benefiting from the resources.
- **Infrastructure Development:** Developing infrastructure, such as access roads and water management systems, can enhance the value and accessibility of salt lick areas.
- **Education and Awareness:** Promoting education and awareness about the importance of salt licks and their conservation can foster a sense of stewardship among local communities and visitors.
- **Community Tourism:** Community-based tourism initiatives can leverage the unique attractions of salt lick areas, benefiting local communities economically and socially.



4.

LEGAL FRAMEWORKS FOR DRYLAND NATURAL ASSETS IN KENYA

4.1 Overview

Kenya's legal frameworks for dryland natural assets focuses on sustainable management and community participation, recognizing that drylands are vital for livelihoods and biodiversity. This framework includes national policies, integrated land use planning, and the recognition of collective land rights. This section provides the applicable legal frameworks for the protection and conservation of dryland natural assets in Kenya.

4.2 Applicable Legal Frameworks for the Protection and Conservation of Dryland Natural Assets

Kenya's legal framework for protecting and conserving dryland natural assets are all aligned with the Constitution of Kenya, 2010, which mandates environmental protection and sustainable resource management. Table 31 summarises these laws including their specific provisions and relevance to this mapping exercise initiative.

Table 31: Applicable Legal Frameworks for the Protection and Conservation of Dryland Natural Assets

Legal Framework	Article	% of Total (57)	Key Implications
Constitution	1	Sovereignty of the people.	Land and natural resources belong to Kenyans. Need for their involvement in their utilization and conservation.
	2 (5) and (6)	General rules of international law, treaties or convention ratified by Kenya form part of Kenya's laws.	There are many Multi lateral Environment (MEAs) related to natural resources including those in the drylands that requires sustainable use, conservation and development
	10	Principles of governance including democracy, rule of law, public participation	Provides anchorage on peoples participation in democratic resource governance. Need for their involvement in their utilization and conservation.
	35	Access to information.	Citizen are informed by facts data on their natural resources and why their involvement in their meaningful participation, conservation and governance.
1. Constitution of Kenya, 2010	40	Protection of right to property	Guarantees the right of individuals to acquire and own property, either individually or in association with others.
	42	Right to a clean and healthy environment	Right to have the environment protected for present and future generations. Natural assets are also environmental resources
	60 (1)	Principles of land policy.	Land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable. Sound conservation and protection of ecologically sensitive areas including dryland assets.
	61	Classification of land.	All land in Kenya belongs to the people of Kenya collectively as a nation, as communities and as individuals. Land in Kenya is classified as public, community or private. Natural assets occupy all the three land categories.
	67	National Land Commission mandate	The Commission role to: manage public land including dryland resources on behalf of the national and county governments; recommend a national land policy to the national government and to conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;

	69	Obligations in respect of the environment	The state to ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits; encourage public participation in the management, protection and conservation of the environment and to utilize the environment and natural resources for the benefit of the people of Kenya.
	70	Enforcement of environmental rights.	Protection of the right to lean and healthy environment recognised and protected under Article 42 if it has been, is being or is likely to be, denied, violated, infringed or threatened.
	71	Agreements relating to natural resource.	Parliament role in the grant of a right or concession by or on behalf of any person, including the national government, to another person for the exploitation of any natural resource of Kenya
	186	Respective functions and powers of national and county governments.	Role of the national government in natural resource management.
	260	Definition of land	“land” includes— (a) the surface of the earth and the subsurface rock; (b) any body of water on or under the surface; (c) marine waters in the territorial sea and exclusive economic zone; (d) natural resources completely contained on or under the surface; and (e) the air space above the surface;
2. Wildlife Conservation and Management Act, 2013	31 (1)	Declaration of protected areas	The CS by notice in the gazette can publish areas zoned to have wildlife conservation and management as their land use priority:
	33 (1)	Conservation and management of wetlands	The CS on recommendation of the KWS, in consultation with the National Land Commission, by notice in the Gazette can declare a wetland that is an important habitat or ecosystem for wildlife conservation a protected wetland.
	39	Establishment of conservancy or sanctuary.	Any person or community who own land on which wildlife inhabits may individually or collectively establish a wildlife conservancy or sanctuary.

	46	Protection of endangered and threatened ecosystems.	The CS may, on the advice of the Service and in consultation with the National Land Commission, by notice in the Gazette, publish a national list of wildlife ecosystems and habitats that are endangered and threatened and are in need of protection.
	74	Migration of wildlife.	Landowners requirement to facilitate the ease of movement of wildlife from one area to the other considering their migratory nature that attaches to the resource.
3. Land Act, 2012	8	Unbundles the role of the Commission in public land management	In the management of public land, NLC: <ul style="list-style-type: none"> • shall identify public land, prepare and keep a database of all public land, which shall be geo-referenced and authenticated by the statutory body responsible for survey • shall evaluate all parcels of public land based on land resources mapping and overall potential for use. • shall share data with the public and relevant institutions in order to discharge their respective functions and powers under this Act; • may require the land to be used for specified purposes and subject to such conditions, covenants, encumbrances or reservations as are specified in the relevant order or other instrument.
	15 (1)	Unbundles the role of the Commission in natural resource protection through reservations	(1) Subject to Article 66 (1) of the Constitution, the Commission may, in consultation with the national government and the county governments, by order in the gazette, reserve public land located within (d) natural resources completely contained on or under the surface ; for one or more purposes in the public interest.
	15 (3)	Commission jurisdiction in undertaking an inventory of all land based natural resources.	Dry land assets constitute land based natural resources that must be mapped and inventoried by NLC
	16 (1)	Commission jurisdiction in placing of care, control and management of reserved public land.	Commission's role to vest the care, control, conditions and management of any reserved dryland assets with a statutory body, public corporation or a public agency.

