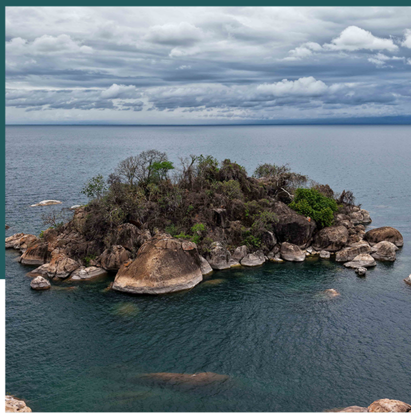
SUMMARY FOR POLICYMAKERS OF THE NATIONAL ECOSYSTEM ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES



SUMMARY FOR POLICYMAKERS OF THE NATIONAL ECOSYSTEM ASSESSMENT REPORT ON BIODIVERSITY AND ECOSYSTEM SERVICES

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Disclaimer

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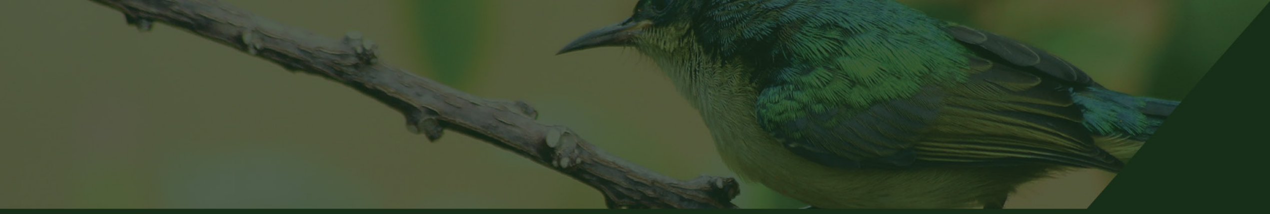



CHAPTER ONE: SCOPING PROCESS

KEY MESSAGES

KM-1: The National Ecosystem Assessment provides Malawi's first integrated evidence base linking biodiversity, ecosystem services, and human well-being, which is essential for aligning national development planning with the Kunming-Montreal Global Biodiversity Framework and Malawi 2063 {1.1, 1.2, 1.6}.

The NEA synthesizes over a decade of scientific data and Indigenous and Local Knowledge (ILK) across terrestrial, aquatic, and wetland ecosystems. It establishes baseline information on the status, trends, and drivers of change for biodiversity and nature's contributions to people. Approximately 85% of Malawi's population directly depends on biodiversity for their livelihoods, and the agriculture sector alone employs over 76% of the workforce and contributes more than 22% of GDP. However, prior to the NEA, this information was scattered across sectoral ministries, making it impossible to discern the overall country picture and changes over time and space. The NEA also responds to reporting obligations under the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, and the United Nations Convention to Combat Desertification. Without this integrated assessment, sectoral policies (agriculture, energy, water, fisheries) have operated with incomplete information, leading to conflicting interventions and missed opportunities for synergy. The NEA as the official reference for all sectoral planning, environmental impact assessments, and international reporting within 12 months.

KM-2: Current policy and legal frameworks for environment and natural resources are fragmented across sectors, weakly enforced, and systematically marginalize Indigenous and Local Knowledge (ILK), creating a structural disconnect between the knowledge systems that inform policy decisions and the community-level governance systems that have historically delivered the best conservation outcomes {1.3, 2.3, 3.5.1, 3.5.4, 6.3}.

Malawi's aquatic, terrestrial, and wetland ecosystems are governed by multiple sectoral policies and laws operating with limited coordination. Key instruments include the Fisheries Conservation and Management Act (1997), Water Resources Act (2013), National Fisheries and Aquaculture Policy (2016), National Water Policy (2004), and Environmental Management Act (2017). While the Environmental Management Act provides an overarching framework, implementation remains fragmented across institutions with competing mandates. A review of 28 national policy instruments found that only the National Environmental Policy (2004) explicitly recognizes ILK's role in conservation governance. Enforcement across all instruments remains weak due to inadequate resources, limited staffing, and corruption. Co-management arrangements remain largely nominal, with limited meaningful participation of Indigenous Peoples and local communities in decision-making. The National Biodiversity Strategy and Action Plan lacks robust monitoring and evaluation mechanisms to support adaptive management. There is need to revise all sectoral ENRM policies to include operational provisions for ILK inclusion, customary governance recognition, and mandatory stakeholder co-design in monitoring and management. Strengthen enforcement mechanisms, ensure accountability, and provide adequate support for community-based committees.

KM 3. Sustained investment in monitoring infrastructure, human capacity, data systems, and institutional coordination is essential for effective ecosystem management, yet current funding remains inadequate and insecure, resulting in fragmented and unresponsive interventions {1.1, 1.2, 1.3, 3.2.4.1, 3.5.1, 4.4}.

Current biodiversity monitoring efforts in Malawi are severely underfunded, fragmented, and disconnected from national statistical systems. Long-term funding essential for building and maintaining monitoring systems capable of reliably assessing ecosystem outcomes is lacking. Hydrometric monitoring for small lakes including Kazuni and Chiuta is absent, leaving hydrological trends and variability undocumented. Water quality monitoring lacks temporal consistency, with no long-term datasets enabling comparison with historic baselines. Stock assessments for non-commercial fish species are absent, and population trend data for most species, including those classified as critically endangered, are insufficient to guide management. A foundational challenge is the lack of interoperability among data systems: compatible metadata standards, vocabularies, and shared ontologies are essential to enable seamless integration across datasets from scientists, citizen scientists, ILK holders, NGOs, and government agencies. Without such interoperability, monitoring efforts risk fragmentation, redundancy, and limited capacity for cross-site analysis and synthesis. It is essential to establish a national ecosystem monitoring framework with clear indicators, baselines, and regular reporting aligned with SDGs and multilateral environmental agreements. Allocate sustained domestic and international financing for human capacity, data infrastructure, and community-based monitoring systems. Treat monitoring as an evolving infrastructure rather than a one-off task.

BACKGROUND Scoping Process

1. The Malawi National Ecosystem Assessment (NEA) provides the country's first integrated evidence base linking biodiversity, ecosystem services, and human well-being across terrestrial, aquatic, and wetland ecosystems. This assessment is essential for aligning national development planning with the Kunming-Montreal Global Biodiversity Framework and Malawi 2063 by enabling coordinated, evidence-based decision-making across sectors {1.1, 1.2, 1.6}

The NEA synthesizes more than a decade of scientific evidence and Indigenous and Local Knowledge (ILK) to establish national baseline information on the status, trends, and drivers of biodiversity and nature's contributions to people. Prior to the assessment, environmental information was fragmented across ministries and sectors, limiting the country's ability to understand cumulative ecosystem change, identify trade-offs, or coordinate responses across landscapes and sectors.

The assessment demonstrates that biodiversity underpins livelihoods, food systems, water security, climate resilience, and economic development in Malawi. Approximately 85% of the population depends directly on biodiversity and ecosystem services, while agriculture employs more than 76% of the workforce and contributes over 22% of GDP. Despite this dependence, sectoral planning in areas such as agriculture, fisheries, energy, water, and infrastructure has often proceeded without integrated ecosystem information, resulting in conflicting interventions, ecosystem degradation, and missed opportunities for synergies.

The NEA also strengthens Malawi's capacity to meet reporting and implementation obligations under multilateral environmental agreements, including the Convention on Biological Diversity, United Nations Framework Convention on Climate Change, and United Nations Convention to Combat Desertification. Institutionalizing the NEA as the national reference framework would support policy coherence, evidence-based planning, and integrated monitoring across sectors and scales *(Well established)* {1.1, 1.2, 1.6}.

2. Current environmental and natural resource governance systems in Malawi remain fragmented across sectors, weakly enforced, and insufficiently inclusive of Indigenous and Local Knowledge (ILK). This disconnect undermines coordinated ecosystem management and limits the effectiveness of community-based governance systems that have historically supported biodiversity conservation and sustainable resource use (Well established).

Malawi's terrestrial, aquatic, and wetland ecosystems are governed through multiple sectoral policies and legal instruments with overlapping mandates and limited institutional coordination. Key frameworks include the Fisheries Conservation and Management Act (1997), Water Resources Act (2013), National Fisheries and Aquaculture Policy (2016), National Water Policy (2004), and Environmental Management Act (2017). Although the Environmental Management Act provides an overarching framework for environmental governance, implementation remains fragmented and inconsistently enforced across sectors and institutions *(Well established)* {1.3}.

A review of 28 national policy instruments revealed that only the National Environmental Policy explicitly recognizes the role of ILK in ecosystem governance and conservation. As a result, local knowledge systems, customary governance structures, and community conservation practices remain largely marginalized within formal policy processes despite their demonstrated contributions to sustainable resource management, ecosystem monitoring, and adaptive responses to environmental change *(Well established)* {3.5.4}.

Weak enforcement capacity, inadequate financing, limited staffing, corruption, and insufficient accountability mechanisms continue to undermine implementation across sectors. Existing co-management arrangements are often nominal, with limited meaningful participation of Indigenous Peoples and local communities in decision-making, planning, monitoring, and benefit-sharing processes. In addition, the National Biodiversity Strategy and Action Plan lacks sufficiently robust monitoring and evaluation systems to support adaptive governance and long-term accountability.
Strengthening policy coherence and recognizing ILK systems as legitimate and complementary knowledge systems would improve governance effectiveness, social legitimacy, and ecosystem stewardship outcomes. Greater inclusion of customary institutions and participatory governance approaches would also strengthen locally grounded conservation and resilience strategies *(Well established)* {2.3, 4.8.1, 4.9.3}

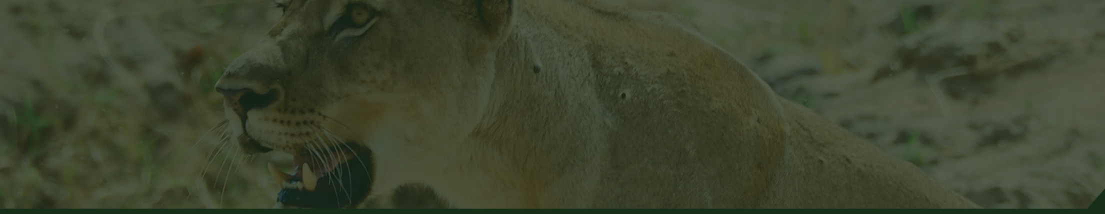
3. Effective ecosystem management in Malawi requires sustained investment in monitoring infrastructure, human capacity, interoperable data systems, and institutional coordination. Current monitoring efforts remain underfunded, fragmented, and insufficient to support timely, adaptive, and evidence-based decision-making (Well establshed) {1.1, 1.2, 1.5, 3.2.4.1, 3.8.2.3 4.4}.

Biodiversity and ecosystem monitoring systems in Malawi are characterized by fragmented datasets, inconsistent methodologies, limited long-term financing, and weak integration across institutions. Existing monitoring efforts are often project-based and short-term, reducing their ability to detect long-term ecosystem trends, evaluate policy effectiveness, or support adaptive management *(Well established)* {1.5}.

Critical information gaps persist across terrestrial, wetland, and aquatic ecosystems. Hydrometric monitoring systems for lakes such as Lake Kazuni and Lake Chiuta are absent, limiting understanding of hydrological variability and climate-related changes. Water quality monitoring lacks temporal consistency and long-term baseline datasets. Population trend data for many species, including threatened and non-commercial fish species, remain inadequate for effective management and conservation planning *(Well established)* {3.2.4.1}.

A major systemic challenge is the lack of interoperability across biodiversity and environmental data systems. Incompatible metadata standards, fragmented databases, and limited coordination between government agencies, researchers, NGOs, citizen scientists, and ILK holders restrict the integration, synthesis, and accessibility of information. Without harmonized data systems and shared monitoring frameworks, ecosystem assessments remain incomplete and fragmented, limiting the country's capacity for national-scale analysis and informed decision-making.

Strengthening monitoring systems requires viewing ecosystem monitoring as long-term national infrastructure rather than short-term projects. Sustained investment in technical capacity, institutional coordination, digital infrastructure, community-based monitoring, and ILK-inclusive approaches would improve national preparedness, policy responsiveness, and ecosystem resilience *(Established but incomplete)* {3.8.2.3}.



CHAPTER TWO: AQUATIC ECOSYSTEMS

KEY MESSAGES

KM 1. Malawi's aquatic ecosystems are critical to national food security, livelihoods, and socio-economic growth and development, yet these benefits are increasingly at risk due to widespread degradation. Protecting and restoring these ecosystems is therefore an urgent priority to sustain biodiversity, strengthen climate resilience, and secure long-term development gains {3.1, 3.2, 3.4}

Aquatic ecosystems cover approximately 20% of Malawi's surface area and include Lakes Malawi, Chilwa, Malombe, Chiuta, and Kazuni, along with major river systems including the Shire, Bua, Linthipe, Dwangwa, North and South Rukuru. These ecosystems support over 1,000 fish species in Lake Malawi alone, 95% being haplochromine cichlids with 99% endemism, representing roughly 4% of the world's fish species and 15% of global freshwater fish biodiversity . The fisheries sector provides 60–70% of animal protein intake for Malawians and supports livelihoods for over 1.6 million people through fishing, processing, marketing, and related activities. Approximately 74,000 people are directly employed as fishers . Aquatic ecosystems also support hydropower generation (over 95% of national electricity), water supply for domestic and irrigation use, transportation, and tourism. The per capita fish consumption stands at approximately 8.5 kg/person/year, contributing up to 40% of dietary animal protein.Despite their importance, these ecosystems face severe pressures from sedimentation, nutrient pollution, overfishing, invasive species, and climate change. Iconic species such as Chambo (Oreochromis spp.) have experienced catch declines exceeding 70%, with landings falling from approximately 9,000 tons annually in the late 1970s to less than 2,500 tons today. The shift toward smaller, less valuable species in catch landings indicates fundamental ecosystem imbalance.

KM 2. Water quality in Malawi's aquatic ecosystems is deteriorating due to sedimentation, pollution, and catchment degradation, with parameters frequently exceeding national thresholds, resulting in eutrophication affecting both primary and secondary production {3.2.2, 3.2.3}

Sedimentation and nutrient pollution in Malawi's lakes and rivers are rising sharply due to deforestation, agricultural expansion, and poor land-use practices. Lake Malawi and its tributaries, particularly the Linthipe River, are experiencing high sediment and nutrient loads, with total dissolved solids and phosphate levels frequently exceeding national standards. Shallow lakes, including Malombe, Chilwa, Chiuta, and Kazuni, are shrinking and highly vulnerable to climate variability, with increased frequency of complete drying events, threatening water availability, ecosystem health, and livelihoods dependent on these water bodies.

KM 3. Aquatic biodiversity information in Malawi shows significant geographic and taxonomic biases, with critical gaps in understanding of non-commercial species, small water bodies, and long-term trends, resulting to limited focus in management and conservation efforts due to compromised decision making {3.2.2, 3.2.4}

While Lake Malawi's cichlid diversity is well documented, information on other fish groups, smaller lakes, and non-fish aquatic fauna remains limited. Several species in Lake Malombe, Lake Chilwa, and the Shire River are critically endangered or vulnerable, yet monitoring is biased toward commercially valuable fish in accessible areas. Smaller water bodies like Lakes Kazuni and Chiuta lack sufficient data on fish stocks and hydrology, and non-fish aquatic species are largely unstudied, hindering effective conservation and management decisions.

KM 4. Indigenous and Local Knowledge (ILK) systems, historically vital for sustainable aquatic resource management, are increasingly eroded and remain poorly integrated into formal governance due to modernization and limited inclusion in existing policies {3.2.7, 3.6.1, 3.5.1, 3.6.7, 4.1}

Traditional management systems, including closed seasons, sacred sites, taboos, and customary governance, have demonstrated effectiveness in conserving aquatic biodiversity. At Mbenje Island in Lake Malawi, a community-managed closed season from December to March, enforced through elaborate ceremonies and traditional sanctions, has sustained fish stocks and unique fish diversity for decades. Similarly, sacred sites including Chaone and Chidyamphiri Islands in Lake Chilwa, Phiri la Mtsatsi in Lake Chiuta, and Mizimu Island in northern Lake Malawi function as de facto protected areas where cultural beliefs prohibit fishing, enabling undisturbed fish breeding and population recovery.

Fishers' knowledge encompasses detailed understanding of fish behavior, breeding grounds, migration patterns, and environmental indicators. Traditional weather prediction using observations of winds (Mwera, Mpoto), cloud formations, bird behavior, and water patterns enables communities to anticipate conditions for safe fishing and prepare for climate variability. Indigenous and local communities interpret geo-climatic signs including rising clouds, wind patterns, water temperature, and animal behavior to determine suitable fishing times and locations, enhancing both safety and fishing efficiency.

However, ILK systems face accelerating erosion driven by modernization, out-migration of youth, influence of monotheistic religions that devalue traditional practices, formal education systems that exclude ILK, and policy neglect. Migration of fishers into traditional areas introduces practices incompatible with local conservation norms, such as destructive fishing gears that undermine traditional management systems. The absence of formal recognition and legal protection for ILK, despite Constitutional provisions in Section 26 guaranteeing the right to participate in cultural life, leaves traditional knowledge vulnerable to exploitation and loss. Current co-management arrangements often remain nominal, with limited meaningful integration of ILK into decision-making processes .

KM 5. Co-management approaches engaging local communities have shown positive impacts on fisheries recovery, but their effectiveness is undermined by persistent challenges in enforcement, funding, and limited institutional support {3.2.4, 3.2.7, 3.8.2}

Community-based fisheries management through Beach Village Committees (BVCs) and the Ecosystem Approach to Fisheries Management (EAFM) has demonstrated measurable success, with community-managed sanctuaries, across 56 sites covering 1,022 hectares contributing to a 24% increase in observed fish species between 2016 and 2019. Co-management in Lake Chilwa (established in 2000, with by-laws formalized in 2012) regulates fishing seasons, restricts gear types, and protects critical habitats, complemented by traditional governance in Lake Chiuta and collaboration between Village Natural Resource Management Committees and the Department of Parks and Wildlife at Lake Kazuni and Zolokere.

However, despite these successes, co-management faces substantial challenges: enforcement remains weak as offenders are often released without meaningful sanctions, corrupt practices by some law enforcers erode trust and effectiveness, committee members serve voluntarily yet patrol duties compete with livelihood activities creating vulnerability to inducements from financially powerful fishers using illegal gear and climate extremes, such as Cyclone Freddy in 2023 which destroyed sanctuary markers and barriers in Lake Chilwa, demonstrate the vulnerability of physical infrastructure. Strengthening enforcement mechanisms, ensuring accountability, providing adequate support for voluntary committee members, and building climate resilience into fisheries management infrastructure are therefore essential to sustain and scale these co-management gains.