4. The Physical and Land Use Act, 2019	29(1)	Inter County Planning	Two or more Counties may, by mutual agreement or out of compelling necessity, formulate an inter-county physical and land use development plan for KOM resources. Natural resources are mostly transboundary in nature.
	37	Objects of County Spatial Planning	A county physical and land use development plan seeks to among others (a) to provide an overall physical and land use development framework for the county; (d) to guide the use and management of natural resources and to (e) to enhance environmental protection and conservation;
	52	Declaration of a Special Planning area.	An area that has unique development, natural resource, environmental potential or challenges can be declared as a special planning area.
	56	Power to undertake development control	County role to (b) control or prohibit the subdivision of land; and to (f) reserve and maintain all the land planned for open spaces, parks, urban forests and green belts in accordance with the approved physical and land use development plans.
The Physical And Land Use Planning Development Permission And Control) (General) Regulations, 2021	Part V— Easements, Wayleaves And Riparian Reserves Reg. 14	Measurement of the extent of riparian reserves.	Establishes the standards for riparian reserves
5. Water Act, 2016	5	Ownership of water resources.	Every water resource is vested in and held by the national government in trust for the people of Kenya.
	11	Water Resources Authority (WRA)	Establishes WRA an agent of the National Government responsible for regulating the management and use of water resources. Water resources are
	22	Protection of catchment areas.	WRA role to conserve a vulnerable water resource including catchment areas to be a protected area.

6. Environmental Management and Coordination Act (EMCA), 1999	3	Entitlement to a clean and healthy environment	Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment including natural resources
	7	Establishment of the National Environment Management Authority (NEMA)	NEMA role (b) take stock of the natural resources in Kenya and their utilisation and conservation;
	42	42. Protection of rivers, lakes and wet lands	The CS to provide for the development of an overall environmental management plan for a lake, river, wetland or coastal area, taking into account the relevant sectoral interest;
	43	Protection of traditional interests	The role to declare the traditional interests of local communities customarily resident within or around a lake shore, wetland, coastal zone or river bank or forest to be protected interests.
	50	Conservation of biological diversity	NEMA to ensure the conservation of biological diversity in Kenya including dryland assets.
	54	Protection of environmentally significant areas	The CS role to declare any area of land, sea, lake or river to be a protected natural environment for the purpose of promoting and preserving specific ecological processes, natural environment systems, natural beauty or species of indigenous wildlife or the preservation of biological diversity in general.
	58	Environmental Impact Assessment	EIA as a crucial tool crucial for protecting dryland assets as it evaluates the environmental, social, and economic impacts of projects, including those that might affect drylands.
	68	Environmental audit	Dryland assets, including land, water resources, and biodiversity, are particularly vulnerable to environmental degradation, making environmental audits crucial for sustainable development.

4.3 Legal Critique of the Applicable Frameworks in Relation to the Mapping

4.3.1 Fragmented Mandates and Overlapping Jurisdictions

Although Kenya's constitutional architecture anchors sustainable land use, environmental protection, and public trusteeship of key natural resources, the mapping exercise demonstrated that institutional mandates remain fragmented and operational responsibilities diffuse, particularly for water-related assets and landscape connectivity resources. The report's scope explicitly covered water resources (rivers/laggas, springs, wetlands), wildlife corridors and dispersal areas, livestock routes and dry-season grazing areas, islands of dense vegetation, and salt licks, yet these categories fall under multiple agencies and levels of government with no single custodian consistently accountable for day to day protection.

This fragmentation was not theoretical—it manifested as an implementation vacuum: assets were identified and mapped, but the governance arrangements needed to translate mapping into enforceable management (designation, reservation, by laws, custodianship, monitoring mandates) were not coherently triggered. Similar coordination gaps were acknowledged in the pilot processes across counties, where the same mapping approach had to rely heavily on institutional legitimacy and multi agency collaboration to gain trust and harmonize actions.

4.3.2 Weak Operationalization of Strong Legal Provisions

The mapping process confirmed a persistent pattern: Kenya's statutes provide tools that are strong on paper but weakly activated in practice. The project was designed to generate geo referenced evidence for protection and conservation decisions, including guiding reservations, gazettement, and development control, but the report also shows that—despite the availability of legal pathways—the practical conversion of mapped assets into legally secured spaces remains limited.

A key gap observed is that procedural steps (who initiates designation, what documentation threshold is required, which agency becomes custodian, what enforcement instruments follow, and how county plans must reflect the designation) are rarely standardized or consistently applied across asset categories. In effect, mapping improves visibility and legitimacy, but without routine legal activation, mapped assets remain vulnerable to encroachment and land-use change.

4.3.3 Insufficient Recognition of Dryland Socio Ecological Systems in Law

A central lesson from the mapping scope itself is that ASAL functionality depends on mobility, seasonality, and landscape connectivity, not on static "sites" alone. Yet legal recognition and protection mechanisms are still more developed for conventional categories (e.g., forests, protected areas, riparian reserves) than for ASAL specific assets such as livestock routes, dry season grazing areas, salt licks, and "islands of dense vegetation"

outside formally gazetted forests. The Isiolo inventory deliberately included these categories—highlighting their ecological and livelihood role—yet their legal pathways for secure recognition remain comparatively thin or inconsistently applied.

The risk is practical: where legal categories are weak or absent, ASAL assets become easier to fragment through fencing, subdivision, settlement expansion, and infrastructure siting—precisely the land use pressures the mapping was meant to anticipate and manage through spatial baselines and planning controls.

4.3.4 Enforcement Deficits and Limited Institutional Capacity

The mapping approach relied on field verification, community guidance, and daily data quality checks, underscoring that effective governance requires consistent field presence, monitoring routines, and enforceable controls, not just laws.