KM 6. Sectoral policy and legal frameworks for aquatic ecosystem management are in place but not yet comprehensive or fully effective; they remain fragmented, weakly enforced, and poorly integrated, resulting in disjointed management efforts {3.5.1, 3.5.4, 6.3}

Malawi has established a comprehensive legal and policy framework for aquatic ecosystems; However, significant implementation gaps undermine its effectiveness. The Water Resources Management Policy lacks guidelines for aquatic biodiversity conservation, has weak enforcement of water quality standards, and insufficiently addresses climate change impacts; the Fisheries Conservation and Management Act focuses narrowly on fish resources while neglecting broader ecosystem elements such as water quality and non-fish species, with weak enforcement enabling continued illegal fishing; and the National Biodiversity Strategy and Action Plan lacks robust monitoring and evaluation mechanisms to support adaptive management. Addressing these implementation gaps through strengthened enforcement, expanded ecosystem scope in legislation, and enhanced monitoring frameworks is essential to translate existing policy commitments into effective conservation and management outcomes.

KM 7. Climate change is increasing stress on aquatic ecosystems through rising temperatures, altered water flows, and more frequent extreme events, with significant impacts on water security, fisheries, and livelihoods {3.4.2, 3.6.1}

Climate change is increasingly disrupting Malawi's aquatic systems, with rising temperatures, erratic rainfall, prolonged droughts, floods, and extreme events affecting water availability and ecosystem stability. Shallow lakes such as Chilwa, Malombe, Chiuta, and Kazuni are highly vulnerable, experiencing fluctuating water levels and more frequent drying events, while siltation and climate pressures further degrade systems like Lake Malombe. In Lake Malawi, warming temperatures and stronger winds are driving more frequent fish kills, while climate variability is reducing key fish stocks such as Chambo. Extreme events, including Cyclone Freddy (2023), have damaged critical fish habitats and reduced productivity. These changes threaten national energy security with hydropower heavily dependent on Lake Malawi and Shire River flows as well as water supply for agriculture, industry, and households. At the same time, climate impacts are contributing to increased disease outbreaks and rising conflicts over scarce water and fisheries resources, with conditions expected to worsen.

KM 8. Invasive alien species are causing ecological damage and economic losses across fisheries, agriculture, and hydropower. Limited monitoring and control heighten the risk of further spread. Strengthening surveillance, early detection, and coordinated management is essential {3.9.1, 3.9.1.2, 4.6.3}

All major water bodies face threats from invasive alien species introductions, both intentional and unintentional, mediated through land-use changes, aquaculture development, and climate change. Documented introductions include invasive tilapiines Oreochromis niloticus and Oreochromis leucostictus, introduced for aquaculture development and new capture fisheries. The introduction of O. leucostictus was accidental due to misidentification as O. niloticus {3.3.3}. While current evidence does not indicate these species are impacting native fish populations, the situation requires close monitoring as impacts may emerge over time. Other introductions include piscivorous Oncorhynchus mykiss (rainbow trout) in Nyika Plateau streams and Protopterus annectens (African lungfish) near Salima. Water hyacinth (Eichhornia crassipes) is widely spread in Shire River, affecting hydropower generation and irrigation. Power shutdowns resulting from aquatic weeds including water hyacinth cost an estimated $27,000 per day, with industrial losses ten times this amount. Damage to infrastructure from invasive species and debris cost $12 million to repair in 2001.

Invasive species impacts extend to biodiversity through competition with native species, alteration of habitats, and disruption of ecological processes. However, comprehensive monitoring programs to identify and track invasive alien species distribution, spread rates, and ecological impacts are lacking, limiting capacity for early detection and rapid response.

KM 9. Intergenerational knowledge transfer of ILK in aquatic resource management is declining, threatening the continuity of traditional conservation practices and local ecological knowledge {3.5.3, 3.5.4, 3.8.2, 3.8.3, 3.8.2.3, 3.4.6.2}

ILK on fisheries covering fishing grounds, breeding areas, migration patterns, sustainable practices, and environmental indicators continues to be transmitted through informal systems such as family learning, community engagement, and customary leadership, particularly in areas like Lake Chilwa and Lake Kazuni where elders and chiefs play key roles in knowledge transfer and enforcement. However, this system is increasingly threatened by urbanization, youth migration, and declining interest among younger generations, alongside formal education systems that largely exclude indigenous and local knowledge (ILK) and shifting beliefs that sometimes undermine its value. Additionally, environmental changes such as climate change and overfishing are reducing the applicability of some traditional practices, while limited documentation leaves this knowledge vulnerable to loss as elder custodians pass away, underscoring the need for targeted policy measures to preserve, integrate, and promote ILK.

KM 10. Inadequate investment in effective aquatic ecosystem management such as monitoring capacity, data systems, research, and institutional coordination efforts resulting into fragmented and unresponsive interventions {3.2, 3.2.1, 3.2.1.3, 3.2.5.1, 3.2.4, 4.4}

Current biodiversity monitoring efforts in Malawi are underfunded, fragmented, and disconnected from national statistical systems, yet long-term investment in monitoring including community-based approaches, citizen science, and capacity building is essential to achieve nationally and globally agreed goals, with demonstrated returns that exceed investment costs despite monitoring remaining under sustained in time and space. Significant data gaps persist across all aquatic ecosystems: hydrometric time series for small lakes such as Kazuni and Chiuta are sparse; water quality monitoring lacks temporal consistency, with long-term datasets for comparison with historic baselines critically missing; and stock assessments for non-commercial species are absent, with population trend data for most fish species including those classified as critically endangered insufficient to guide management. A foundational challenge is the lack of interoperability among data systems: compatible metadata standards, vocabularies, and shared ontologies are essential to enable seamless integration across datasets from scientists, citizen scientists, Indigenous and local knowledge holders, NGOs, and government agencies; without such interoperability, monitoring efforts risk fragmentation, redundancy, and limited capacity for cross-site analysis and synthesis. Addressing these gaps requires sustained investment in human capacity, data collection and curation infrastructure, and standardized monitoring frameworks to improve representativeness, comparability, and the overall evidence base for effective natural resource management.

KM 11. Long-term aquatic biodiversity monitoring in Malawi benefits from the weaving of scientific research and Indigenous and Local Knowledge (ILK), which together reveal ecosystem changes and inform conservation strategies {3.1, 3.2.4, 3.3, 3.8, 4.4}

Malawi's aquatic monitoring draws from centuries of Indigenous and Local Knowledge (ILK) on fish behavior, breeding grounds, migration routes, and sustainable harvesting, alongside formal scientific studies dating back several decades. Early limnological research on Lake Malawi established baselines for its extraordinary biodiversity, including over 1,000 fish species with 99% endemism among haplochromine cichlids. Databases such as GBIF and OBIS now host substantial scientific data from Malawi, yet ILK provides unique historical context and early warnings of ecological shifts. The complementary use of these knowledge systems has been critical for documenting biodiversity loss, exemplified by the decline in Chambo (Oreochromis spp.) catches from ~9,000 tons annually in the late 1970s to under 2,500 tons today. This integrated evidence base supports more robust assessments of ecosystem change than either system alone.

KM 12. Malawi's aquatic ecosystems are rapidly degrading due to multiple interacting pressures, with the most severe impacts on shallow lakes, catchments of major rivers, and commercially important fish species {3.2, 3.2.1, 3.2.2, 3.2.4, 3.4}

Shallow lakes including Chilwa, Malombe, Chiuta, and Kazuni are especially vulnerable to climate variability and land-use pressures, experiencing amplified water-level fluctuations and more frequent complete drying events. Lake Chilwa recorded twelve recession periods between 1900 and 2012, with dry-ups becoming increasingly common. Lake Malombe's surface area declined overall from 1973 to 2008, linked to erratic rainfall and rising sedimentation. River systems with intensive catchment disturbance show extreme degradation: the Linthipe River contributes an estimated 30–40% of Lake Malawi's total sediment load from severe gully erosion; the Dwangwa River delivers a massive permanent silt plume and critically poor water quality from agricultural runoff and sugar mill effluents; and the South Rukuru catchment produces a persistent large turbidity plume in Lake Malawi from some of the country's worst soil erosion. Fisheries declines are most acute for high-value species: Chambo (Oreochromis spp.) catches have fallen by over 70% since the late 1970s. Lake Malombe's fishery collapsed in the early 1990s from overfishing, with species such as Kampango (Bagrus meridionalis), Mlamba (Clarias spp.), and Nchila (Labeo mesops) reaching record lows. The growing dominance of smaller, less valuable species in landings signals a fundamental ecosystem imbalance across affected water bodies.

KM 13. Substantial data gaps for non-commercial species, small water bodies, water quality parameters, and long-term ecological changes severely constrain a comprehensive understanding of aquatic ecosystem status and trends in Malawi {3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.4.4, 3.2.5.1, 3.2.5.3}

Despite notable advances in documenting Malawi's fish diversity, major knowledge gaps persist across taxonomic groups, ecosystems, and time scales. While Lake Malawi's cichlids are relatively well known (over 800 species described), data for invertebrates, amphibians, reptiles, and aquatic plants remain severely limited. Similarly, Lake Malombe has documented 57 fish species, but comprehensive non-fish biodiversity inventories are lacking, and Lake Chilwa has sparse information on macroinvertebrates and zooplankton communities despite hosting 21 described fish species. Small water bodies such as Lake Kazuni and Lake Chiuta are critically under-studied, with no hydrometric time series on water levels or hydrological trends. For Lake Kazuni, located within Vwaza Wildlife Reserve, detailed fish stock assessments are absent. Water quality monitoring lacks temporal consistency; although the MCLIMES project has installed automatic gauging stations on Lake Malawi, long-term datasets needed for comparison with historic baselines remain missing. Conservation assessments are also hindered: three fish species in Lake Malombe are classified as data deficient under IUCN criteria, and for most non-commercial species, population trends, distributions, and threat statuses are unknown. The absence of long-term monitoring programs capable of detecting abundance shifts, range changes, or ecosystem responses to environmental stressors leaves most of Malawi's water bodies without reliable trend data.

KM 14. Co-management arrangements between government and fishing communities have improved fisheries management in Malawi but remain limited by weak enforcement, inadequate institutional support, and insufficient integration of Indigenous and Local Knowledge (ILK) {3.2.4, 3.8.2, 3.8.2.1, 3.8.2.2, 3.8.2.3}

Community-based fisheries management through Beach Village Committees (BVCs) and the Ecosystem Approach to Fisheries Management (EAFM) has produced measurable successes. Between 2016 and 2019, community-managed sanctuaries across 56 sites covering 1,022 hectares contributed to a 24% increase in total observed fish species. In Lake Chilwa, co-management established in 2000 regulates fishing seasons (closed December–March), restricts gear types, and protects critical habitats such as Chisi Island; following total desiccation in the 1990s, fish populations showed capacity to repopulate within three years under improved management. In Lake Chiuta, traditional governance combined with co-management has yielded notable conservation outcomes, with communities enforcing restrictions around sacred sites. At Lake Kazuni and Zolokere, Village Natural Resource Management Committees collaborate with the Department of Parks and Wildlife to manage fishing permits, conduct patrols, and enforce by-laws. However, co-management faces substantial challenges: enforcement remains weak, with offenders often released without meaningful sanctions; corrupt practices by some law enforcers undermine effectiveness; voluntary committee members must sacrifice livelihood activities for patrol duties, making them vulnerable to inducements from financially powerful fishers using illegal gear. Physical infrastructure such as sanctuary markers is vulnerable to climate extremes. Cyclone Freddy (2023) destroyed markers and barriers in Lake Chilwa. Women's participation is constrained where approved fishing gear requires skills and physical capacity many women lack, reducing their access to fishing grounds and motivation to engage in co-management.

KM 15. Women play essential roles in aquatic resource use and management in Malawi but face systematic barriers to decision-making participation and benefit-sharing, undermining both equity and conservation outcomes {3.9.3, 3.11.2}

Approximately 90% of women over age 15 rely on natural resources including firewood, water, and wild foods for domestic needs, compared to only 24% of men. About 24% of households in Malawi are female-headed, making them particularly vulnerable to resource scarcity and increasing their likelihood of falling into poverty when ecosystems degrade. Women dominate fish processing and trading, yet their roles in fisheries management decision-making remain limited. In fishing communities, women face distinct challenges: approved fishing gear changes can exclude them where new gear requires skills and physical capacity many women lack for example, at Zolokere, women previously fished using baskets, but recommended gear changes reduced their access to fishing grounds and affected their livelihoods. Women remain underrepresented in co-management structures and decision-making spaces, despite their central roles in resource use and stewardship. Conservation initiatives that fail to address women's unique challenges risk limited impact. Data on household dependence and benefits derived from different ecosystems remain inadequate, hindering effective programming and integration of gender equality and social inclusion considerations. Strengthening women's participation in aquatic resource governance, recognizing their knowledge systems, and ensuring equitable benefit-sharing are essential for both social justice and effective conservation.

BACKGROUND Aquatic Ecosystem

1. Malawi's aquatic ecosystems are critical to national food security, livelihoods, and socio-economic growth and development, yet, these benefits are increasingly at risk due to widespread degradation. Protecting and restoring these ecosystems is therefore an urgent priority to sustain biodiversity, strengthen climate resilience, and secure long-term development gains {3.1, 3.2, 3.4}

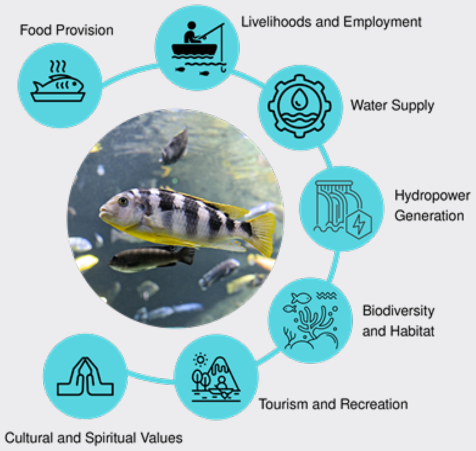


Figure SPM 1 : Contributions of Aquatic Ecosystems (left) (Source: NEA) and Aquatic Ecosystem supporting Transportation (right) (Source: africanlanders.com)

Aquatic ecosystems cover approximately 20% of Malawi's surface area and include Lakes Malawi, Chilwa, Malombe, Chiuta, and Kazuni, along with major river systems including the Shire, Bua, Linthipe, Dwangwa, North Rukuru, and South Rukuru. Lake Malawi alone supports over 1,000 fish species (95% endemic cichlids), representing roughly 4% of the world's fish species and 15% of global freshwater fish biodiversity. The fisheries sector provides 60–70% of animal protein intake for Malawians, supports livelihoods for over 1.6 million people, and directly employs approximately 74,000 fishers. Aquatic ecosystems also underpin over 95% of national electricity generation through hydropower, alongside water supply for domestic and irrigation use, transportation, and tourism *(Well established)* {3.1, 3.2.4, 3.4.1, 3.4.4}.

Despite their importance, these ecosystems face severe pressures from sedimentation, nutrient pollution, overfishing, invasive species, and climate change. Iconic Chambo (Oreochromis spp.) catches have declined by over 70%, from approximately 9,000 tons annually in the late 1970s to less than 2,500 tons today, with the shift toward smaller, less valuable species indicating fundamental ecosystem imbalance. The Linthipe River delivers 30–40% of Lake Malawi's total sediment load, and phosphate levels exceed national standards across multiple water bodies including Lake Kazuni (0.254 mg/l) and the North and South Rukuru Rivers (0.227–1.089 mg/l). Water hyacinth in the Shire River costs an estimated $27,000 per day in power shutdowns, with industrial losses ten times that amount *(Well established)* {3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.3.3}.

Shallow lakes including Chilwa, Malombe, Chiuta, and Kazuni are highly vulnerable to climate variability, with Lake Chilwa experiencing twelve recession periods between 1900 and 2012 and complete dry-ups becoming more frequent. Rising temperatures and stronger winds in Lake Malawi are driving more frequent fish kills, while extreme events such as Cyclone Freddy (2023) have damaged critical fish habitats and reduced productivity. Protecting and restoring aquatic ecosystems is therefore an urgent priority to sustain biodiversity, strengthen climate resilience, and secure long-term development gains *(Well established)* {3.2.1, 3.3.2, 3.5.3, 3.6.1}.

2. Water quality degradation through sedimentation and nutrient pollution is pervasive across Malawi's aquatic ecosystems, driven by catchment deforestation, agricultural expansion, and inadequate wastewater management {3.2.2, 3.2.3}

Figure SPM 2: Acquatic Ecosystem Pollution (Source: Environmental Care Initiative)

Sedimentation rates have increased dramatically across all major water bodies, driven by deforestation, agricultural expansion, and poor land-use practices in catchments. The Linthipe River delivers 30–40% of Lake Malawi's total sediment load, with gully erosion in its catchment among the most severe in southern Africa {3.2.2}. The Dwangwa River carries exceptionally high sediment yields, with severe aggradation of the riverbed raising it by several meters in places, increasing flood risk and rapidly silting irrigation infrastructure {3.2.2}. The South Rukuru catchment generates sediment yields among the highest in the country, with massive persistent turbidity plume extending into Lake Malawi {3.2.2}. (*Well established*)

Recent water quality monitoring reveals phosphate levels exceeding Malawi Standard (MS691:2005) thresholds of 0.15 mg/l across multiple water bodies: Lake Kazuni (0.254 mg/l), North Rukuru River (0.227–1.089 mg/l), South Rukuru River (0.212–0.570 mg/l), Dwangwa River (0.205–0.751 mg/l), and Linthipe River (0.129–0.706 mg/l) {3.2.3}. Total Dissolved Solids in Lake Malawi consistently exceed the 100 mg/l standard, with values ranging from 126–166 mg/l *(Well established)* {3.2.3}.

In Lake Malombe, increased siltation has reduced waterbody size from 33,300 ha in 1989 to 30,483 ha in 2019, following expansion of agricultural land from 52,932 ha to 78,983 ha during the same period {3.2.1}. Shallow lakes including Chilwa, Malombe, Chiuta, and Kazuni are particularly vulnerable to climate variability, with wide fluctuations in water levels and increased frequency of complete drying events {3.2.1}. Lake Chilwa has experienced twelve recession periods between 1900 and 2012, with complete dry-ups in 1934, 1967, and 1995 *(Well established)* {3.2.1}.

Sources of nutrient pollution include agricultural runoff from fertilizer-intensive farming, untreated sewage from urban centers (particularly affecting Linthipe River which receives discharges from Lilongwe City), industrial effluents (including sugar mill discharges into Dwangwa River), and atmospheric deposition from biomass burning, with Lake Malawi region among the most frequently burned in Africa {3.2.2, 3.2.3}. Eutrophication, algal blooms, and hypoxic conditions are increasing, with mass fish kill events in Lake Malawi attributed to warming temperatures fueling algal blooms and oxygen depletion. (Well established) {3.3.2}.

3. Aquatic biodiversity information in Malawi shows significant geographic and taxonomic biases, with critical gaps in understanding of non-commercial species, small water bodies, and long-term trends, resulting to limited focus in management and conservation efforts due to compromised decision making {3.2.2, 3.2.4}

While Lake Malawi's cichlid diversity is globally recognized, with over 800 species described, data for other taxonomic groups and water bodies remains severely limited. In Lake Malombe, 57 fish species belonging to nine families have been documented, with Cichlidae contributing over 75% of recorded species. However, conservation assessments reveal concerning status: three species are critically endangered (Bagrus meridionalis, Oreochromis karongae, Serranochromis robustus), one is endangered (Aulonocara guentheri), one vulnerable (Rhamphochromis longiceps), and three data deficient *(Well established)* {3.2.4}.

Lake Chilwa supports 21 fish species across four families, with 15 classified as least concern, five as not evaluated, and one (Nothobranchius kirki) as vulnerable. The Shire River harbors at least 47 fish species belonging to 14 families, including two critically endangered species (Bagrus meridionalis, Serranochromis robustus) and three data deficient species (Well established) {3.2.4}.

Geographic biases are pronounced: most long-term monitoring data concentrates on commercially valuable species and accessible areas. Data for small water bodies including Lake Kazuni and Lake Chiuta are particularly sparse, with limited hydrometric time series and stock assessments {3.2.1, 3.2.4}. In Lake Kazuni, despite evidence of high fishing pressure, detailed stock assessment data to determine catch trends over time is absent {3.2.4}. Non-fish aquatic fauna, including invertebrates, amphibians, reptiles, and aquatic vegetation, remain critically under-documented across all water bodies *(Well established)* {3.2.6, 3.2.7}.

4. Indigenous and Local Knowledge (ILK) systems, historically vital for sustainable aquatic resource management, are increasingly eroded and remain poorly integrated into formal governance due to modernization and limited inclusion in existing policies {3.2.7, 3.6.1, 3.5.1, 3.6.7, 4.1}

Traditional management systems, including closed seasons, sacred sites, taboos, and customary governance, have demonstrated effectiveness in conserving aquatic biodiversity. At Mbenje Island in Lake Malawi, a community-managed closed season from December to March, enforced through elaborate ceremonies and traditional sanctions, has sustained fish stocks and unique fish diversity for decades. Sacred sites including Chaone and Chidyamphiri Islands in Lake Chilwa, Phiri la Mtsatsi in Lake Chiuta, and Mizimu Island in northern Lake Malawi function as de facto protected areas where cultural beliefs prohibit fishing, enabling undisturbed fish breeding and population recovery. Fishers' knowledge encompasses detailed understanding of fish behavior, breeding grounds, migration patterns, and environmental indicators, including traditional weather prediction using observations of winds (Mwera, Mpoto), cloud formations, bird behavior, and water patterns *(Well established)* {3.2.7, 3.6.7}.

However, ILK systems face accelerating erosion driven by modernization, out-migration of youth, influence of monotheistic religions that devalue traditional practices, formal education systems that exclude ILK, and policy neglect. Migration of fishers into traditional areas introduces practices incompatible with local conservation norms, such as destructive fishing gears that undermine traditional management systems. The absence of formal recognition and legal protection for ILK, despite Constitutional provisions in Section 26 guaranteeing the right to participate in cultural life, leaves traditional knowledge vulnerable to exploitation and loss. Intergenerational knowledge transfer is declining as elder custodians pass away without documentation, and younger generations lose interest due to modern education and urban migration (Established but incomplete) {3.5.3, 4.3.5, 3.5.1}. Current co-management arrangements often remain nominal, with limited meaningful integration of ILK into decision-making processes. A review of national policy instruments reveals that only the National Environmental Policy (2004) explicitly recognizes ILK's role in governance, while sectoral policies on fisheries, water, and forestry remain largely silent on ILK or fail to provide mechanisms for its meaningful incorporation. This perpetuates top-down management approaches that inadequately reflect local realities and miss opportunities for cost-effective, culturally appropriate conservation *(Established but incomplete)* {3.5.1, 3.5.4, 4.1}.

5. Co-management approaches engaging local communities have shown positive impacts on fisheries recovery, but their effectiveness is undermined by persistent challenges in enforcement, funding, and limited institutional support {3.2.4, 3.2.7, 3.8.2}

Community-based fisheries management through Beach Village Committees (BVCs) and the Ecosystem Approach to Fisheries Management (EAFM) has shown measurable success. Between 2016 and 2019, community-managed sanctuaries across 56 sites covering 1,022 hectares contributed to a 24% increase in total observed fish species (Well established) {3.5.2}. In Lake Chilwa, co-management established in 2000, with by-laws formalized in 2012, regulates fishing seasons (closed December–March), restricts gear types, and protects critical habitats, including Chisi Island *(Well established)* {3.8.2}.

In Lake Chiuta, traditional governance combined with co-management has produced notable conservation outcomes, with communities enforcing restrictions around sacred sites and maintaining sustainable fishing practices {3.2.7}. At Lake Kazuni and Zolokere in Vwaza Wildlife Reserve, Village Natural Resource Management Committees (VNRMCs) collaborate with Department of Parks and Wildlife to manage fishing permits, conduct patrols, and enforce by-laws governing open and closed seasons *(Well established)* {3.5.2}.

Despite these successes, co-management faces substantial challenges. Enforcement remains weak, with committees reporting that offenders apprehended for illegal fishing are often released without meaningful sanctions, undermining community motivation and enabling continued non-compliance {3.5.3}. Corrupt practices by some law enforcers further erode trust and effectiveness *(Well established)* {3.5.3}. Committee members serve on voluntary basis, yet patrol duties require sacrificing livelihood activities, creating vulnerability to inducements from financially powerful fishers using illegal gear *(Well established)* {3.5.3}.

The 2023 Cyclone Freddy destroyed sanctuary markers and barriers in Lake Chilwa, demonstrating vulnerability of physical infrastructure to climate extremes *(Well established)* {3.5.3}.

6. Policy frameworks for aquatic ecosystem management are fragmented across multiple sectoral laws and institutions, with weak coordination mechanisms, inadequate enforcement capacity, and insufficient integration of ILK {3.5.1, 3.5.4, 6.3}

Malawi's aquatic ecosystems are governed by multiple sectoral policies and laws operating with limited coordination. Key instruments include the Fisheries Conservation and Management Act (1997), Water Resources Act (2013), National Fisheries and Aquaculture Policy (2016), National Water Policy (2004), and Environmental Management Act (2017) {3.5.1}. While the Environmental Management Act provides overarching framework with provisions for wetland protection, pollution control, and biodiversity conservation, implementation remains fragmented across institutions with competing mandates *(Established but incomplete)* {6.3.1}.

Significant policy gaps persist. The Water Resources Management Policy lacks guidelines for aquatic biodiversity conservation and insufficiently addresses climate change impacts {3.5.1}. The Fisheries Conservation and Management Act focus primarily on fish resources with limited attention to broader aquatic ecosystems including water quality and non-fish species {3.5.1}. Enforcement across all instruments remains weak due to inadequate resources, limited staffing, and corruption {6.3.2}. The National Biodiversity Strategy and Action Plan lack robust monitoring and evaluation mechanisms *(Well established)* {3.5.1}.

Critically, policies inadequately recognize or integrate ILK. With the exception of the National Environmental Policy (2004), which acknowledges the role of local knowledge in biodiversity conservation, most sectoral policies are silent on ILK or fail to provide mechanisms for its meaningful incorporation {3.5.4}. This perpetuates top-down management approaches that inadequately reflect local realities and miss opportunities for cost-effective, culturally appropriate conservation. Inter-agency coordination remains limited, resulting in fragmented efforts, conflicting policies, and missed synergies *(Established but incomplete)* {6.3.2}.

7. Climate change acts as a threat multiplier, exacerbating existing pressures on aquatic ecosystems through increased temperatures, hydrological variability, and extreme events, with disproportionate impacts on shallow lakes and dependent communities {3.4.2, 3.6.1}

Climate change intensifies all existing pressures on aquatic ecosystems. Rising temperatures increase evaporation rates, directly affecting water levels in shallow lakes including Chilwa, Malombe, Chiuta, and Kazuni {3.2.1}. Increased rainfall variability produces more frequent extremes, prolonged droughts causing water level declines and complete drying events, alongside intense rainfall events causing flooding, nutrient runoff, and sediment mobilization {3.6.1}. Lake Chilwa has experienced twelve recession periods between 1900 and 2012, with complete drying events becoming more frequent *(Well established)* {3.2.1}.

Warmer temperatures fuel algal blooms and exacerbate oxygen depletion, contributing to mass fish kill events in Lake Malawi, particularly in the southern part (Established but incomplete) {3.4.2}. Strong Mwera winds, potentially influenced by changing climate patterns, worsen these effects through increased mixing and resuspension of sediments {3.3.2}. Rainfall fluctuations significantly impact catches of Chambo (Oreochromis spp.) (Well established) {3.3.2}. Cyclone Freddy (2023) destroyed fish sanctuaries and breeding sites, removed physical barriers, and directly reduced fish stocks across multiple water bodies *(Well established)* {3.5.3}.

Hydropower generation faces increasing risk due to changing water levels in Lake Malawi and Shire River flows the source of over 95% of national electricity *(Well established)* {3.6.1}. Water security for agriculture, domestic use, and industry is compromised, with projections indicating worsening trends *(Established but incomplete)* {3.6.1}. Disease outbreaks have become more frequent in wetland-dependent communities *(Established but incomplete)* {3.6.1}. Conflicts over limited fisheries and water resources are increasing among fishing communities as resources decline and competition intensifies *(Established but incomplete)* {3.6.1}.

8. Invasive alien species pose an escalating threat to Malawi's native aquatic biodiversity, with several introductions already established and insufficient monitoring to prevent further spread. Beyond ecological damage, these invasions carry significant economic costs disrupting fisheries, undermining agricultural productivity, and threatening hydropower generation by clogging waterways and reducing efficiency. Strengthening surveillance, early detection, and coordinated management is therefore critical to protect biodiversity, secure rural incomes, safeguard energy production, and ensure long-term economic resilience {3.9.1, 3.9.1.2, 4.6.3}

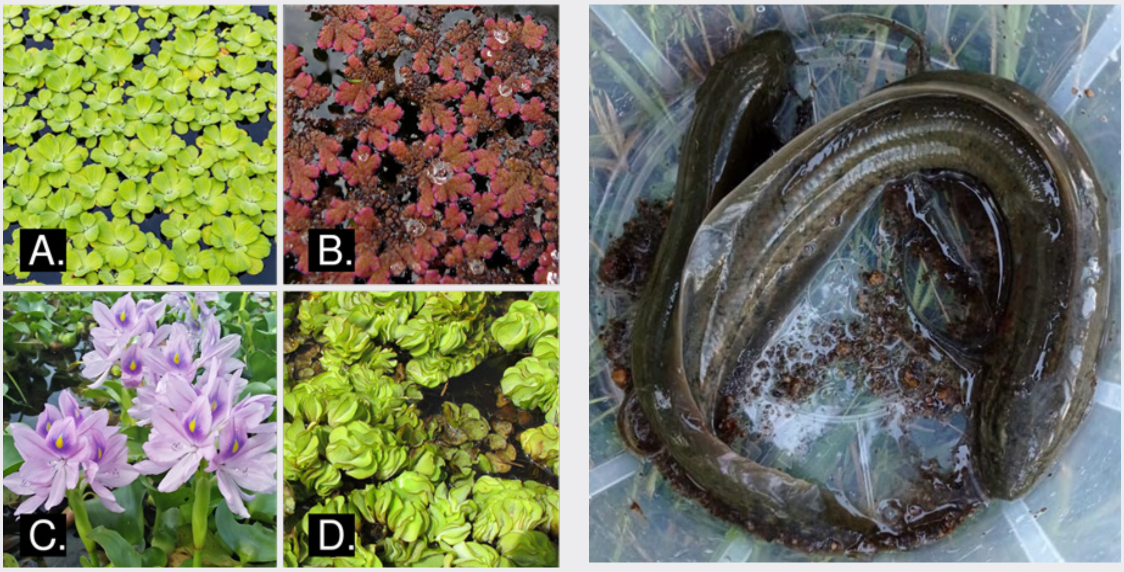


Figure SPM 3: Most notable Aquatic Invasive Alien Species (Left) (A: Water Lettuce (Pistia stratiotes), B: Red Water Fern (Azolla filiculoides), C: Water Hyacinth (Eichhornia crassipes) & D: Water Spangles or Floating Fern (Salvinia); (Right) Giant Mottled Eel (Anguilla marmorata).

Malawi's aquatic ecosystems are facing growing environmental pressures such as climate change, pollution, habitat degradation and invasive alien species are undermining the ecological integrity of these freshwater systems and their capacity to sustain these benefits *(Established but incomplete)* {4.6.3}. Several invasive or non-native aquatic species have already established populations in Malawi's lakes and rivers. Among the most prominent is the floating macrophyte water hyacinth *(Eichhornia crassipes)* has spread across sections of rivers and lakes including Lake Chilwa and the Shire River system. These invasive plants form dense floating mats that block sunlight, reduce dissolved oxygen, and alter aquatic habitats, thereby threatening native biodiversity and fisheries productivity *(Established but incomplete)* {3.9.1}.

Dense mats of invasive plants can obstruct fishing grounds, damage fishing gear, reduce access to open water, and alter fish habitats by lowering oxygen levels and increasing sediment accumulation. In shallow and nutrient-enriched systems such as Lake Chilwa and Lake Malombe, invasive vegetation can exacerbate ecological imbalances already driven by eutrophication, sedimentation and fluctuating water levels, potentially contributing to shifts in fish species composition and declines in high-value species catches. {3.9.1.2}*(Established but incomplete)*. Despite these risks, monitoring and management of invasive aquatic species remain limited. Data on distribution, ecological impacts and economic costs are still incomplete, and surveillance systems for early detection of new invasions are weak. Many aquatic ecosystems especially smaller lakes and river systems lack systematic ecological monitoring, making it difficult to track the spread of invasive species or evaluate the effectiveness of management responses *(Well established)* {3.2}.

9. Indigenous and Local Knowledge systems embody sophisticated understanding of aquatic ecosystems but face accelerating erosion from socio-cultural change, policy neglect, and inadequate documentation {3.5.3, 3.5.4, 3.8.2, 3.8.3, 3.8.2.3, 3.4.6.2}

Indigenous and local communities possess detailed knowledge of aquatic ecosystems accumulated through generations of direct interaction. This knowledge encompasses fish behavior and ecology, including breeding grounds, migration patterns, feeding habits, and habitat preferences of different species (*Established but incomplete)* {3.8.2}. Fishers understand relationships between environmental conditions and fish availability, for example, that hot periods signal high Chambo catches, while Mwera and Mpoto winds indicate increased catches of Mlamba (Clarias spp.) *(Established but incomplete)* {3.8.2}.

Traditional management systems include closed seasons, sacred sites, taboos, and customary governance. At Mbenji Island, a community-managed closed season from December to March, enforced through elaborate ceremonies and traditional sanctions, has sustained fish stocks for decades *(Well established)* {3.8.2.3}. Sacred sites including Chaone and Chidyamphiri Islands in Lake Chilwa, Phiri la Mtsatsi in Lake Chiuta, and Mizimu Island in northern Lake Malawi function as de facto protected areas where cultural beliefs prohibit fishing, enabling undisturbed fish breeding *(Well established)* {3.8.2.2}. Taboos, such as prohibiting fishing by men whose wives are pregnant, regulated fishing pressure and maintained social cohesion *(Well established)* {3.8.2}. However, ILK systems face accelerating erosion. Modernization and out-migration of youth disconnect younger generations from knowledge holders (Well established) {3.5.3}. Formal education prioritizes scientific knowledge while neglecting ILK *(Well established)* {3.4.6.2}. Influence of monotheistic religions leads some communities to abandon traditional practices as incompatible with religious teachings. Migration of fishers into traditional areas introduces practices incompatible with local conservation norms *(Well established)* {3.5.3}. Critically, ILK remains overwhelmingly undocumented and orally transmitted, as elder custodians pass away, their knowledge is lost forever *(Well established)* {3.5.3}. Current policy frameworks inadequately recognize or protect ILK, leaving it vulnerable to exploitation and erosion *(Well established)* {3.5.4}.

10. Sustained investment in monitoring infrastructure, human capacity, data systems, and institutional coordination is essential for effective aquatic ecosystem management, yet current funding remains inadequate and insecure {3.2, 3.2.1, 3.2.1.3, 3.2.5.1, 3.2.4, 4.4}

Current biodiversity monitoring efforts are severely underfunded, fragmented, and disconnected from national statistical systems. Long-term funding essential for building and maintaining monitoring systems capable of reliably assessing ecosystem outcomes is lacking *(Well established)* {4.4}. Hydrometric monitoring for small lakes including Kazuni and Chiuta is absent, leaving hydrological trends and variability undocumented *(Well established)* {3.2.1, 3.2.5.1}. Water quality monitoring lacks temporal consistency, with no long-term datasets enabling comparison with historic baselines *(Well established)* {3.2.1.3, 3.2.3}. Stock assessments for non-commercial fish species are absent, and population trend data for most species, including those classified as critically endangered are insufficient to guide management *(Well established)* {3.2.4, 3.2, 4.4}.

11. Aquatic biodiversity monitoring in Malawi has historical foundations in both scientific research and Indigenous and Local Knowledge systems, providing valuable long-term perspectives on ecosystem change {3.1, 3.2.4, 3.3, 3.8, 4.4}

Malawi's aquatic ecosystems have been shaped by centuries of interaction between local communities and their environment. Indigenous and local knowledge systems, passed down through generations, have documented fish behavior, breeding patterns, hydrological cycles, and environmental indicators long before formal scientific monitoring began *(Well established)* {3.3}. This knowledge includes detailed understanding of fish spawning grounds, migration routes, seasonal availability of different species, and sustainable harvesting techniques that maintained ecosystem balance *(Established but incomplete)* {3.3, 3.11}.

Formal scientific monitoring of aquatic ecosystems in Malawi dates back several decades, with early limnological studies on Lake Malawi establishing baseline understanding of the lake's exceptional biodiversity, over 1,000 fish species with 99% endemism among haplochromine cichlids {3.1}. Museum collections, research institutions, and fisheries surveys have contributed to accumulating knowledge, with the Global Biodiversity Information Facility (GBIF) and Ocean Biodiversity Information System (OBIS) now hosting substantial data from Malawi {referencing C1 from MTA}.

The integration of these knowledge systems provides powerful complementary perspectives. While scientific monitoring offers quantitative data on catch rates, water quality parameters, and species distributions, ILK provides historical baselines, understanding of species interactions, and early warning of ecological changes detected through generations of observation *(Established but incomplete)* {3.8}. This combined evidence base has been essential for documenting biodiversity loss, including the dramatic decline of Chambo (Oreochromis spp.) catches from approximately 9,000 tons annually in the late 1970s to less than 2,500 tons today *(Well established)* {3.2.4}.