However, the broader pilot experience (including Samburu’s documented challenges) illustrates how capacity constraints, terrain/remoteness, language barriers, and community expectations complicate enforcement and compliance in drylands—even when rules exist.

In the dryland counties context, this enforcement gap is especially consequential because these counties sit within wider rangeland systems and connectivity corridors. Where enforcement is sporadic, the cumulative effect is incremental encroachment—often becoming “normal” land use before regulators respond.

4.3.5 Weak Integration of National Laws into County-Level Instruments

Devolution places counties at the center of spatial planning and development control, yet the mapping findings point to a recurring structural weakness: national legal intentions are not consistently translated into county planning instruments, zoning, and enforceable by laws. The mapping initiative explicitly aimed to influence county and national plans, support reservations/gazettement, and strengthen governance through evidence-based spatial baselines.

Where county spatial plans and development control do not explicitly recognize mapped assets as planning constraints and protected zones, the legal framework remains abstract. This is particularly critical for ecologically sensitive features that require site-specific controls (buffer rules, regulated access, seasonal restrictions, corridor protection measures, and prohibition of incompatible subdivisions).

4.3.6 Limited Use of Community Land Act Provisions to Protect Communal Assets

The mapping rationale explicitly recognizes that community knowledge and participation are fundamental to identifying and validating assets, and the methodology relied on participatory approaches and indigenous knowledge integration.

Yet the practical protection of communal assets remains constrained where community land tools (local by laws, community governance arrangements, customary access rules formalization, and integration into land registers) are not systematically linked to mapping outputs.

Experience from the pilot processes shows that trust and tenure anxieties are real barriers: communities sometimes feared mapping could lead to land loss, requiring NLC-led clarification and confidence-building. This demonstrates the legal-policy paradox: community land mechanisms are among the most appropriate pathways for protecting ASAL commons, yet they are the most sensitive to deploy without strong tenure safeguards, technical support, and clear benefit narratives.

4.3.7 Procedural and Transboundary Gaps: Gazettement, Reservations, and Inter County Connectivity

A key omission in many legal critiques is that the problem is not only fragmented mandates, but also weak procedural bridging instruments. The report repeatedly frames mapping as a foundation for reservations, gazettement, and landscape connectivity management across wider systems.

Yet the operational procedures that would standardize this transition—criteria for listing an asset as “critical,” documentary thresholds, roles of county vs national agencies, and how inter county assets should be handled—remain uneven.

This is especially important because rangeland resources and wildlife/livestock mobility systems are transboundary by nature; without explicit inter county instruments and shared governance structures, county-by-county protection can leave “gaps” that undermine the entire connectivity network the mapping reveals

4.4 Emerging Legal Issues

Dryland natural asset mapping is increasingly used to create authoritative inventories that support decision making, strengthen governance, and enable legal protection of critical resources through instruments such as reservations and gazettement, while improving public access to information through atlas-style products. However, as mapping becomes more central to land and natural resource governance, several emerging legal issues arise that Kenya’s framework must address more directly to ensure that maps translate into enforceable protection and sustainable use.

1) Tenure, Mobility and Access Rights in a Mapped Landscape

A persistent issue is how mapping interacts with land tenure arrangements and resource access regimes in drylands. Mapping makes resources visible and contestable, yet dryland livelihoods depend on mobility and seasonal access rather than fixed, exclusive site control. Legal and policy frameworks therefore need clearer guidance on how mapped assets (e.g., water points, grazing reserves, routes) are secured without undermining legitimate mobility-based access, and how rights of use are recognized where tenure is layered (public/community/private) or not fully formalized. This is foundational because the mapping rationale is to strengthen governance of land-based resources nationally, yet governance outcomes depend on how tenure and access are handled after mapping.

2) From “Mapped” to “Legally Secured”: Designation, Reservation and Planning Integration

A key emerging issue is the legal “conversion pathway” from mapped features to enforceable protection. Mapping is meant to inform decisions and facilitate legal protection through tools such as reservations in land cadastres and gazette notices, and to guide management actions. Yet, in practice, many frameworks are stronger on identifying assets than on specifying:

- which authority triggers legal protection once an asset is mapped,
- what evidentiary threshold the map must meet,
- what instrument applies to each asset type (reservation, gazette, by law, easement, special planning controls), and
- how mapped assets must be embedded into spatial plans, development control, and licensing decisions.

This gap allows mapped resources to remain “known” but not “secured,” weakening the governance value of inventories that were intended to streamline management.

3) Ecological Connectivity, Transboundary Systems and Ecosystem Scale Governance

Dryland systems function through landscape connectivity (corridors, dispersal areas, routes, seasonal refugia) and often cut across administrative boundaries. Mapping makes these networks visible, but legal frameworks still tend to rely on site-based protection approaches, which are often insufficient for connectivity-dependent systems. The emerging issue is the need for enforceable governance mechanisms that recognize:

- ecological networks as governance objects (not just discrete sites), and
- coordination where assets span multiple jurisdictions.

International guidance on conserving connectivity through ecological networks illustrates the growing global recognition that corridor governance requires standards and coordinated planning, which mapping now makes practically necessary.

4) Climate Risk, Seasonality and Adaptive Legal Instruments

Dryland assets are highly dynamic under climate variability (seasonal water availability, drought cycles, shifting grazing patterns). Mapping provides a baseline, but the emerging legal issue is that static legal designations and rigid use rules can become misaligned with changing ecological conditions. Frameworks increasingly need adaptive instruments—rules that accommodate seasonality and climate shocks, support resilience-building actions, and enable periodic updating of mapped baselines without reopening tenure insecurity or conflict over access.