12. Aquatic ecosystems in Malawi are undergoing rapid degradation driven by multiple interacting pressures, with the most severe impacts on shallow lakes, rivers with degraded catchments, and commercially important fish species {3.2, 3.2.1, 3.2.2, 3.2.4, 3.4}

Despite their national importance, Malawi's aquatic ecosystems face accelerating degradation. Shallow lakes including Chilwa, Malombe, Chiuta, and Kazuni are particularly vulnerable, experiencing wide fluctuations in water levels, increased frequency of complete drying events, and heightened sensitivity to climate variability {3.2.1}. Lake Chilwa has undergone twelve recession periods between 1900 and 2012, with complete dry-ups becoming more frequent *(Well established)* {3.2.1}. Lake Malombe's surface area fluctuated between 317.5 km² and 335.6 km² from 1973 to 2008, with overall declining trends linked to erratic rainfall and increased sedimentation *(Well established)* {3.2.1}.

River systems show severe degradation, particularly those with intensive catchment disturbance. The Linthipe River delivers an estimated 30–40% of Lake Malawi's total sediment load, with gully erosion in its catchment among the most severe in southern Africa *(Well established)* {3.2.2}. The Dwangwa River carries exceptionally high sediment yields, delivering a massive permanent silt plume into Lake Malawi, while water quality is critically poor due to agricultural runoff and sugar mill effluents {3.2.2}. The South Rukuru catchment is recognized as one of Malawi's most severe soil erosion areas, with massive persistent turbidity plume extending into Lake Malawi *(Well established)* {3.2.2}.

Fisheries declines are most pronounced for high-value species. Chambo catches have declined by over 70% from late 1970s levels {3.2.4}. In Lake Malombe, the fishery collapsed in the early 1990s due to overfishing, with species including Kampango (Bagrus meridionalis), Mlamba (Clarias spp.), and Nchila (Labeo mesops) reaching record lows *(Well established)* {3.2.4}. The shift toward dominance of smaller, less valuable species in catch landings indicates fundamental ecosystem imbalance *(Well established)* {3.2.4}.

13. Significant data gaps limit comprehensive understanding of aquatic ecosystem status and trends, particularly for non-commercial species, small water bodies, water quality parameters, and long-term ecological changes {3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.4.4, 3.2.5.1, 3.2.5.3}

Despite progress in biodiversity documentation, substantial knowledge gaps persist across all aquatic ecosystems. For Lake Malawi, while cichlid fish diversity is well-studied, with over 800 species described, data for other taxonomic groups including invertebrates, amphibians, reptiles, and aquatic plants remains severely limited {3.2.2}. Lake Malombe has documented 57 fish species, but comprehensive biodiversity inventories for non-fish taxa are lacking {3.2.4}. Lake Chilwa supports 21 described fish species, yet information on macroinvertebrates, zooplankton communities, and their ecological roles is sparse *(Well established)* {3.2.2}.

Small water bodies including Lake Kazuni and Lake Chiuta are critically under-studied. Hydrometric time series data documenting water level fluctuations, volume changes, and hydrological trends are absent *(Well established)* {3.2.1, 3.2.5.1}. For Lake Kazuni, despite being located within Vwaza Wildlife Reserve and supporting important fisheries, detailed stock assessments to determine catch trends and population status are lacking {3.2.4}. Water quality monitoring lacks temporal consistency, while recent efforts through the MCLIMES project have installed automatic gauging stations on Lake Malawi, long-term datasets enabling comparison with historic baselines remain critically missing *(Well established)* {3.2.1.3, 3.2.3}. Conservation status assessments reveal concerning data deficiencies. In Lake Malombe, three fish species are classified as data deficient under IUCN criteria, meaning insufficient information exists to assess extinction risk {3.2.4}. For most non-commercial fish species, population trends, distribution patterns, and threat status remain unknown. Long-term monitoring programs capable of detecting trends in species abundance, distribution shifts, and ecosystem responses to environmental change are absent for most water bodies *(Well established)* {3.2.4, 4.4}.

14. Co-management arrangements between government and fishing communities have demonstrated effectiveness in improving fisheries management but require strengthened institutional support, enforcement capacity, and meaningful integration of ILK {3.2.4, 3.8.2, 3.8.2.1, 3.8.2.2, 3.8.2.3}

Community-based fisheries management through Beach Village Committees (BVCs) and the Ecosystem Approach to Fisheries Management (EAFM) has shown measurable success. Between 2016 and 2019, community-managed sanctuaries across 56 sites covering 1,022 hectares contributed to a 24% increase in total observed fish species *(Well established)* {3.8.1}. In Lake Chilwa, co-management established in 2000 regulates fishing seasons (closed December–March), restricts gear types, and protects critical habitats including Chisi Island *(Well established)* {3.8.2.1}. Following total desiccation in the 1990s, fish populations demonstrated capacity to repopulate within three years under improved management *(Established but incomplete)* {3.2.4}.

In Lake Chiuta, traditional governance combined with co-management has produced notable conservation outcomes, with communities enforcing restrictions around sacred sites *(Established but incomplete)* {3.8.2.1}. At Lake Kazuni and Zolokere, Village Natural Resource Management Committees collaborate with Department of Parks and Wildlife to manage fishing permits, conduct patrols, and enforce by-laws governing open and closed seasons *(Established but incomplete)* {3.8.2.1}.

However, co-management faces substantial challenges. Enforcement remains weak, with committees reporting that offenders apprehended for illegal fishing are often released without meaningful sanctions *(Established but incomplete)* {3.8.2.2}. Corrupt practices by some law enforcers undermine effectiveness and community motivation *(Established but incomplete)* {3.8.2.2}. Committee members serve voluntarily yet patrol duties require sacrificing livelihood activities, creating vulnerability to inducements from financially powerful fishers using illegal gear *(Established but incomplete)* {3.8.2.3}. Physical infrastructure including sanctuary markers remains vulnerable to climate extremes, Cyclone Freddy (2023) destroyed markers and barriers in Lake Chilwa *(Well established)* {3.8.2.2}. Women's participation is constrained where approved fishing gear requires skills and physical capacity many women lack, reducing their access to fishing grounds and motivation to participate in co-management *(Well established)* {3.8.2.2, 3.11.2}.

15. Women play crucial roles in aquatic resource use and management but face systematic barriers to participation in decision-making and benefit-sharing, undermining both equity and conservation outcomes {3.9.3, 3.11.2}

Approximately 90% of women over age 15 rely on natural resources including firewood, water, and wild foods for domestic needs, compared to only 24% of men {Executive Summary}. About 24% of households in Malawi are female-headed, making them particularly vulnerable to resource scarcity and increasing their likelihood of falling into poverty when ecosystems degrade {Executive Summary}. Women dominate fish processing and trading, yet their roles in fisheries management decision-making remain limited *(Well established)* {3.9.3, 3.11.2}.

In fishing communities, women face distinct challenges. Approved fishing gear changes can exclude women where new gear requires skills and physical capacity many women lack at Zolokere, women previously fished using baskets, but recommended gear changes reduced their access to fishing grounds and affected their livelihoods *(Well established)* {3.8.2.3}. Women remain underrepresented in co-management structures and decision-making spaces, despite their central roles in resource use and stewardship *(Well established)* {3.9.3, 3.11.2}.

Conservation initiatives that fail to address women's unique challenges risk limited impact. Data on household dependence and benefits derived from different ecosystems remains inadequate, hindering effective programming and integration of gender equality and social inclusion considerations {Executive Summary}. Strengthening women's participation in aquatic resource governance, recognizing their knowledge systems, and ensuring equitable benefit-sharing are essential for both social justice and effective conservation *(Well established)* {3.9.3, 3.11.2}.

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CHAPTER THREE: TERRESTRIAL ECOSYSTEMS

KEY MESSAGES

KM 1. Safeguarding Malawi's terrestrial ecosystems is essential because they underpin food security, rural livelihoods, biodiversity conservation, and climate resilience, while also driving economic development through agriculture, tourism, and natural resource use. Protecting and sustainably managing these ecosystems ensures long-term ecological stability, cultural heritage, and the well-being of the nation's people {4.4, 4.5, 4.1.2}

Terrestrial ecosystems in Malawi provide vital contributions to people and the nation's economy. They support food security through agriculture and wild food resources, sustain rural livelihoods with timber, fuelwood, and non-timber products, and regulate water supply and soil fertility essential for farming. These ecosystems are central to biodiversity conservation, hosting diverse species that underpin ecological resilience, while also playing a key role in climate regulation by storing carbon and buffering communities against floods and droughts. Beyond ecological functions, terrestrial ecosystems contribute to cultural identity and traditions, and they drive economic development through agriculture, tourism, and natural resource use. Protecting and sustainably managing these ecosystems is therefore critical to secure Malawi's biodiversity, strengthen climate resilience, and safeguard the well-being of its people.

KM 2. Malawi's terrestrial ecosystems are at a tipping point forest cover has halved, land degradation is widespread, and ecosystem services are collapsing. Urgent action on land-use and enforcement is critical to protect both nature and the nation's economy {4.3.1, 4.5, 4.6}

Malawi's terrestrial ecosystems are facing a critical tipping point as forest cover has declined from 47% in 1975 to just 24% in 2020, with deforestation rates among the highest in Southern Africa at 2.8% annually. Land degradation is widespread, with 59% of the country's land severely degraded and 14% critically endangered, while only 20% remains natural or semi-natural despite the nation's heavy reliance on natural resources for its economy. Ecosystem services have also collapsed, with a 5.8% decline in value between 2001 and 2022, particularly in regulating, supporting, and cultural services, as cropland expansion has boosted provisioning services at the expense of long-term ecological resilience. These trends underscore the urgent need for stronger land-use reform, enforcement, and sustainable management to protect biodiversity, secure livelihoods, and safeguard Malawi's economic future.

KM 3. Rapid population growth and rising demand for natural resources underscore the need for strong, coordinated policies and legal frameworks to secure the sustainable management of Malawi's terrestrial ecosystems {4.4}

Existing policy frameworks regulate human activities such as logging, mining, farming, energy production, and wildlife use, while defining rights, responsibilities, and penalties to balance resource utilization with conservation. Malawi has developed several national policies and strategies such as the National Forest Policy (2016), National Forest Landscape Restoration Strategy, National Charcoal Strategy (2017–2027), National Wildlife Policy (2018), and National Energy Policy (2018) which collectively aim to address the rising demand for land, energy, and forest resources driven by population growth. Through measures such as forest restoration, promotion of renewable energy, sustainable charcoal production, and community participation in wildlife and forest management, these policies seek to reduce pressure on natural ecosystems while supporting livelihoods, biodiversity conservation, and long-term sustainable development, in line with the national development vision of Malawi 2063.

KM 4. Over the past fifty years, institutions and policy tools involving IPLCs have shifted through three distinct phases from exclusion, to procedural inclusion, to partial co-management with each phase delivering measurable but insufficient contributions to conservation and nature's contributions to people, and with IPLC-led governance consistently outperforming formal institutional arrangements where it has been allowed to operate {4.2.2.4, 4.8, 4.10.3, 4.10.4 }

Over the past five decades, Malawi's approach to Indigenous Peoples and Local Communities (IPLCs) in conservation has evolved through three phases: exclusion during the colonial and early post-independence era, procedural inclusion in the 1990s and 2000s through community-based natural resource management programs, and partial co-management in recent years via forest agreements and wildlife buffer zone projects. Despite these shifts, state agencies have retained dominant authority, limiting the effectiveness of community participation. Evidence from Malawi and across Southern Africa shows that IPLC-led governance rooted in customary tenure systems and traditional knowledge consistently delivers stronger biodiversity outcomes, reduces resource conflicts, and sustains livelihoods compared to centralized enforcement. Current policies acknowledge community roles but often stop at token consultation, underscoring the need for genuine power-sharing. Aligning with the Kunming-Montreal Global Biodiversity Framework, Malawi must strengthen co-management, secure tenure rights, and legally recognize customary systems, as empowering IPLCs is critical for resilient conservation and sustainable development.

KM 5. Safeguarding Malawi's food security requires protecting and promoting crop diversity including neglected and underutilized species and crop wild relatives as the genetic variation they provide is vital for breeding, climate adaptation, and long-term resilience. Without stronger support, local varieties of maize and rice risk disappearing, undermining both biodiversity and future agricultural sustainability {4.2.5, 4.2.5.1, 4.3.4}

Malawi's food security depends on safeguarding its broad crop diversity, which extends beyond staple grains to include legumes, root crops, fruits, and indigenous vegetables. This diversity provides essential genetic variation that underpins crop improvement, resilience to pests and diseases, and adaptation to changing climate conditions. Neglected and underutilized species such as sorghum, millet, pigeon pea, cowpea, cassava, sweet potato, and indigenous leafy vegetables are particularly important because they are often more drought-tolerant, nutrient-dense, and culturally significant, yet they remain underrepresented in research, extension services, and policy support. Crop wild relatives also play a critical role, offering traits that can strengthen resistance and adaptability in breeding programs. Without stronger investment in conserving and promoting this diversity, Malawi risks losing valuable genetic resources that are vital for long-term agricultural sustainability, biodiversity conservation, and the resilience of rural livelihoods.

KM 6. Land-use change is the leading driver of decline in Malawi's terrestrial ecosystems, followed by overexploitation through logging, hunting, and harvesting making stronger land-use policies and enforcement essential for safeguarding nature {4.6, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5}

Agricultural expansion is the most widespread form of land-use change, with over one third of the terrestrial land surface being used for cropping or animal husbandry. This expansion, alongside a doubling of urban area since 1992 and an unprecedented expansion of infrastructure linked to growing population and consumption, has come mostly at the expense of forests (largely old-growth tropical forests), wetlands and grasslands. In freshwater ecosystems, a series of combined threats that include land-use change, including water extraction, exploitation, pollution, climate change and invasive species, are prevalent. Human activities have had a large and widespread impact on the world's oceans. These include direct exploitation, in particular overexploitation, of fish, shellfish and other organisms, land- and sea-based pollution, including from river networks, and land-/sea-use change, including coastal development for infrastructure and aquaculture.

KM 7. Malawi has developed several policies and strategies that support biodiversity conservation and ecosystem functions, but their success depends on stronger implementation and sustainable land-use management {4.10, 4.10.1, 4.10.2, 4.12, 4.13}

Frameworks such as the National Biodiversity Strategy and Action Plan II (2015–2025) and the National Forest Policy (2016) support ecosystem protection, landscape restoration, and the integration of biodiversity into development planning to sustain key ecosystem services such as carbon storage, water regulation, and soil fertility. Community-based and participatory natural resource management initiatives also contribute to conservation while supporting rural livelihoods (Policy impacts on biodiversity and ecosystem functions; Forest Governance).

However, increasing pressures from agricultural expansion, urban growth, and land degradation continue to reduce and fragment natural ecosystems, weakening biodiversity and ecosystem services Policy impacts on biodiversity and ecosystem functions; Status of Biodiversity in Terrestrial Ecosystem; Forest Governance). Future policy interventions should therefore strengthen ecosystem conservation and restoration, sustainable land-use planning, and inclusive community participation to enhance climate resilience, livelihoods, and human well-being in Malawi (Contribution of Terrestrial Biodiversity to Malawi's Economy, Community Livelihood, Food Security and Quality of Life).

KM 8. Biodiversity and ecosystem governance for terrestrial ecosystems in Malawi operates through a formal scientific and policy architecture that systematically marginalizes ILK which creates a structural disconnect between the knowledge systems that inform policy decisions and the community-level governance systems that have historically delivered the best conservation outcomes {4.8, 4.8.5, 4.10.3, 4.10.4 }

Malawi's governance framework has evolved from pre-colonial community management to a co-model codified through the Forest Act (1997) and National Forest Policy (2016). Decision-making is driven primarily by scientific and technical knowledge, produced through institutions such as FRIM, while ILK is either absent or referenced without operational effect. A review of 28 national policy instruments found that only the National Environmental Policy (2004) explicitly recognizes ILK's role in conservation governance. Field evidence demonstrates the opposite dynamic: at Khulubvi Sacred Forest, where ILK is practiced, biodiversity outcomes measurably exceed those at formally managed sites like Mulanje Forest Reserve.

This gap stems from the institutional dominance of Western science, which subjects ILK to validation procedures that extract only elements compatible with dominant paradigms, a process of "cognitive mining" that fragments ILK systems without incorporating their governance value. The recommended solution is the Multiple Evidence Base approach, treating ILK and science as co-equal knowledge systems within transdisciplinary governance, a requirement already embedded in Malawi's commitments under CBD Article 8(j) and IPBES.

KM 9. Recognizing the knowledge, innovations, practices, institutions and values of indigenous peoples and local communities, and ensuring their inclusion and participation in environmental governance, often enhances their quality of life and the conservation, restoration and sustainable use of nature, which is relevant to broader society. Governance, including customary institutions and management systems and co-management regimes that involve indigenous peoples and local communities, can be an effective way to safeguard nature and its contributions to people by incorporating locally attuned management systems and indigenous and local knowledge {4.8, 4.8.1, 4.8.2, 4.8.3, 4.8.4, 4.10.3}

Indigenous and Local Knowledge (ILK) plays a critical role in biodiversity conservation, sustainable resource management, and environmental governance. In Malawi, the knowledge, practices, values, and institutions of Indigenous Peoples and Local Communities (IPLCs) have historically guided the sustainable use and protection of natural resources across aquatic, terrestrial, and forest ecosystems. These knowledge systems are embedded in cultural traditions, customary rules, and community-based management practices that support both ecosystem health and local livelihoods.

In terrestrial ecosystems, ILK supports sustainable land management, conservation of wildlife habitats, and the protection of culturally significant landscapes. Local communities often apply traditional rules governing the use of forests, sacred sites, and communal lands. These practices promote ecological balance, prevent overexploitation of natural resources, and support ecosystem restoration. Traditional ecological knowledge also helps communities adapt to environmental changes by relying on locally developed strategies for resource management.

Despite its importance, ILK in Malawi is increasingly under pressure from several drivers. Climate change has disrupted ecological systems through droughts, floods, and extreme weather events, affecting both biodiversity and traditional management systems. For example, severe events such as Cyclone Freddy have damaged aquatic habitats and fish breeding sites. Socio-economic pressures such as poverty often push communities toward short-term survival strategies that undermine traditional sustainable practices. Migration and urbanization in fishing and rural communities have weakened social cohesion and disrupted the intergenerational transmission of knowledge.

KM 10. Community-level bylaws and natural resource management committees in Malawi's terrestrial ecosystems operate largely within a formalized governance template that has progressively disconnected from the cultural and traditional beliefs that historically made community conservation effective, producing bylaws that regulate behaviour without drawing on the values that once motivated compliance {4.2.2.4, 4.8, 4.10.3, 4.10.4}.

This assessment reveals a two-tier reality in Malawi's wetland governance. At sites like Khulubvi Sacred Forest, customary bylaws enforced through chiefs and spiritual beliefs—, anchored in the Mb'ona legend demonstrate effective ILK-based governance with measurable biodiversity outcomes. Similarly, Mbande Hill, Hora Mountain, Lake Kaulime, and Zolokere Chiefdom burial sites maintain conservation norms through intact cultural traditions, where community bylaws function as genuine extensions of ILK governance.

Conversely, the majority of community-based organisations now operate under externally designed bylaws no longer grounded in ILK. At Vwaza Wildlife Reserve, formalised management structures introduced by conservation organisations have displaced customary governance systems. While the Forest Act (1997) empowers Village Natural Resources Management Committees, it provides no mechanism for these bodies to draw on customary norms. The resulting bylaws specify fines and quotas but lack cultural authority, social accountability, or spiritual sanctions, rendering them unenforceable and producing weak community ownership (unresolved).

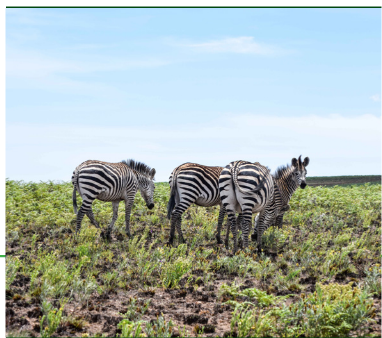
KM 11. Closing knowledge gaps – such as updating national red lists, improving data on plants, fungi, and microorganisms, and strengthening research on ecosystem functions – is essential for effective policy and sustainable management of Malawi's terrestrial ecosystems {4.3, 4.2.1, 4.6.5, 7.2.4}.

In order to improve our understanding and assessment of biodiversity and ecosystem services in Malawi, it is crucial to address several key knowledge gaps across all components of terrestrial systems including agroecosystems, mountains, grasslands, forests, and parks. This includes expanding our focus on terrestrial biodiversity beyond just trees, as this is essential for effective policy development and sustainable management. Additionally, there is significant lack of mapping of terrestrial ecosystems, highlighting a pressing need for more comprehensive research in the area. Moreover, national red lists need to be promptly updated to accurately reflect declines in local populations. Other important taxonomic groups such as microorganisms and fungi have limited data available on their status and trends, despite their crucial roles in nutrient cycling and decomposition. Addressing these gaps in knowledge is essential for the conservation and management of biodiversity in Malawi, and for meeting the country's monitoring and reporting obligations under multilateral environmental agreements.

KM12. Terrestrial biodiversity is a strategic national asset for Malawi because it underpins ecosystem services that sustain agriculture, energy production, and livelihoods. {4.1.2, 4.4, 4.5}

Agriculture remains a cornerstone of Malawi's economy and livelihoods (well established), contributing over 22% of GDP in 2020, employing more than 76% of the workforce, and accounting for over 90% of national exports. The sector is dominated by smallholder farmers, who produce about 80% of the country's food and contribute nearly 70% of agricultural GDP, with key crops including maize, rice, cassava, legumes, and potatoes. Tobacco remains the leading export crop, alongside sugar, tea, groundnuts, and cotton. Although agricultural growth has benefited from land reforms and support programmes such as the Farm Input Subsidy Program (FISP) and the Agricultural Input Programme (AIP), the sector has shown fluctuating performance, with declining GDP contribution and variable growth rates over time {4.4}. Sustaining agricultural productivity and rural livelihoods therefore depends on conserving terrestrial biodiversity and ecosystem services that support soil fertility, water regulation, pollination, climate resilience, and hydropower production.




BACKGROUND TERRESTRIAL ECOSYSTEMS

1. Safeguarding Malawi's terrestrial ecosystems is essential because they underpin food security, rural livelihoods, biodiversity conservation, and climate resilience, while also driving economic development through agriculture, tourism, and natural resource use. Protecting and sustainably managing these ecosystems ensures long-term ecological stability, cultural heritage, and the well-being of the nation's people {4.4, 4.5, 4.1.2}.

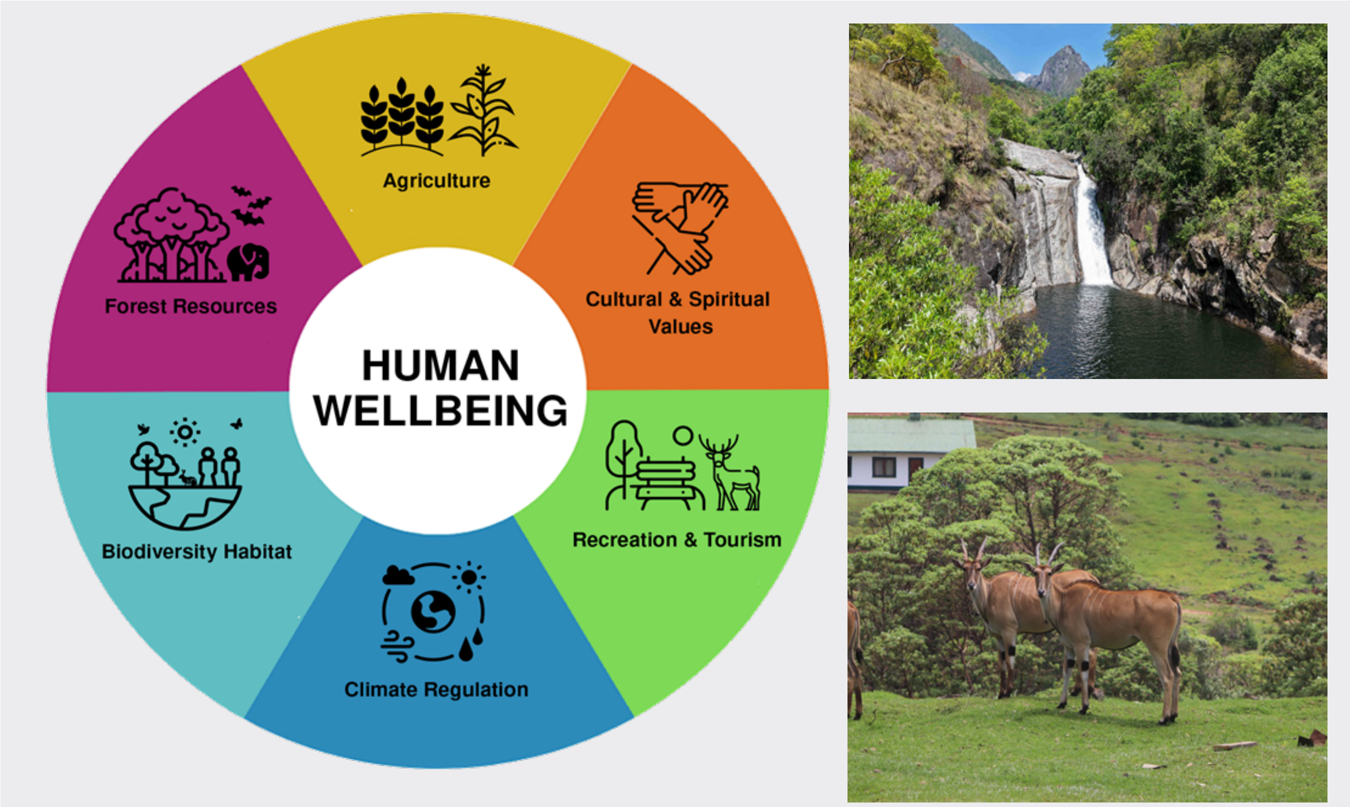


Figure SPM 4: (Contributions of Terrestrical Ecosystem to the Human Wellbeing (left) & Recreation aservices from terrestrial ecosystem (Right) (Source: NEA)

Healthy terrestrial ecosystems regulate climate, protect soils, maintain water cycles, and provide essential resources such as food, fuelwood, timber, medicines, and genetic materials for crop improvement *(Well established)* {4.1.2}. These services support agricultural productivity, pollination, pest control, and resilience to climate change-related shocks such as droughts and floods. Given that agriculture remains the backbone of Malawi's economy contributing significantly to exports, employment, and GDP sustaining biodiversity is critical for long-term economic stability and food security *(Well established)* {4.4, 4.5}. Therefore, policies need to prioritize the conservation and sustainable management of terrestrial biodiversity, integrating ecosystem protection into agricultural development and land-use planning to ensure resilient livelihoods, sustainable economic growth, and intergenerational equity.

2. Malawi's terrestrial ecosystems are at a tipping point forest cover has halved, land degradation is widespread, and ecosystem services are collapsing. Urgent action on land-use and enforcement is critical to protect both nature and the nation's economy {4.3.1, 4.6, 4.5}

SPM

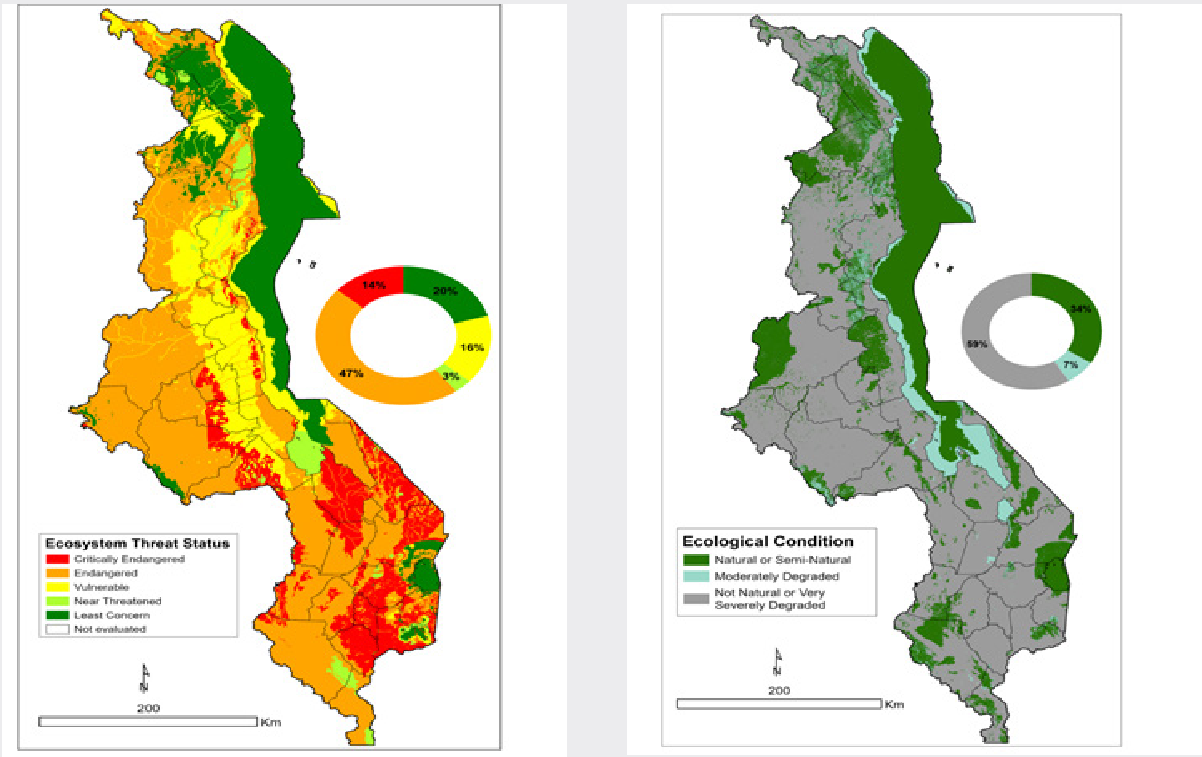


Figure SPM 5: status of Ecosystems (left) and Ecological condition (right) in Malawi

Malawi's terrestrial ecosystems are facing a critical tipping point as forest cover has declined from 47% in 1975 to just 24% in 2020, with deforestation rates among the highest in Southern Africa at 2.8% annually *(Well established)* {4.3.1}. Land degradation is widespread, with 59% of the country's land severely degraded and 14% critically endangered, while only 20% remains natural or semi-natural despite the nation's heavy reliance on natural resources for its economy *(Well established)* {4.6}. Ecosystem services have also collapsed, with a 5.8% decline in value between 2001 and 2022, particularly in regulating, supporting, and cultural services, as cropland expansion has boosted provisioning services at the expense of long-term ecological resilience *(Well established)* {4.5}. These trends underscore the urgent need for stronger land-use reform, enforcement, and sustainable management to protect biodiversity, secure livelihoods, and safeguard Malawi's economic future.

3. Rapid population growth and rising demand for natural resources underscore the need for strong, coordinated policies and legal frameworks to secure the sustainable management of Malawi's terrestrial ecosystems {4.4}

Malawi is a low-income country characterized by a high population growth rate (about 3.06%) and high poverty levels. The country's population is growing quickly having increased from just under 3 million in 1950 to over 18 million in 2017. At current rates, it is projected to more than double to over 40 million by 2050. This growth is creating an ever-larger demand for agricultural land and natural resources, which is driving the rapid degradation of Malawi's land and natural resources. Unsustainable agriculture and land use practices and climate change create and exacerbate further environ- mental vulnerabilities (Bank, 2019) Poverty levels could be linked to below potential productivity of the Malawian agricultural sector despite the apparent success of the Farm Input Subsidy Program (FISP) and now Agriculture Programme (AIP) that reportedly increased maize productivity from 1480 kg/ha in 2006 to 2100 kg/ha in 2013 (CIAT; World Bank 2018). Agricultural productivity is low in Malawi especially for female-managed farms (25% lower than male-managed farms). The difference arises from disparities in resource endowment that puts female farmers at a disadvantage in terms of input use. Low productivity, market failures, (aggravated by some counter-effective trade policies), and climate vulnerability further challenge the agri-sector. Amid the socio-ecological challenges, Malawi has largely pursued an input-intensive agriculture policy for food production to address low productivity and food insecurity through subsidies for fertilizer and hybrid seed. This input-intensive approach does not address underlying drivers of deforestation, biodiversity loss and land degradation (Lunduka 2013; Messina et al., 2017) *(Well established)* {4.4}.

4. Over the past fifty years, institutions and policy tools involving IPLCs have shifted through three distinct phases from exclusion, to procedural inclusion, to partial co-management with each phase delivering measurable but insufficient contributions to conservation and nature's contributions to people, and with IPLC-led governance consistently outperforming formal institutional arrangements where it has been allowed to operate {4.2.2.4, 4.8, 4.10.3, 4.10.4}

This assessment traces a clear historical arc in Malawi's ecosystem governance. In the pre-colonial era, Indigenous Peoples and Local Communities governed through customary institutions, sacred forests, and rotational practices, systems that maintained abundant biodiversity through genuine ownership and sustainable management (Section: Trends and Status of ILK) {4.2.2.4}. Colonialism severed this relationship, replacing community governance with exclusionary "fences and fines" models that stripped traditional leaders of authority, frameworks inherited and maintained by post-independence governments. The 1996 Forest Policy and Forest Act (1997) marked the first significant institutional shift, establishing co-management through Block Management Committees and Village Natural Resources Management Committees. This was reinforced by the National Forest Policy (2016), NBSAP frameworks, and international commitments under CBD Article 8(j), UNFCCC, and AFR100. Public-private partnerships with African Parks brought investment to Liwonde, Majete, and other reserves with Majete demonstrating black rhino recovery since 2003 (Well established) {4.10.3}.

Yet despite this architecture, biodiversity trajectories remain negative: forest cover fell from 47% in 1975 to 24% in 2020. Where IPLC institutions retain genuine authority at Khulubvi Sacred Forest, Mbande Hill, Hora Mountain, Lake Kaulime, and Zolokere Chiefdom sites conservation outcomes markedly exceed formally managed areas. The persistent failure is not institutional absence but the inability to translate procedural inclusion into substantive ILK integration and shared decision-making power *(Well established)* {4.8, 4.10.4}.

5. Safeguarding Malawi's food security requires protecting and promoting crop diversity including neglected and underutilized species and crop wild relatives as the genetic variation they provide is vital for breeding, climate adaptation, and long-term resilience. Without stronger support, local varieties of maize and rice risk disappearing, undermining both biodiversity and future agricultural sustainability {4.2.5, 4.2.5.1, 4.3.4}.

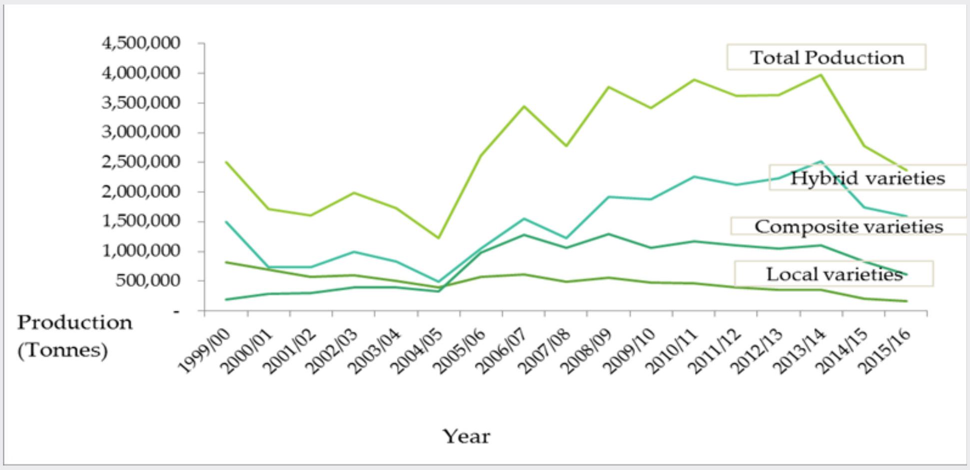


Figure SPM 6: Food Produtions Trends

Figure SPM 7: A variety of crops grown on the terrestrial ecosystem (Source: NEA)

SPM

Malawi's food security lies in existing diversity (variation) in crops and that of their crop wild relatives. Crop genetic variation is the basis for crop improvement and fundamental to all breeding programs. Crop diversity is defined as the total variations of genetic and phenotypic characteristics of plants used in agriculture (Scheffers et al., 2016). Crop diversity is key to human and animal survival as it ensures food and nutritional security and adaptation to climate change. A diversity assessment on local maize and cultivated rice revealed low production in local varieties compared to composite and hybrid which is contributing significantly to the disappearance of most local varieties in the county (SPM figure4). Similar trends were observed in rice production where some varieties were more preferred than the other due to some traits such as yield and vulnerability to pests and diseases *(Well established)* {4.2.5, 4.2.5.1, 4.3.4}.