5) Digital Governance and the Legal Status of Spatial Data

Mapping is now fundamentally digital: inventories are designed to become data hubs that support decisions and streamline governance. This raises new legal questions about:

- **data custodianship** (who holds and maintains the authoritative dataset),
- **evidentiary status** (whether mapped layers must be considered in approvals, EIAs, subdivision decisions, and enforcement),
- **interoperability** with statutory land information systems and planning workflows, and
- **sensitive data protection**, given that some mapped assets can be conflict-sensitive or culturally sensitive.

Without clear digital governance rules, spatial evidence can remain technically strong but legally optional—limiting its effect on real decisions.

6) Enforcement, Accountability and Institutional Coordination

Even where laws exist, mapping highlights that effective protection depends on enforcement capacity and clear accountability. An emerging issue is how enforcement agencies and counties operationalize mapped evidence: who monitors, who acts on encroachment, and how compliance is verified. Because dryland natural resource governance is shared across levels of government, strengthening accountability mechanisms and coordination is critical if mapping is to move beyond documentation toward sustained protection and restoration.



5.

DISCUSSION

5.1 Water Resources

Isiolo County experiences significant water scarcity, with studies showing about 65% of the County classified as very arid. Water availability fluctuates due to erratic rainfall patterns and spatial variations. Surface water is seasonal, and groundwater is a potential source, but requires further assessment. The Ewaso Ng'iro River is a major water resource for the county, supporting a large population, including indigenous pastoralists, who depend on it for their livelihoods. Isiolo town, and the surrounding area, are located along the course of the Ewaso Ng'iro River, making it a vital water source for the region. Equally, this mapping initiative found that the county is also endowed with a variety of water resources including the ponds, rock catchments, sand dams, springs and wetlands. The Lorian Swamp stood out as a significant wetland in the County fed by the Ewaso Ng'iro River, which originates from Mount Kenya. The swamp is a crucial habitat for various wildlife and a vital source of water for the region.

Despite this endowment, the county faces water resources challenges, primarily due to its arid and semi-arid climate, leading to water scarcity and reliance on unreliable water sources. These challenges are exacerbated by climate change, including droughts and floods, impacting water availability and quality. Additionally, the Ewaso Nyiro River, a crucial water source for the County, faces threats from upstream activities like deforestation and unsustainable agricultural practices, impacting water quantity and quality downstream. Unsustainable water management practices, including over-extraction and pollution, further strain the available water resources.

The report thus calls for implementing practices that ensure long-term water security, such as water harvesting, efficient irrigation, and conservation agriculture. Equally there is need for a Gender-Sensitive Approaches and targeting in water resources management and planning that will ensure that water infrastructure and services are accessible to all genders, with special attention to marginalized and vulnerable populations. Lastly, nature-based solutions aimed at restoring and protecting natural water storage areas, wetlands, and catchment areas, promoting agroforestry, and enhancing soil health is highly recommended.

5.2 County Water Seasonality

Isiolo County, located in arid and semi-arid northern Kenya, experiences pronounced water seasonality, meaning water availability fluctuates dramatically across the year due to climate variability, erratic rainfall, and limited permanent water sources. Rainfall is low (300–700 mm annually) and highly variable. Some years experience delayed or failed rains, leading to prolonged droughts, while others may have short intense rainfall causing flash floods. For livelihoods, the impact of water seasonality in the county means Pastoralists must move livestock across long distances in search of water and pasture during dry seasons. Conflicts may also arise over access to shrinking water points, especially around shared boreholes and riverbanks. Equally on wildlife, their migration is heavily influenced by water availability. Competition between wildlife and livestock often increases in dry seasons, especially near water points like the Ewaso Ng'iro.

The following strategies are proposed for managing water seasonality in the county:

- **Water infrastructure investment:** More boreholes, water pans, and rainwater harvesting systems.
- **Watershed protection:** Managing catchment areas like Mount Kenya's slopes to stabilize river flow.
- **Early warning systems:** Drought monitoring and weather forecasting for better preparedness.
- **Integrated water resource management (IWRM):** Balancing use among humans, livestock, and ecosystems.

In conclusion, water seasonality in Isiolo County is a defining feature of its climate and livelihoods. Addressing it requires a mix of traditional coping strategies and modern water management interventions to enhance resilience for both people and wildlife.

based solutions aimed at restoring and protecting natural water storage areas, wetlands, and catchment areas, promoting agroforestry, and enhancing soil health is highly recommended.

5.3 Wildlife Resources & Connectivity

Isiolo County is home to significant wildlife resources, including three national game reserves: Shaba, Buffalo Spring, and Bisanadi. These reserves are part of a larger tourism circuit known for its unique wildlife and landscapes. While much of the County's wildlife depends on the protection of reserves, healthy wildlife populations also need access to resources in the broader landscape outside protected areas. The mapped wildlife breeding or concentration areas and migratory corridors connect core habitats and are critical for species' survival and long-term viability of ecosystems. Animals disperse or migrate across landscapes to access vital resources such as pasture, water, and breeding grounds; to reduce the risks of predation; and to enhance genetic health.

Despite their role, these wildlife breeding or concentration areas and migratory corridors face various threats, including habitat loss due to increased human population and development, climate change impacting water and habitat availability, and human-wildlife conflict. Invasive plant species also pose a threat to wildlife habitats and biodiversity. Human-wildlife coexistence and sustainable development should be a future priority to enable both development and conservation goals to be achieved. Proper management of the spread of human settlements should be undertaken to avoid further encroachments to the corridors. This will be achieved

through improved spatial planning, since informatics-based approaches are shown to offer value to conservation practices. Measures should also be undertaken to combat land degradation, informed by the analysis of environmental and conservation data and by encouraging communities to use sustainable livestock numbers to avoid overgrazing.

Lastly, Wildlife connectivity in Isiolo County, Kenya, is vital for maintaining ecological balance and supporting the movement of species such as elephants, Grevy’s zebras, and lions. The county serves as a critical link between major conservation areas, including Samburu, Laikipia, and Meru despite many threats (Fig. 27). Wildlife connectivity—the maintenance of natural corridors that allow wild animals to move freely across landscapes—is critically important in Northern Kenya due to its unique ecological, economic, and cultural context. Why a landscape connectivity is vital:

1. Ecological Resilience and Biodiversity Conservation

- **Seasonal Migration:** Many species in Northern Kenya, such as elephants, Grevy’s zebras, and Oryx, depend on vast migratory routes for access to food and water, especially in arid and semi-arid environments.
- **Genetic Diversity:** Connected habitats prevent wildlife populations from becoming isolated, ensuring healthy breeding and greater genetic diversity.
- **Species Survival:** Endangered species like the Grevy’s zebra require large ranges. Fragmented habitats can lead to inbreeding, stress, and population decline.

2. Climate Change Adaptation

- **Dynamic Movement:** As rainfall patterns become more unpredictable and habitats change, wildlife must move across broader areas to survive. Corridors allow animals to track shifting water and forage availability.
- **Buffer Against Drought:** Connectivity allows movement from degraded or drought-hit areas to better-resourced zones, reducing mass mortality during harsh seasons.

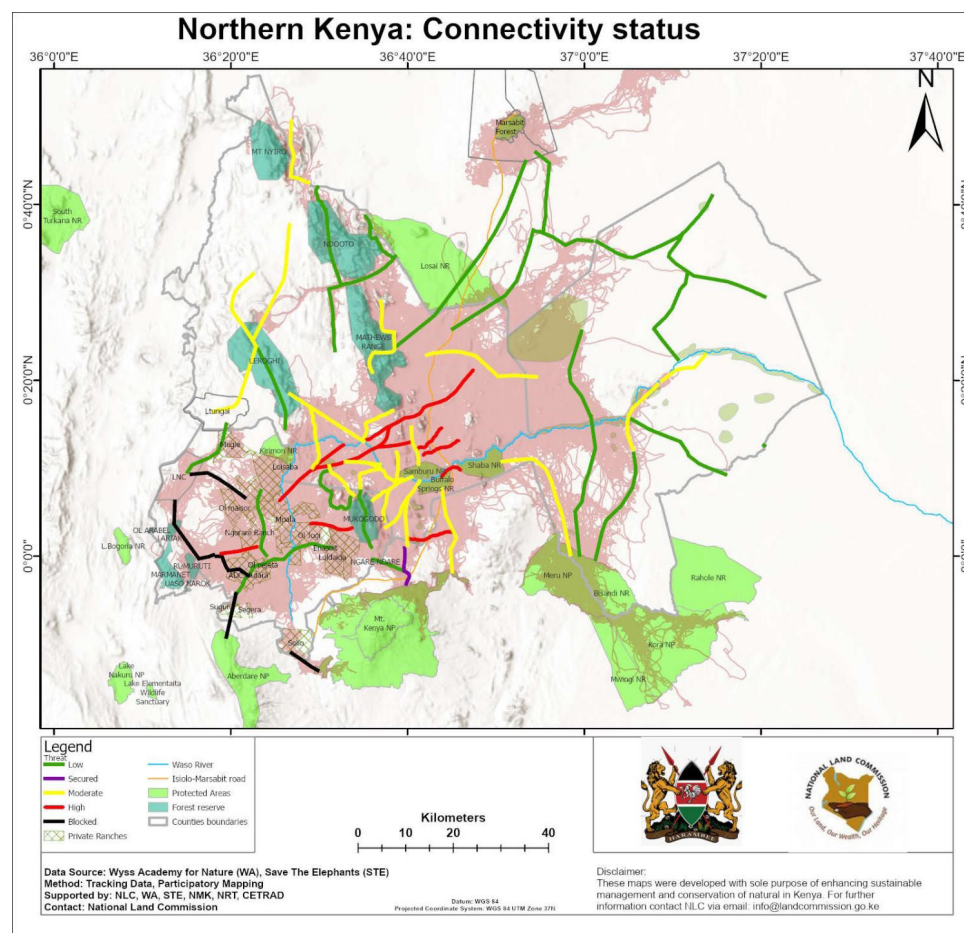


Figure 27: Wildlife connectivity in Isiolo County and Beyond

3. Support for Community-Based Conservation

- **Livelihoods:** Community conservancies that maintain corridors often benefit from eco-tourism, jobs, and conservation-related development.
- **Conflict Reduction:** Well-managed corridors can reduce human-wildlife conflict by directing animal movements away from farms and settlements.
- **Cultural Stewardship:** Indigenous communities, such as the Samburu and Borana, have deep-rooted relationships with wildlife. Corridor conservation supports the continuation of traditional pastoralism and wildlife coexistence.

4. Protection from Infrastructure Fragmentation

- **Roads and Rail:** Projects like the Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) corridor cut across key ecosystems. Wildlife corridors mitigate the impact of such developments.
- **Urban Expansion:** As towns grow, preserving movement paths helps prevent habitat loss and dangerous interactions between humans and wildlife.

5. Enhancing Protected Area Effectiveness

- **Connectivity Between Reserves:** Protected areas like Samburu, Buffalo Springs, Meru, and Lewa are only effective if animals can move between them. Corridors link these areas into a functional conservation landscape.
- **Buffer Zones:** Corridors often serve as buffer areas that reduce pressure on core protected zones.

In Northern Kenya, wildlife connectivity is not just a conservation ideal—it's a necessity for ecosystem health, community welfare, and long-term biodiversity survival. Preserving and restoring wildlife corridors must remain a priority in land-use planning, infrastructure development, and local governance across the region.