6. Land-use change is the leading driver of decline in Malawi's terrestrial ecosystems, followed by overexploitation through logging, hunting, and harvesting making stronger land-use policies and enforcement essential for safeguarding nature {4.6, 4.6.1, 4.6.2, 4.6.3, 4.6.4, 4.6.5}

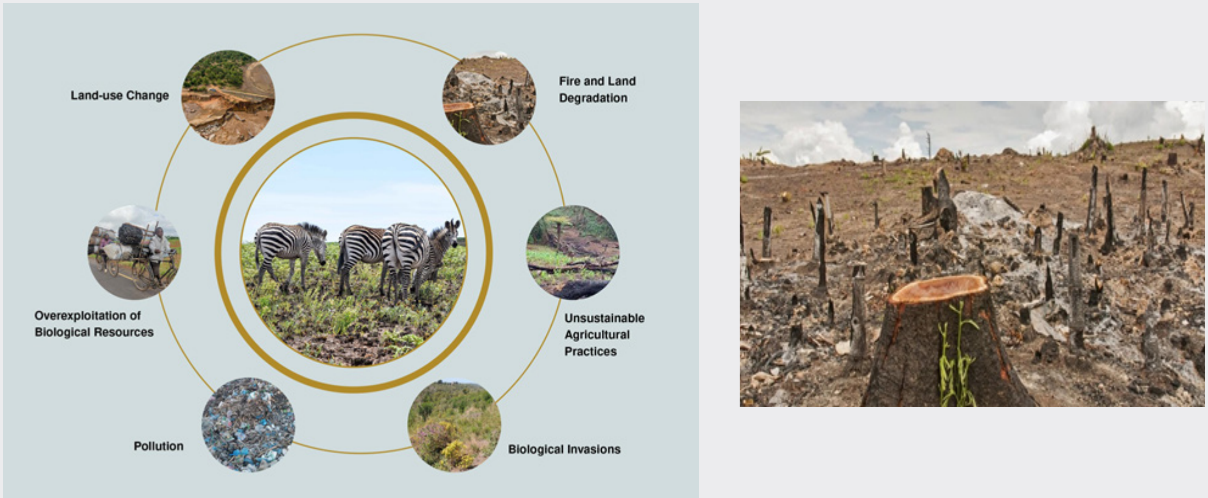


Figure SPM 8: Drivers of Terrestrial Ecosystem degradation (Source: NEA)

Rapid urbanization, agricultural expansion, and industrial activities generate waste and pollutants that degrade terrestrial ecosystems. Poor waste management in many Malawian towns has resulted in the accumulation of solid waste, which contaminates soil and nearby habitats and contributes to biodiversity loss. In addition, agricultural runoff containing fertilizers and other chemicals can pollute soils and adjacent ecosystems, reducing ecological productivity and affecting wildlife. Pollution therefore interacts with land-use change by degrading natural habitats and reducing the capacity of ecosystems to provide services such as soil fertility, water purification, and biodiversity conservation (Government of Malawi, 2010; Manda, 2013) {4.6}.

Uncontrolled fires and land degradation are major threats to Malawi's terrestrial ecosystems, especially in forest and grassland areas. Bushfires are frequently used for land clearing and hunting, but repeated burning destroys vegetation cover, reduces soil organic matter, and accelerates erosion. Over time, this process degrades land productivity and alters species composition in natural habitats. Land degradation is further intensified by deforestation and unsustainable land-use practices, which increase surface runoff and soil erosion, eventually affecting water quality and ecosystem stability. These processes contribute to the loss of biodiversity and reduce the resilience of ecosystems to environmental changes (Frontiers in Forests and Global Change, 2025; Environmental Impact Assessment Reports) *(Well established)* {4.6.2}.

Unsustainable agricultural practices play a significant role in the decline of Malawi's terrestrial ecosystems. As population growth increases the demand for food and land, forests and natural habitats are often converted into farmland. Continuous cultivation without adequate soil conservation measures, poor crop rotation, and expansion of farming into fragile areas such as wetlands and riverbanks contribute to soil degradation and loss of biodiversity. Studies show that large areas of forest land in Malawi are lost each year due to agricultural expansion and charcoal production. These practices lead to habitat destruction, reduced soil fertility, and increased erosion, which ultimately undermine both ecological sustainability and long-term agricultural productivity (Kosamu et al., 2017; Makwinja et al., 2021) *(Well established)* {4.6.1}.

The over-exploitation of biological resources is another critical driver of ecosystem decline in Malawi. Many communities rely heavily on forests, wildlife, and fisheries for their livelihoods, leading to excessive harvesting of natural resources. For instance, the demand for firewood and charcoal used by a large proportion of households as a primary energy source has resulted in widespread deforestation and degradation of forest ecosystems. Similarly, unregulated harvesting of timber and wildlife reduces species populations and disrupts ecological balance. Over-exploitation not only threatens biodiversity but also weakens ecosystem services that support human well-being, such as climate regulation, soil protection, and water resources (Government of Malawi Biodiversity Reports; Environmental Impact Assessments) *(Well established)* {4.6.3}.

7. Malawi has developed several policies and strategies that support biodiversity conservation and ecosystem functions, but their success depends on stronger implementation and sustainable land-use management {4.10, 4.10.1, 4.10.2, 4.12, 4.13}

Frameworks such as the National Biodiversity Strategy and Action Plan II (2015–2025) and the National Forest Policy (2016) promote ecosystem protection, restoration of degraded landscapes, and the integration of biodiversity considerations into development planning to sustain ecosystem services such as carbon storage, water regulation, and soil fertility *(Well established)* {4.10, 4.12}. Community-based initiatives and participatory natural resource management further support conservation while improving rural livelihoods.

However, increasing land-use pressures from agricultural expansion, urban growth, and land degradation continue to reduce natural ecosystems and weaken regulating and cultural ecosystem services *(Well established)* {4.12}. These pressures are intensifying as population growth and rising demand for resources drive further conversion of natural habitats for food production, settlement, and infrastructure development.

Therefore, future policy interventions must prioritize ecosystem conservation, restoration, community participation, and sustainable land-use planning to ensure that biodiversity continues to support Malawi's economic development, climate resilience, and human well-being *(Well established)* {4.10, 4.12, 4.13}.

Malawi's governance framework for terrestrial ecosystems has evolved from pre-colonial community management through customary institutions and sacred forests – systems that maintained abundant biodiversity to colonial-era exclusionary "fences and fines" models, and finally to co-management codified through the 1996 Forest Policy, Forest Act (1997), and National Forest Policy (2016) *(Well established)* {4.8, 4.10.3}. Despite these shifts, decision-making remains driven primarily by scientific and technical knowledge produced through institutions such as FRIM, while ILK is either absent or referenced without operational effect. A systematic review of 28 national policy instruments found that only the National Environmental Policy (2004) explicitly recognises ILK's role in conservation governance *(Well established)* {4.10.4}. As a result, terrestrial ecosystem management remains dominated by top-down, sector-driven approaches that inadequately reflect local realities and cultural values.

Field evidence demonstrates the opposite dynamic: at Khulubvi Sacred Forest, Mbande Hill, Hora Mountain, Lake Kaulime, and Zolokere Chiefdom burial sites, where ILK is practiced through traditional beliefs and customary bylaws enforced by chiefs, biodiversity outcomes measurably exceed those at formally managed sites like Mulanje Forest Reserve {4.8}. The marginalization of ILK stems from the institutional dominance of Western science, which subjects ILK to validation procedures that extract only elements compatible with dominant paradigms a process of "cognitive mining" that fragments ILK systems without incorporating their governance value *(Well established)* {4.8.5}. The recommended solution is the Multiple Evidence Base (MEB) approach, recognizing ILK and science as co-equal knowledge systems, already embedded in Malawi's commitments under CBD Article 8(j) and IPBES. To address this structural disconnect, Malawi must transition from discretionary consultation to formal legal recognition of ILK through sui generis frameworks and Biocultural Community Protocols *(Well established)* {4.10.3}.

9. Recognizing the knowledge, innovations, practices, institutions and values of indigenous peoples and local communities, and ensuring their inclusion and participation in environmental governance, often enhances their quality of life and the conservation, restoration and sustainable use of nature, which is relevant to broader society. Governance, including customary institutions and management systems and co-management regimes that involve indigenous peoples and local communities, can be an effective way to safeguard nature and its contributions to people by incorporating locally attuned management systems and indigenous and local knowledge {4.8, 4.8.1, 4.8.2, 4.8.3, 4.8.4, 4.10.3}

Indigenous and Local Knowledge (ILK) plays a critical role in biodiversity conservation, sustainable resource management, and environmental governance. These knowledge systems are embedded in cultural traditions, customary rules, and community-based management practices that support both ecosystem health and local livelihoods *(Well established)* {4.8}. In terrestrial ecosystems, ILK supports sustainable land management, conservation of wildlife habitats, and the protection of culturally significant landscapes. Local communities often apply traditional rules governing the use of forests, sacred sites, and communal lands. These practices promote ecological balance, prevent overexploitation of natural resources, and support ecosystem restoration. Traditional ecological knowledge also helps communities adapt to environmental changes by relying on locally developed strategies for resource management. Despite its importance, ILK in Malawi is increasingly under pressure from several drivers. Climate change has disrupted ecological systems through droughts, floods, and extreme weather events, affecting both biodiversity and traditional management systems. For example, severe events such as Cyclone Freddy have damaged aquatic habitats and fish breeding sites. Socio-economic pressures such as poverty often push communities toward short-term survival strategies that undermine traditional sustainable practices. Migration and urbanization in fishing and rural communities have weakened social cohesion and disrupted the intergenerational transmission of knowledge *(Well established)* {4.8.2}.

Modernization, westernization, and changing cultural values also contribute to the erosion of ILK. Formal education systems, media influences, and shifting religious practices have reduced the importance placed on traditional customs, rituals, and ecological practices. Additionally, policy and legal frameworks have not fully recognized or protected ILK, resulting in limited integration of community knowledge into national environmental planning and development processes. Nevertheless, ILK provides multiple benefits for biodiversity conservation and sustainable development. It enhances community participation in natural resource governance, strengthens local stewardship of ecosystems, and contributes valuable insights that complement scientific knowledge. Recognizing and empowering Indigenous Peoples and Local Communities improves decision-making, promotes culturally appropriate conservation strategies, and supports more effective and sustainable environmental management *(Well established)* {4.8.1, 4.8.3, 4.8.4, 4.10.3}.

10. Community-level bylaws and natural resource management committees in Malawi's terrestrial ecosystems operate largely within a formalized governance template that has progressively disconnected from the cultural and traditional beliefs that historically made community conservation effective producing bylaws that regulate behaviour without drawing on the values that once motivated compliance {4.2.2.4, 4.8, 4.10.3,4.10.4}

The assessment reveals a two-tier reality in Malawi's terrestrial ecosystem governance. In some sites, effective ILK-based governance persists where cultural traditions and customary institutions remain strong. Sacred and culturally significant areas such as Khulubvi Sacred Forest, Mbande Hill, Hora Mountain, and Lake Kaulime continue to be protected through customary bylaws, spiritual beliefs, and traditional authority systems *(Well established)* {4.8}. These governance systems promote strong community ownership, compliance, and biodiversity conservation, with sacred forests and burial sites functioning as important refugia and replenishment zones for biodiversity. The findings show that community bylaws are most effective when they are rooted in local cultural values and Indigenous and Local Knowledge (ILK) systems.

In contrast, many community-based governance structures established through formal conservation programs operate under externally designed bylaws that are disconnected from customary governance systems. In areas such as Vwaza Wildlife Reserve, formalized management structures have weakened traditional authority and replaced culturally grounded governance with regulations perceived as externally imposed *(Well established)* {4.2.2.4}. Although policies such as the Forest Act support institutions like Village Natural Resources Management Committees and Block Management Committees, they provide limited space for customary norms, spiritual sanctions, and traditional leadership *(Well established)* {4.10.3.11}. As a result, enforcement and community ownership are often weak, further undermined by governance challenges such as corruption, power imbalances, limited capacity, and unresolved human-wildlife conflicts *(Well established)* {4.10.4}. The assessment highlights the need for Malawi to move beyond procedural participation toward substantive ILK integration by legally recognizing and empowering customary governance systems, particularly through Community Conservation Area models that align local governance with national conservation objectives *(Well established)* {4.8}.

11. Closing knowledge gaps such as updating national red lists, improving data on plants, fungi, and microorganisms, and strengthening research on ecosystem functions is essential for effective policy and sustainable management of Malawi's terrestrial ecosystems {4.3, 4.2.1, 4.6.5, 7.2.4}.

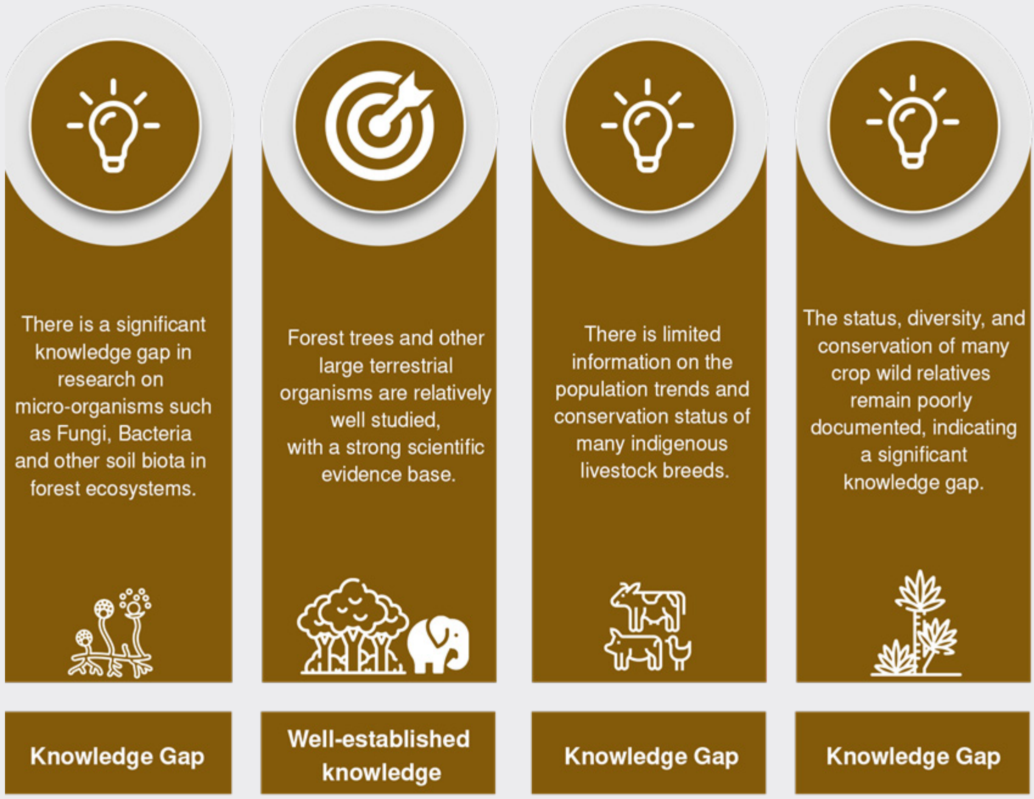
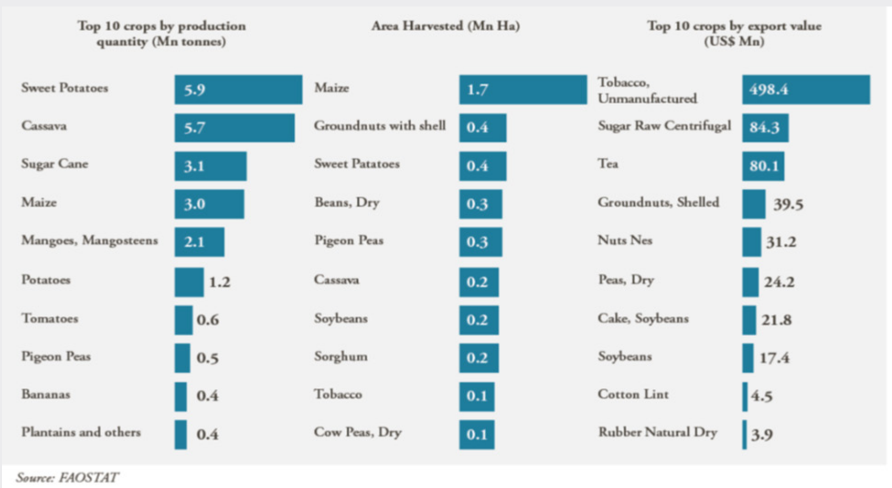


Figure SPM 9: Knowledge gaps on Terrestrial Ecosystem (Source: NEA)

In order to improve our understanding and assessment of biodiversity and ecosystem services in Malawi, it is crucial to address several key knowledge gaps across all components of terrestrial systems including agroecosystem, mountains, grasslands forests and parks. This includes expanding our focus on terrestrial biodiversity beyond just trees as this is essential for effective policy development and sustainable management. Additionally, there is significant lack of mapping of terrestrial ecosystem highlighting a pressing need for more comprehensive research in the area. Moreover, national red lists need to be promptly updated to accurately reflect declines in local populations. Other important plant groups such as micro-organism and fungi have limited data available on their status and trends, despite their crucial roles in nutrient cycling and decomposition. Addressing these gaps in knowledge is essential for the conservation and management of biodiversity in Malawi (Well established) {4.3, 4.2.1, 4.6.5, 7.2.4}.

12. Terrestrial biodiversity is a strategic national asset for Malawi because it underpins ecosystem services that sustain agriculture, energy production, and livelihoods. {4.1.2, 4.4, 4.5}

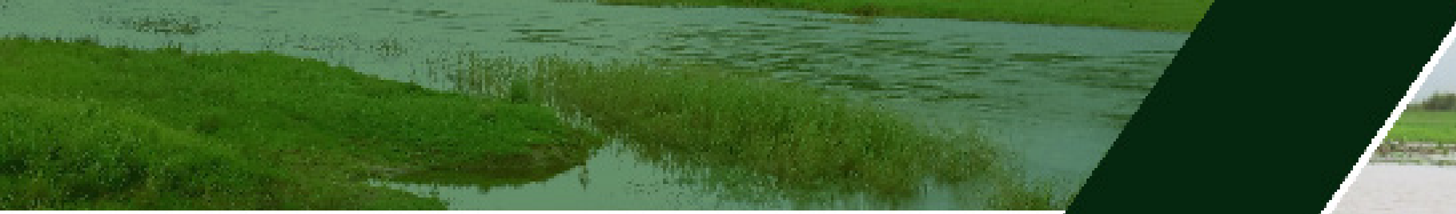


Source: World Bank Development Indicators

The agriculture sector remains a crucial driver of the country's overall social and economic performance (well established). The sector accounted for over 90% of the national exports and employed over 76 % of the country's workforce in 2019 and contributed to more than 22 % of the GDP in 2020. The sector has, however, experienced mixed performance in the last decade with its contribution to GDP declining from 29 percent in 2011. The growth rate has also fluctuated, experiencing its highest growth rate in 2013 (6.6 %) and its lowest in 2016 (-2.3 %). Figure 4.-20 shows top 10 crops in Malawi by production, area harvested and export value for 2019 while Figure 4.-21 shows GDP and growth rate between 2011 and 2020 in Malawi *(Well established)* {4.1.2, 4.4}.

Tobacco is the major national export (66% of agricultural export). Raw sugar, tea, groundnut, and cotton lint are also significant export products (11%, 9%, 3% and 2.7% of total exports, respectively). Malawian producers are primarily small-scale (cultivating less than 1 ha), with some large-scale (cultivating more than 25 ha) producers. There is an emergence of medium scale farmers cultivating not less than 5 ha and not more than 25 ha of land. Large scale producers are almost exclusively involved in production of tobacco, tea, sugar, and macadamia for export. Small Scale producers are mostly subsistence farmers cultivating maize, rice, cassava, legumes and sweet potato (AGRA Malawi 2017) *(Well established)* {4.4}.