5.4 Livestock Resources

Isiolo County's economy heavily relies on livestock, is a significant source of livelihood for over 80% of residents. Isiolo serves as a major livestock producing and marketing hub in northern Kenya supported by livestock routes that are essential for the livelihoods of pastoralists, allowing them to maintain their herds and access resources in these challenging environments. Equally the livestock dry season grazing areas including the traditional and drought grazing reserves play a key role in enabling pastoralists move to these areas as dry conditions worsen and browse becomes scarce.

Despite their role, Isiolo experiences frequent droughts, leading to livestock losses, reduced pasture availability, and water scarcity thus significantly impacting on livestock populations. Equally, inter-tribal conflicts and cattle rustling pose a threat to pastoral communities, disrupting grazing patterns and livestock mobility. Implementing pasture restoration technologies, such as reseeding, can help build resilience and enhance livestock productivity. Further, promoting peaceful coexistence and addressing the root causes of inter-tribal conflicts is crucial for ensuring the safety and security of livestock herders. Engaging pastoral communities in the planning and implementation of solutions can ensure that interventions are relevant and sustainable.

5.5 Islands of Dense Vegetation

Isiolo County has both natural forests and areas with high tree cover, but it's not characterized by dense vegetation in the traditional sense of dense, impenetrable forests. The county's vegetation is largely composed of arid and semi-arid landscapes with thorny bushes and short grasses, with pockets of natural forests and dense vegetation in certain areas. Many dense vegetation areas are managed as community conservancies, where wildlife conservation is combined with other land uses like pastoralism. However, land degradation, deforestation, charcoal burning and desertification remain to be major threats to these dense vegetation areas. Equally, increased livestock numbers and overgrazing, particularly in the northern parts of the county, contribute to land degradation and reduce the carrying capacity of the rangelands.

Traditional knowledge and practices through a combination of customary practices, local knowledge, like grazing units and use of "scouts" to monitor resource conditions and guide grazing patterns, are crucial for managing dense vegetation areas. Such practices focus on sustainable resource use, particularly grazing, and involve partitioning land into wet and dry season grazing areas, along with drought grazing reserves. Effective management of dense vegetation islands will also requires collaboration between different stakeholders, including local communities, the county government, and external organizations.

5.6 Salt Lick Areas

In dryland ecosystems such as Isiolo, salt licks are critical natural resources that provide essential minerals, primarily sodium, to a wide variety of wildlife, including herbivores, carnivores, and other animals. These areas, rich in mineral salts, support the health and well-being of diverse animal populations, particularly in regions where minerals are scarce. Salt licks are important sources of essential minerals like sodium, calcium, magnesium, and trace elements that are often lacking in the diets of herbivores. Equally, the presence of salt licks influences the distribution and movement patterns of wildlife and livestock thus impacting various ecosystem processes, including grazing patterns, seed dispersal, and food web dynamics. By providing essential minerals and promoting healthy ecosystems, salt licks can contribute to the overall sustainability of dryland ecosystems such as Isiolo.

However, within Isiolo County, areas with salt licks face challenges related to wildlife access, resource competition, and potential conflicts between pastoralists and other land users. These challenges can impact both the livelihoods of local communities and the conservation of wildlife populations. Involving local communities in the management of salt licks through participatory approaches can help to ensure sustainable resource use and reduce conflicts. Also, establishing buffer zones around salt licks and implementing mechanisms for resource allocation can help to balance the needs of wildlife and pastoralists. Lastly, establishing effective conflict resolution mechanisms, such as community-based mediation or formal dispute resolution systems, can help to address conflicts over land use and resource access.



6.

CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

Isiolo County is endowed with a rich and diverse portfolio of natural resource assets, including more than 17 major wildlife and livestock corridors, five livestock routes, 29 dry season grazing areas, 27 islands of dense vegetation, 61 salt licks, and extensive water resources comprising wetlands, ponds, rock catchments, springs, and sand dams. Collectively, these assets form the ecological and economic backbone of the county, underpinning pastoral livelihoods, biodiversity conservation, tourism, and other resource based enterprises that contribute to both county and national development.

Despite this significant endowment, Isiolo County's natural assets are under increasing pressure. Ongoing community land adjudication and privatization processes have constrained access to traditionally shared resources, fragmenting landscapes and disrupting mobility patterns essential for pastoral systems. These pressures are further compounded by climate change, which has intensified competition over scarce water and pasture resources, heightened the frequency of resource based conflicts, and undermined livestock productivity and household resilience.

Equally critical is the fact that the true value and full potential of these natural assets remain inadequately documented and appreciated in development planning and policy processes. The absence of comprehensive, spatially explicit information has limited evidence based decision making, weakened protection mechanisms, and constrained opportunities for sustainable investment. In this regard, the mapping and inventory of natural resource assets undertaken through this initiative represents a foundational step toward securing these resources for present and future generations.

By generating reliable data to inform county and national cadastral systems, this initiative strengthens the basis for protection, sustainable management, and equitable access to natural assets. Ultimately, safeguarding Isiolo County's natural resources will require a multifaceted approach that integrates ecosystem protection, improved resource governance, meaningful community participation, and effective implementation of existing legal and policy frameworks. Such an approach is essential to sustain livelihoods, reduce conflict, and unlock long term socio economic benefits, including the creation of green jobs and resilient local economies.

6.2 Recommendations and Prioritization

6.2.1 Planning Around Water Sources and Infrastructure Development.

Given the central role of water resources within Isiolo County's wider natural asset base—supporting pastoral mobility, dry season grazing, wildlife corridors, and local economies—future water infrastructure development must be planned as part of an integrated landscape and resource governance framework. Although the county is endowed with diverse water sources, access remains uneven and increasingly constrained by population growth, climate variability, and the fragmentation of traditionally shared resource areas. Long distances to water points continue to undermine household resilience, livestock productivity, and conflict mitigation.