Smallholder farmers disproportionately produce crops for domestic consumption. They produce approximately 80% of all food consumed in Malawi. By contrast, smallholder farmers produce just 20% of agricultural exports. In Malawi, smallholder production accounts for nearly 70% of the agricultural GDP. The major domestic food crops are maize, rice, cassava, legumes, sweet potato and Irish potato. The agri-sector has had significant growth in recent years, reaching the 6% growth rate target set forth by the Comprehensive Africa Agriculture Development Programme (CAADP), to which Malawi is a signatory (CIAT; World Bank 2018). This growth can be primarily attributed to land reforms, which strengthened tenure security and promoted equal access to land for smallholder farmers. Increased investments in the agriculture sector (e.g. through the Farm Input Subsidy Program (FISP) and now Agricultural Input Programme (AIP) also served to augment fertilizer use and, consequently, crop productivity, particularly for maize *(Well established)* {4.5}



CHAPTER FOUR: WETLAND ECOSYSTEMS

KEY MESSAGES

KM 1. Wetlands in Malawi provide vital contributions to people, supporting food security, livelihoods, water supply, biodiversity, climate regulation and economic development {5.1, 5.2}

Malawi hosts more than 18 major wetlands, including internationally recognized Ramsar sites such as Lake Chilwa and Elephant Marsh, most of which are located on customary land and managed as communal resources. These wetlands generate substantial economic value through fisheries, agriculture, water provision, energy, and cultural services, contributing millions of US dollars annually to local and national economies. They also play a critical role in regulating floods, maintaining water quality, sequestering carbon, and supporting biodiversity, thereby underpinning national development priorities and multiple Sustainable Development Goals. Elephant marsh's regulatory services were valued in the range of at 3 to 255 million USD per year (World 2019). For rural communities, wetlands are critical sources of food, income, and daily subsistence through fisheries, crop production, grazing, harvesting of thatch grass, firewood, clay, medicinal plants, and wild foods Farmers in Malawi also rely on wetlands for agriculture production; in 2012 Lake Chilwa wetland produced an estimated 50,000 metric tonnes of rice (Ngozo 2012). It is also estimated that 60% of Malawians get their animal protein from fish (Kosamu et al 2012). Elephant marsh has an estimated production of 85,000 tonnes of fish in 2012 (Kosamu et al 2012).

KM 2. Wetlands are a cornerstone of Malawi's climate mitigation and adaptation, providing substantial carbon storage while supporting livelihoods, food security, and biodiversity {5.8.4, 5.8.5}

Covering approximately 20% of the national territory, Malawi's wetlands including lakes, floodplains, dambos, and swamps store large quantities of carbon in waterlogged soils and vegetation. When intact, these ecosystems act as long-term carbon sinks; however, degradation and conversion are increasingly turning them into sources of greenhouse gas emissions.

Recent national data show that wetland-related emissions increased between 2018 and 2022, indicating declining ecosystem integrity and the urgent need for restoration and improved management. Strategic protection and rehabilitation of key wetland systems such as Lake Chilwa marshes, Lake Malawi shoreline wetlands, and dambos could significantly enhance Malawi's carbon sequestration potential while delivering co-benefits for flood regulation, water security, fisheries, and climate-resilient livelihoods.

Wetlands also represent an underutilized opportunity for climate finance, including participation in voluntary carbon markets and results-based financing under nature-based solutions. Integrating wetland conservation and restoration into Malawi's Nationally Determined Contributions (NDCs) would provide a cost-effective pathway to reduce emissions from land use, strengthen ecosystem-based adaptation, and support sustainable development goals. Safeguarding wetlands is therefore not only an environmental priority, but a strategic investment in Malawi's climate resilience and long-term economic stability.

KM 3. Wetland degradation in Malawi is driven by the interplay of demographic, policy, economic, and climatic pressures, resulting in ecological decline, socio-economic impacts, and erosion of Indigenous and Local Knowledge (ILK) systems that have traditionally supported sustainable wetland management {5.2, 5.3, 5.4, 5.8}

Wetland degradation in Malawi stems largely from indirect drivers such as rapid population growth, climate change, and government policies that prioritize food security and economic growth over ecological sustainability. Wetlands like Lake Chilwa and Elephant Marsh, among the country's most densely populated areas, support livelihoods heavily dependent on agriculture, fisheries, and natural resources making them especially vulnerable to these pressures. Climate variability manifested through recurrent droughts, floods, and rising temperatures has intensified water stress and forced communities to expand cultivation and resource extraction within wetland catchments.These drivers translate into direct pressures including deforestation, over-cultivation, over-grazing, upstream water abstraction, commercial agriculture expansion, urban waste discharge, invasive alien species, and unsustainable fishing practices. In major wetlands, extensive land conversion for irrigation farming, abstraction of river flows for hydropower and large-scale agriculture, and the spread of invasive species have reduced water availability, altered hydrological regimes, and degraded habitat quality. As a result, the state of wetlands has changed markedly. Catchments exhibit severe soil erosion, nutrient depletion, siltation, declining water quality, reduced dissolved oxygen, rising salinity, and loss of biodiversity. In Lake Chilwa, expansion of agriculture has coincided with forest loss, shrinking wetland area, loss of deep pools, and declining fishery resilience.

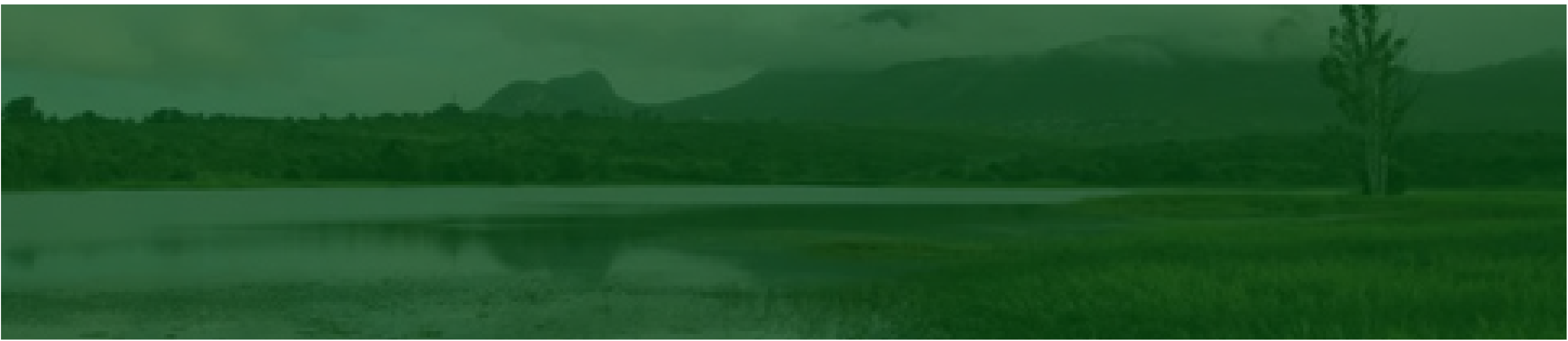
KM 4. Urban infrastructure development has played a major role in accelerating wetland degradation and loss {5.2.3, 5.3.2}

Urban infrastructure development in Malawi has accelerated wetland degradation by altering hydrological systems, increasing pollution, and driving land-use change, particularly in fast-growing cities like Mzuzu, Lilongwe and Blantyre. Evidence shows that expansion of roads, housing, and industrial zones has reduced wetland cover, disrupted water flow, and undermined ecosystem services essential for food security, biodiversity, and climate resilience. These developments disrupt natural drainage systems, increase surface runoff, and reduce groundwater recharge, weakening wetlands' ability to regulate water supply, filter pollutants, and buffer floods. In addition, urban growth contributes to higher levels of wastewater discharge and solid waste dumping, which degrade water quality and harm aquatic biodiversity. As wetlands lose their ecological functions, communities face reduced food security, diminished livelihoods, and greater vulnerability to climate change impacts such as flooding. This makes sustainable urban planning and integrated catchment management essential to balance development needs with the protection of wetlands and the long-term resilience of Malawi's ecosystems.

KM 5. Wetland governance in Malawi is constrained by fragmented legal and policy frameworks, the absence of a dedicated National Wetlands Policy, and weak integration of Indigenous and Local Knowledge (ILK), results in uncoordinated management, persistent degradation, and missed opportunities for sustainable development {5.2.2, 5.6, 5.6.1, 5.6.2, 5.6.3}

Malawi recognises wetlands as important ecosystems, and aspects of wetland conservation and use are addressed across multiple sectoral policies and laws, including those related to environment, water, agriculture, fisheries, land, forestry, biodiversity, and climate change. The country is also a Party to the Ramsar Convention, which promotes the wise use of wetlands and encourages the development of national wetland policies. However, existing sectoral instruments remain largely resource or sector focused rather than ecosystem-based, resulting in partial, inconsistent, and sometimes conflicting approaches to wetland management.

However, the absence of a dedicated National Wetlands Policy represents the most significant governance gap. Without a unifying framework, wetlands are treated as subsidiary resources serving sectoral objectives such as agriculture, irrigation, and fisheries rather than as integrated ecosystems delivering multiple contributions to people. This has led to uncoordinated decision-making, weak enforcement, and conflicting mandates, particularly where agricultural expansion and irrigation development undermine conservation goals. At the national level, this policy gap also weakens alignment with international commitments and national development aspirations, including Malawi Vision 2063 and progress towards the Sustainable Development Goals related to health, water security, biodiversity, and climate resilience



KM 6. Community catchment areas are vital assets for strengthening wetland management, offering locally driven solutions that enhance sustainability, resilience, and long-term ecological health {5.6.2.1, 5.6.3}

Community catchment areas are vital assets for strengthening wetland management in Malawi because they integrate local participation into land and water stewardship, directly addressing soil erosion, deforestation, and unsustainable farming practices that threaten downstream ecosystems. By restoring vegetation, protecting riparian zones, and promoting conservation agriculture, community-driven catchment initiatives improve water quality, regulate flows, and reduce flood risks, thereby enhancing the resilience of wetlands. These locally led approaches also support biodiversity conservation, sustain livelihoods through access to natural resources, and build climate resilience by stabilizing soils and maintaining ecological balance. As such, community catchment areas provide sustainable, long-term solutions that reinforce ecological health while aligning conservation goals with the needs of local communities. The Community Conservation Area (CCA) approach, as implemented in wetlands such as Elephant Marsh, shows how multi-level governance systems can integrate national oversight, district coordination, traditional authority, and community participation. These arrangements highlight the critical role of Indigenous and Local Knowledge in regulating access, managing seasonal use, resolving conflicts, and enabling adaptive management.

KM 7. Malawi must urgently establish a dedicated National Wetlands Policy to provide a coherent governance framework that recognizes wetlands as integrated ecosystems, strengthens community-based management through approaches such as Community Conservation Areas, and aligns wetland conservation with national climate and development agendas, including NDCs and the NAP. {4.1, 4.2, 4.5, 5.4.1, 5.4.4}

Wetlands in Malawi are critical socio-ecological assets that underpin food security, livelihoods, water supply, biodiversity conservation, climate regulation, and national economic value, yet their governance remains fragmented due to the absence of a dedicated policy framework. Despite generating substantial economic benefits particularly in systems such as Lake Chilwa, Elephant Marsh, Lake Malombe, and Lake Chiuta wetlands are increasingly degraded by competing sectoral pressures, including agriculture expansion, overfishing, pollution, and climate change. Existing policies address wetlands only indirectly, resulting in uncoordinated management that undervalues their integrated contributions to people and weakens sustainable use.

BACKGROUND Wetland Ecosystems

1. Wetlands in Malawi provide vital contributions to people, supporting food security, livelihoods, water supply, biodiversity, climate regulation and economic development {5.1, 5.5}

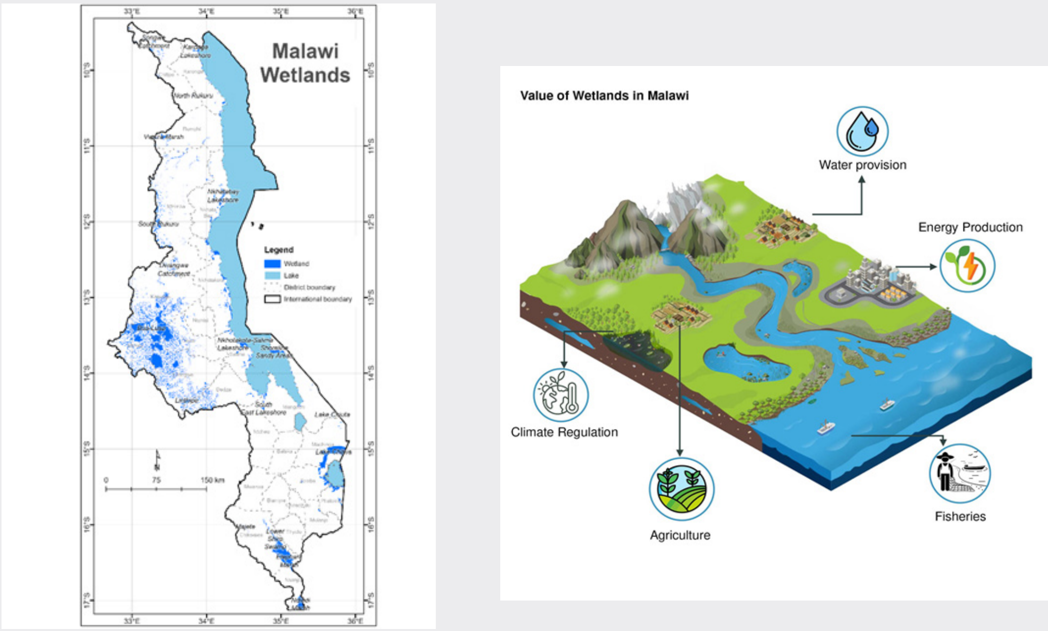


Figure SPM 12 : Wetlands Distributions (left) and Contributions (left) (Source: NEA)

Malawi is home to over 18 major wetlands, including internationally recognized Ramsar sites such as Lake Chilwa and Elephant Marsh, most of which are situated on customary land and managed as communal resources. These wetlands provide a wide array of ecosystem services, including supporting fisheries and agriculture, supplying water for domestic and industrial use, regulating water flows and local climates, offering opportunities for energy generation (SPM Figure12). Collectively, they contribute millions of US dollars annually to both local livelihoods and the national economy. Wetlands contribute an estimated US$329.91 million annually across four major wetlands alone, while directly sustaining the livelihoods of the 85% of Malawians who depend on subsistence farming and fishing {5.1} *(Well-established)*. They provide food, water, medicine, income, and cultural identity yet degradation is eroding these contributions at measurable and compounding cost *(Well established)*. The interdependence of these four dimensions means that a decline in wetland health does not affect one sector in isolation; it collapses all simultaneously (inconclusive). Lake Chilwa contributes US$24.36M, Lake Malombe (US$20.35M), Elephant Marsh (US$268M), and Lake Chiuta (US$17.2M). The assessment has revealed that wetland communities at Lake Kazuni possess ILK-based knowledge of a vast range of medicinal plants sourced from within the wetland knowledge that is community-held and largely undocumented in formal science {5.5} *(Established but incomplete)*. Wetlands ecosystem also ensures food security *(Well established)*. Community knowledge of seasonally available wetland foods documented at Lake Kazuni, including mphalata (flying ants), *mapala mphalabungu* (edible caterpillars), mushrooms, *nthowa* (traditional drink), pumpkin, *mathyokolo, maviru, mbula nthumbakalulu,* and *matwatwa* foods used for both household consumption and income generation, representing nutritional knowledge that exists only within ILK systems *(Well established)* {5.1}.

2. Wetlands are a cornerstone of Malawi's climate mitigation and adaptation, providing substantial carbon storage while supporting livelihoods, food security, and biodiversity {5.8.4, 5.8.5}.

Wetlands are vital natural assets, capable of taking up atmospheric carbon and restricting subsequent carbon loss to facilitate long-term storage. They can be deliberately managed to provide a natural solution to mitigate climate change, as well as to help offset direct losses of wetlands from various land-use changes and natural drivers. Wetland soils are wet, oxygen is not readily available to facilitate decomposition. Roots that die decompose slowly while new roots continue to be produced, which leads to accumulation of organic matter in the soil. Carbon makes up approximately 50 percent of this organic matter *(inconclusive)* {5.8.4}. Wetlands also represent an underutilized opportunity for climate finance, including participation in voluntary carbon markets and results-based financing under nature-based solutions. Integrating wetland conservation and restoration into Malawi's Nationally Determined Contributions (NDCs) would provide a cost-effective pathway to reduce emissions from land use, strengthen ecosystem-based adaptation, and support sustainable development goals. Safeguarding wetlands is therefore not only an environmental priority, but a strategic investment in Malawi's climate resilience and long-term economic stability (*Well established)* {5.8.5}.