To address these challenges, planning should prioritise strategic, high-impact investments that enhance access while safeguarding mobility corridors and ecologically sensitive areas. Emphasis should be placed on rehabilitating and upgrading existing water points, protecting dry season water sources, and developing infrastructure in locations that deliver the greatest collective benefit to communities, livestock, and ecosystems. Such an approach aligns with national water service standards and ensures that limited financial resources generate maximum gains in access, resilience, and long-term sustainability, while reinforcing the protection and equitable use of Isiolo County's natural resource assets.

6.2.2 Environmentally Sustainable Opportunities in the Mining Sector

Isiolo County is endowed with a variety of mineral resources with significant socio economic potential, yet much of this endowment remains underexplored, undocumented, and weakly regulated. Existing mineral extraction activities are largely small scale, informal, and in many cases environmentally unsustainable, posing risks to fragile ecosystems, shared water sources, and community livelihoods. These challenges mirror broader governance gaps identified across the county's natural resource base, where limited data and weak oversight constrain sustainable utilisation.

To address this, the County Government, in collaboration with relevant national agencies, should prioritise the systematic identification, mapping, and regulation of mineral resources as part of an integrated natural resource management framework. Emphasis should be placed on promoting environmentally responsible mining practices, strengthening compliance with existing legal and environmental safeguards, and formalising small scale extraction activities. Linking regulated mineral development to value chains and markets can enhance local benefits, support livelihood diversification, and contribute to county and national economic growth, while safeguarding ecosystems and reducing resource based conflicts.

6.2.3 Fast Tracking County Spatial Planning

County Spatial Plans (CSPs) provide the primary framework for guiding the orderly, sustainable, and integrated use of land and natural resources across the county. In Isiolo, where livelihoods, biodiversity conservation, and economic activities are tightly linked to spatially distributed natural assets, delayed or incomplete spatial planning poses a significant risk to long term sustainability. Without timely spatial plans, critical resources such as water sources, grazing areas, wildlife corridors, and mineral zones remain vulnerable to unplanned development, fragmentation, and permanent loss.

There is therefore an urgent need for the County Government to fast track the preparation and implementation of County Spatial Plans to ensure that key natural resource assets are systematically captured, reserved, and secured within the county land cadastre. Embedding these assets within CSPs will strengthen protection mechanisms, guide compatible land uses, and align county development priorities with national policy frameworks. Accelerated spatial planning is essential to safeguard ecosystem goods and services, reduce land use conflicts, and support evidence based decision making for sustainable socio economic development.

6.2.4 Strengthening Security of Land Tenure

The long term sustainability of Isiolo County's dryland natural assets is closely linked to secure and equitable land tenure arrangements. Although these assets underpin pastoral livelihoods, ecosystem services, and landscape resilience, their full value remains inadequately documented and integrated into land governance processes. Ongoing community land registration under the Community Land Act (2016), while critical for tenure security, presents a risk that shared natural assets may be overlooked, fragmented, or lost if not explicitly recognised and protected.

It is therefore imperative that the County Government takes deliberate measures to ensure that key public natural assets—such as grazing areas, water sources, wildlife corridors, and dry season refugia—are identified, safeguarded, and reserved within community land registration processes. Strengthening tenure security in this manner will help preserve equitable access, protect ecosystem goods and services, and prevent irreversible loss of livelihoods and landscape resilience. Failure to do so could have severe social, economic, and ecological consequences in both the short and long term.

Table 32: Proposed Gazettement of Critical and Vulnerable Assets for Public Use

Priority Resource/Site	Issues/Threats	Proposed Conservation Measures
Kom livestock dry season grazing area	<ul style="list-style-type: none"> • Shared resource traversing Isiolo-Samburu and Marsabit Counties • Critical dry season livestock grazing area for communities including as far as Wajir and Garissa. • Faced with security challenges and resource use conflicts • Mining area (gold) 	<ul style="list-style-type: none"> • Inter county dialogues • Inter-county physical and land use planning • Inter-county natural resource committee tasked with setting grazing plans alongside other attendant regulations. • Gazettement as a special planning area
Lorian Swamp	<ul style="list-style-type: none"> • Lowest point in Isiolo County and the Ewaso Nyiro and associated tributaries drain into this swamp. • Critical wildlife and livestock grazing area especially during dry seasons. • Critical wildlife corridor • Invasive species proliferation especially <i>Prosopis Juliflora</i> • Proposed road construction through the swamp 	<ul style="list-style-type: none"> • Strengthen management and conservation of the landscape including adjoining rivers and riparian areas • Establish and strengthen local level governance • Ecosystem based approach and landscape scale connectivity planning
Marire Wetland/ Swamp	Faces several significant threats due to changing land use, population pressures, and weak governance.	<ul style="list-style-type: none"> • Enforce land use zoning to protect riparian buffers. • Reserve under the Land Act, section 15. • Gazettement accordance with the Land Act 2012 and Water Act, 2016
Kinna Kanchoradhi spring/catchment area	Degradation and encroachment	Reserve and gazette under Land and Water Acts by NLC and WRA respectively
Oldonyiro-Mokorri corridor:	Forms part of the broader northern rangeland migratory system, enabling seasonal movement of wildlife across community lands, conservancies, and key grazing landscapes.	Gazette in accordance with the Wildlife Act, 2013; and Land Act 2012
The Shaba-Meru National Park	Facilitates seasonal wildlife movements, particularly for elephants, reticulated giraffes, Grevy's zebras, and large carnivores, ensuring gene flow and access to essential resources such as water and forage.	

Babala–Meru National Park wildlife corridor	Enables the free movement of key wildlife species, including elephants, lions, and various antelope species, between community lands and the protected park ecosystem. It plays an essential role in maintaining ecological processes, supporting seasonal movements, and reducing human–wildlife conflict by providing a natural passageway for wildlife.	
Babala–Kina corridor	Supports migratory routes for elephants, Grevy’s zebras, and other key species, allowing access to water points, grazing areas, and refuge during dry seasons. It also plays a role in mitigating human–wildlife conflict by guiding animal movements away from densely settled zones.	
Ilgwesi–Buffalo Springs wildlife corridor	It facilitates seasonal wildlife movements, particularly for elephants, Grevy’s zebras, giraffes, and carnivores, between communal rangelands and protected areas. The corridor supports ecosystem connectivity across the Ewaso ecosystem, enabling animals to access critical resources such as water, salt licks, and dry-season grazing grounds.	
Buffalo Springs to Meru Wildlife Corridor (Main Route)	<ul style="list-style-type: none"> • Plays a crucial role in genetic exchange, dispersal, and survival of wide-ranging species, especially in the face of increasing habitat fragmentation. 	
Badha Bisan Hajaho (Forest of Smelly Water) – Kulamawe Location, Kinna Ward	<ul style="list-style-type: none"> • Natural dryland forest area with seasonal wetlands or marshes. • Known for its sulfurous or mineral-rich water sources—hence the name “smelly water” • Held in traditional reverence by local communities; sometimes associated with sacred sites or folklore • Threats: Encroachment and land conversion, Historical and Boundary Conflicts, Charcoal burning and Lack of legal protection. 	<ul style="list-style-type: none"> • Gazettement as a dryland state forest in accordance with the Forest Conservation and Management Act, 2016; preceded by reservation under section 15 and 16 of Land Act 2012 • Collaborative management between cloleca communities (Dedha structure) and the state

<p>Badha Sotewesa (Forest of Giraffes) – Kulamawe, Kinna Ward</p>	<ul style="list-style-type: none"> • Ecological Zone: Arid/semi-arid dryland woodland – Acacia-Commiphora biome • Used as a wildlife dispersal zone, particularly by reticulated giraffes, dik-diks, and possibly antelopes and small carnivores. • Known and named by local communities, possibly regarded as ancestral land, seasonal grazing refuge, or a traditional grazing reserve (badha). • seasonally connected to ephemeral streams or pans, important for both livestock and wildlife. 	
<p>Ewaso Nyiro Riparian Reserve</p>	<ul style="list-style-type: none"> • Invasive species proliferation especially <i>Prosopis Juliflora</i> impeding access to the river and other resources insitu. 	<ul style="list-style-type: none"> • Demarcation of riparian reserves. • Institute measures for control and management of alien species
<p>Spring Protection outside protected areas</p>	<ul style="list-style-type: none"> • Numerous springs outside protected areas that support local communities and recharge aquatic ecosystems. • Human and livestock destruction, pollution/contamination 	<ul style="list-style-type: none"> • Institute spring protection measures by local community and WRA • Spring infrastructure development including provision of animal watering points along side domestic water points.

6.2.6 Commission survey of the Priority sites to cadastral standards for gazettment

To commission a survey of priority sites to meet cadastral standards for gazettment, one needs to follow a structured process involving surveying, plan preparation, and submission to relevant authorities. This includes conducting surveys, creating cadastral maps, and boundary plans and potentially obtaining permits or approvals from the relevant government agencies like the State Department for Lands and Physical Planning.

By dint of Section 35 (1) of the Wildlife Conservation and Management Act, 2013, the Cabinet Secretary may, upon national reserve. recommendation of the relevant county government and after consultation with the National Land Commission, by notice in the Gazette, declare any land under the jurisdiction of a county government to be a national reserve where the land is —

- a. rich in biodiversity and wildlife resources or contains endangered and threatened species;
- b. an important catchment area critical for the sustenance of a wildlife conservation area;
- c. **an important wildlife buffer, zone, migratory route, corridor or dispersal area.**

Additionally, Section 2 of the Act, defines a “**national reserve**” as an area of community land declared to be a national reserve under this Act or under any other applicable written law. The above legal provision will guide on the gazettment of the identified key wildlife migratory route, corridor or dispersal area. Equally, section 31 (1) of the Wildlife conservation and management Act, 2013, provides that the Cabinet Secretary, may in consultation with the competent authority, by notice in the Gazette — **c) declare a wetland** to be a protected area under the management of the Service. This legal provision can be invoked in the gazeettment of the proposed Ewaso Narok and Pesi wetlands. These are vital avenues for protection of these fragile resources. Here are the detailed steps for survey of the proposed priority sites cadastral standards for gazzettment:

1. **Identification of Priority Sites:** Determine the specific locations or properties that need to be surveyed and meet the cadastral standards for gazettment.
2. **Survey Planning:** Develop a detailed survey plan that outlines the scope, objectives, and methods to be used.
3. **Survey Execution:** Conduct the necessary surveys using appropriate surveying methods, equipment, and techniques.
4. **Data Processing:** Process the collected survey data to create accurate and reliable cadastral maps and plans.
5. **Plan Preparation:** Prepare cadastral maps and plans that meet the required standards, including the use of special forms, scales, and plotting methods, as specified in Survey Regulations.
6. **Submission:** Submit the completed cadastral maps and plans to the relevant authorities for review and approval.
7. **Gazettment:** Once the cadastral maps and plans are approved, they can be gazetted, making them publicly accessible and legally binding.

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APPENDICES

Appendix 1: Stakeholders Report

Appendix 2: Assets Inventory