3. The sustainability of Malawi's wetland ecosystems is being fundamentally undermined by interconnected drivers which include demographic pressure, climate change vulnerability, governance gaps, short-term economic priorities, and cultural change. Together, these forces are systematically dismantling the ecological, social, and knowledge foundations on which wetland sustainability depends {5.2, 5.3, 5.4, 5.8}

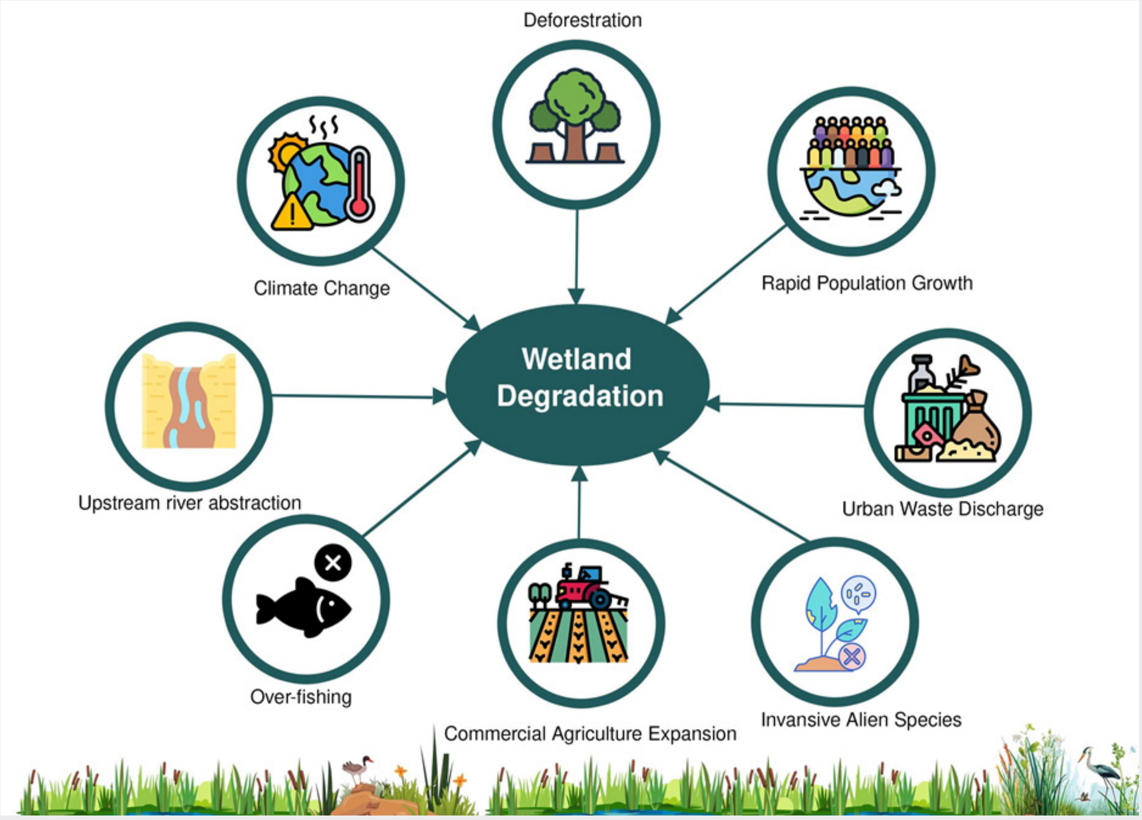


Figure SPM 13 : Wetland degradation drivers (Source: NEA)

This assessment distinguishes between indirect drivers (underlying socioeconomic conditions) and direct drivers (immediate anthropogenic activities) of wetland degradation. A central finding is that these drivers operate synergistically; addressing direct pressures without resolving underlying causal mechanisms yields only temporary outcomes (well established). Rapid population growth is identified as the primary indirect driver across all regions (Section 4.2.3 Wetland Transformation) (well established). The Lake Chilwa and Elephant Marsh ecosystems are situated within some of Africa's most densely populated landscapes, supporting 321 persons per km² (National Statistics Office, 2008). This demographic pressure forces cultivation of marginal areas, accelerating soil erosion within catchments (well established), intensifying pressure on fisheries, and driving encroachment for settlement and agriculture. The analysis further notes that households remain reliant on low-input maize production on progressively degrading smallholdings (Sanchez, 2002). This decline in terrestrial productivity pushes communities toward wetland dependence as an adaptive livelihood strategy *(Well Established)* {5.2, 5.2.3, 5.3.1}.

Climate change constitutes the second primary indirect driver, operating through prolonged drought, floods, elevated temperatures, and rainfall variability (Section: Wetland State of Change) *(Well established)* {5.3.3}. Malawi's dependence on a single rainfall season renders food production acutely sensitive to this variability, compelling over-exploitation of wetlands for winter cultivation as a survival mechanism. Lake Chilwa has experienced twelve complete recession periods between 1900 and 2012, accompanied by progressive salinization, reduced dissolved oxygen, and rising temperatures, all climate-driven (well established). Future projections for Southern Africa indicate worsening conditions (Nkhoma et al., 2021), already manifesting through increased evaporation and declining flows across the Zambezi Basin, Shire River, and Lake Chilwa catchments *(Well Established)* {5.8}.

4. Urban infrastructure development has played a major role in accelerating wetland degradation and loss {5.2.3, 5.3.2}

Figure SPM 14 : Construction on Wetland (right) and Sand Mining (left) (Source: Lilongwe City Council)

The conversion of wetlands through infrastructure development is among the key drivers of wetland degradation and loss of biodiversity associated ecosystem services. Some wetlands have been reclaimed for settlement in most parts of the country. The increase in population growth contributes to the increase in demand for ecosystem services which eventually causes wetlands to be converted into arable for land settlements and intensive production. For instance, there are 3 hydropower plants along the Shire River basin which flows into Elephant Marsh wetland (Brown et al 2016). (*Well established)* {5.2.3}. The construction of the hydropower station to generate electricity leads into the conversion of the wetlands. Commercial agriculture threatens wetlands sustainability such the practice of commercial Agriculture involves instalment of heavy machines and facilities on the converted wetland area. For Example, Elephant Marsh wetland has the Illovo sugar plantations on its edges, there are threats of releases of agro-chemicals into the marsh though not yet documented but the possibility exists *(Well established)* {5.3.2} Commercial Agriculture uses machinery and there is the threat of removing indigenous trees that are part of the wetland ecosystems as they are clearing land (Mvula and Haller, 2009). This wetland conversion through commercial agriculture comes also with employment which entices migration as well as urban expansion that contribute to high waste generation as well as chemicals and sewage discharges into wetland areas resulting into wetland degradation and loss of biodiversity associated ecosystem services like water quality *(Well Established)* {5.3.2}.

5. Wetland governance in Malawi is constrained by fragmented legal and policy frameworks, the absence of a dedicated National Wetlands Policy, and weak integration of Indigenous and Local Knowledge (ILK), results in uncoordinated management, persistent degradation, and missed opportunities for sustainable development {5.2.2, 5.6, 5.6.1, 5.6.2, 5.6.3}

Current governance arrangements remain fragmented and inequitable, with the absence of a dedicated wetland policy representing a foundational failure. Sectoral policies address wetlands only incidentally, and co-management mechanisms intended to integrate community knowledge have been undermined by unresolved disputes and inequitable practices at sites such as Vwaza Wildlife Reserve. Consequently, wetland management remains reactive, and governance outcomes are inadequate (Well established) {5.2.2} Malawi currently lacks a specific wetland policy instrument. Existing sectoral policies address wetlands only incidentally, with their broader goals consistently overpowering wetland-specific concerns. This policy vacuum has created conditions in which short-term exploitation regularly overrides both scientific recommendations and ILK-based conservation practices. Evidence from Mpasanjoka in Salima, Lunyangwa Dambo in Mzuzu, and Elephant Marsh confirms this pattern *(Established but not complete)* {5.2.2, 5.6, 5.6.1}.

SPM

Policy approaches driven solely by scientific knowledge have resulted in inadequate wetland governance outcomes (well established). In contrast, the incorporation of ILK, even informally, has resulted in community-level conservation that is more responsive to local dynamics and contextually accurate *(Well established)* {5.6}. The evidence therefore indicates that formal, policy-backed integration of both knowledge systems is not optional but essential for effective wetland management. methodology was deliberately designed to integrate natural and social sciences with ILK gathered through participatory processes, including walking workshops, key informant interviews (KII), and FDGs. This approach affirms that neither knowledge system alone is sufficient for comprehensive wetland assessment and management (*Well established)* {5.6}. Despite well-documented scientific evidence of degradation across Kasungu Plain, Vwaza Marsh, Elephant Marsh, Mpatsanjoka Dambo, Shire River, Bua River, Lake Chilwa, and Limphasa swamps, policy responses have remained inadequate. Scientific assessments such as those quantifying ecosystem service value losses at Lake Malombe (US$45.58M from 1989–2019) have not translated into effective policy action, pointing to a structural disconnect between scientific knowledge generation and policy uptake *(Well established)*. {5.6.2, 5.6.3}.

6. Community catchment areas are vital assets for strengthening wetland management, offering locally driven solutions that enhance sustainability, resilience, and long-term ecological health {5.6.2.1, 5.6.3}

Figure SPM 15: VNMRC Wetland management (left) & Ecotoursm in wetlands (right)
(Source: Davies Chogawana)

Community catchment areas are vital assets for strengthening wetland management offering locally driven solutions that enhance sustainability, resilience and long-term ecological health. For instance, the Community Based Natural Resource Management. It is an approach that involves the participation and engagement of the local communities. (GoM 2002). CBNRM it is a central element of co-management. Co management was introduced to strengthen the importance of fisher's knowledge in the effective management of the fisheries in Malawi (Well Established) {5.6.3}. For example, Lake Chilwa, an important fisheries ground for small – scale artisanal fishers, has community based natural resource management such as Beach Village Committees (BVC) and Village Natural Resources Management Committees (VNRM) that collaborate with the fisheries department and Department of Parks and Wildlife to enforce regulations hence protecting crucial fish breeding grounds by preventing the cutting of lake grass and fishing in deep pools during the lean season. There is also adherence to closed fishing seasons and community education promotion of sustainable fishing methods and gear *(Well established)* {5.6.2.1}.

There are several success stories of co-management of aquatic resources firstly, the breeding sites of fish are preserved hence increasing in population of fish and their diversity in varieties. Secondly, women and youth are given roles in decision making and leadership through the committees that manage aquatic resources. The co-management allows that each group benefits from rich resources and technicalities of handling the aquatic resources for sustainability. *(Well established)* {5.6.2.1}.

7. Wetlands in Malawi provide vital contributions to people, supporting food security, livelihoods, water supply, biodiversity, climate regulation, and economic development, yet they lack a dedicated policy framework, resulting in uncoordinated management, persistent degradation, and missed opportunities for sustainable development {5.1, 5.2.2, 5.6.1}

Background information: Malawi hosts more than 18 major wetlands, including internationally recognized Ramsar sites such as Lake Chilwa and Elephant Marsh, most of which are located on customary land and managed as communal resources. These wetlands generate substantial economic value: Lake Chilwa contributes US24.36 million annually, Lake Malombe US24.36 million annuall, LakeMalombeUS20.35 million, Elephant Marsh US268 million, and Lake Chiuta US268 million, and Lake Chiuta US17.2 million. Elephant Marsh's regulatory services alone were valued between 3 million and 255 million per year. Wetlands contribute an estimated US$329.91 million annually across four major wetlands alone, while directly sustaining the livelihoods of the 85% of Malawians who depend on subsistence farming and fishing *(Well established)* {5.1, 5.5}. However, wetlands are threatened by sedimentation, nutrient pollution, overfishing, invasive species, climate change, and conversion to agriculture. Critically, Malawi lacks a specific wetland policy instrument. Existing sectoral policies address wetlands only incidentally, with their broader goals (agriculture, irrigation, energy) consistently overpowering wetland-specific concerns.

The absence of a dedicated National Wetlands Policy represents the most significant governance gap. Without a unifying framework, wetlands are treated as subsidiary resources serving sectoral objectives rather than as integrated ecosystems delivering multiple contributions to people *(Well established)* {5.2.2, 5.6.1}. Policy implication: Fast-track the development and adoption of a dedicated National Wetlands Policy within 18 months, operationalizing the Community Conservation Area (CCA) model and integrating wetlands into Malawi's Nationally Determined Contributions (NDCs) and National Adaptation Plan (NAP).

CHAPTER FIVE: THE NEXUS AND SCENARIOS

KEY MESSAGES

KM 1. Ecosystem interconnectivity is critical but increasingly disrupted; Terrestrial, aquatic, and wetland ecosystems are highly interdependent, and disruptions in one system (e.g., through land-use change or water diversion) trigger cascading negative impacts across others, affecting biodiversity, water availability, food security, and human health {3.2.2, 4.2.1, 6.1, 6.2}.

Malawi's terrestrial, aquatic, and wetland ecosystems are closely interconnected rather than existing in isolation. Degradation in one system, such as deforestation in a catchment, can trigger a chain of negative impacts across others, weakening water security, food production, and climate resilience. Addressing these challenges effectively requires moving beyond siloed, sector-based approaches toward integrated, cross-sectoral management that recognizes and manages these vital linkages.

KM 2. Climate change is amplifying ecosystem degradation and risks: Reduced carbon sequestration capacity of forests and wetlands, combined with land degradation, is worsening climate impacts and increasing the frequency and intensity of extreme events such as floods, droughts, and cyclones, further undermining ecosystem services and livelihoods {3.2.2, 4.2.1, 5.7.3, 6.2}

Climate change is affecting all ecosystem types in Malawi terrestrial, aquatic, and wetlands through interconnected processes that amplify environmental stress. In terrestrial ecosystems, rising temperatures and erratic rainfall are accelerating deforestation, land degradation, and loss of soil fertility, reducing productivity and carbon storage. In aquatic systems, such as rivers and lakes, altered rainfall patterns and increased runoff are changing water levels, degrading water quality, and increasing sedimentation, which affects fisheries and water supply. Wetlands, which serve as critical buffers for floods and droughts, are increasingly drying or becoming degraded due to prolonged dry spells and changing hydrological regimes. Because these systems are closely linked, climate impacts in one ecosystem often cascade into others, intensifying overall vulnerability and reducing the capacity of natural systems to support livelihoods and economic activities.

KM 3: The future of Malawi's ecosystems and the services they provide will be determined by the interplay between governance quality and socio-economic development, with the potential for either cascading benefits or reinforcing cycles of decline {6.5.1, 6.5.2, 6.5.3, 6.5.4}

Governance and socio-economic conditions are the main factors shaping the future of Malawi's ecosystems. When governance is strong and people's livelihoods improve, ecosystems can recover and support better well-being. However, weak governance and widespread poverty create a negative cycle, where environmental degradation worsens poverty, and poverty drives further unsustainable use of natural resources. These scenarios are not predictions, but they clearly show that the choices made today will determine the country's future.

KM4: Siloed management is a primary driver of ecosystem collapse; restoring terrestrial (forests) and aquatic (rivers) connectivity is a cost-effective form of natural infrastructure for water and energy security {6.1, 6.2, 6.3}

The assessment demonstrates a direct and powerful causal link: deforestation in catchments like the Linthipe and South Rukuru directly causes extreme sedimentation in Lake Malawi and the Shire River. This single chain of events degrades fish habitats (impacting food security) and silts up hydropower reservoirs (costing an estimated $27,000/day in shutdowns). Managing a forest is therefore not just a conservation action but a direct investment in the nation's energy and fisheries infrastructure.

KM 5. Without transformative action, the interplay of weak governance and poverty will lock Malawi into a "decline cycle" of environmental collapse, leading to irreversible loss of food, water, and energy security {6.5.1, 6.5.2, 6.5.3, 6.5.4}

The future of Malawi's ecosystems depends almost entirely on the quality of governance and socio-economic conditions. The "Nyehkwhe" (Hardship) scenario characterized by weak law enforcement, corruption, and persistent poverty creates a destructive feedback loop where environmental degradation deepens social vulnerability, which in turn drives further unsustainable exploitation. Conversely, the "Mkaka ndi Uchi" (Abundance) scenario shows that good governance can rebuild ecological wealth and break the cycle of poverty. This reframes environmental management as a core strategy for socio-economic stability.

KM 6. Malawi's terrestrial, aquatic, and wetland ecosystems function as an interconnected natural infrastructure system, and degradation in one particularly through deforestation and unsustainable land use in catchments triggers cascading impacts on water quality, hydropower generation, food security, and community resilience. Safeguarding these linkages requires integrated, cross-sectoral catchment management that recognizes priority basins as strategic national assets {3.2.2, 4.2.1, 5.7.3, 6.1, 6.2}

The strong interdependence between ecosystems in Malawi is evident in key catchments such as the Linthipe River and South Rukuru River, where deforestation and land degradation have accelerated soil erosion and sediment transport into Lake Malawi. The Linthipe River alone contributes a substantial proportion of sediment loads entering the lake, degrading aquatic habitats, reducing water quality, and affecting fisheries productivity. These upstream pressures also extend to energy systems, as sedimentation reduces the efficiency of hydropower infrastructure along systems such as the Shire River, which underpins the majority of Malawi's electricity generation. At the same time, the degradation of wetlands such as Elephant Marsh diminishes their ability to regulate floods and sustain dry-season flows, increasing vulnerability to climate extremes. These interconnected impacts demonstrate that sectoral approaches to land, water, and energy management are insufficient. Declaring priority catchments as strategic natural infrastructure and implementing legally binding, community-inclusive catchment management plans is essential to maintain ecosystem functionality, reduce risk, and sustain Malawi's development pathways.

KM 7. Climate change is intensifying existing pressures across Malawi's terrestrial, aquatic, and wetland ecosystems, amplifying risks to water security, fisheries, energy production, and livelihoods; urgent integration of ecosystem-based adaptation and nature-based solutions into national planning is essential to build resilience {3.4.2, 3.9.1, 4.2.4, 5.8.2, 5.8.7}

Across Malawi, climate change is already disrupting ecosystem stability through rising temperatures, erratic rainfall, droughts, floods, and extreme events. Shallow lake systems such as Lake Chilwa, Lake Malombe, Lake Chiuta, and Lake Kazuni are particularly vulnerable, with increasing frequency of water level fluctuations and drying events, while warming waters in Lake Malawi are contributing to fish kills and ecosystem stress. These changes have direct implications for national energy security, as hydropower generation along the Shire River the backbone of Malawi's electricity supply is highly sensitive to water level variability. Extreme events such as Cyclone Freddy (2023) have further exposed system vulnerabilities by destroying fish habitats, disrupting breeding cycles, and reducing fish stocks. On land, climate variability accelerates deforestation, soil degradation, and declining agricultural productivity, while wetlands critical for buffering floods and sustaining dry-season flows are increasingly degraded or drying out. These ecological changes are already translating into heightened human impacts, including disease outbreaks, resource-use conflicts, and declining livelihood security. Addressing these risks requires scaling up nature-based solutions such as reforestation, wetland restoration, and sustainable land management within Malawi's NAPs and NDCs, alongside strengthened early warning systems and community-led resilience strategies in climate-vulnerable landscapes.

KM 8. Malawi's future development pathway will be shaped by the interaction between governance quality and socio-economic conditions, with strong, coordinated governance enabling a virtuous cycle of ecosystem restoration, improved livelihoods, and resilience, while weak governance risks reinforcing environmental degradation and poverty {6.5.1, 6.5.2, 6.5.3, 6.5.4} .

Scenario analysis shows that governance and socio-economic conditions are the most decisive drivers of ecosystem outcomes across Malawi. Under the "Mkaka ndi Uchi" (Abundance) scenario, effective governance, policy coherence, and improved livelihoods lead to recovery of fisheries, enhanced biodiversity, and reduced pressure on natural resources. In contrast, the "Nyehkwhe" (Hardship) scenario reflects weak governance, fragmented institutions, and persistent poverty, resulting in overexploitation, land degradation, pollution, and declining ecosystem services. These dynamics are already visible in policy fragmentation, where agricultural expansion and irrigation objectives often conflict with forest and wetland conservation goals. This disconnect overlooks critical system linkages for example, restoring forested catchments can simultaneously improve water quality for fisheries, regulate flows for hydropower, and enhance climate resilience. Moving forward, Malawi can shift toward a positive trajectory by adopting the "Mkaka ndi Uchi" scenario as a national planning target under Malawi 2063, embedding scenario-based risk assessments in major decisions, and strengthening cross-sectoral coordination under the Environmental Management Act (2017) to align development with ecosystem sustainability.

KM 9. Indigenous and Local Knowledge (ILK) systems are foundational to sustainable ecosystem management in Malawi, offering time-tested practices and ecological insights, yet their continued erosion due to weak recognition and protection threatens both biodiversity conservation and cultural resilience {3.3, 3.4.6, 3.8.2, 3.11, 4.8, 4.10.3}

Across Malawi, ILK systems provide detailed, place-based knowledge of ecosystem dynamics, including fish behavior, breeding cycles, seasonal indicators, and sustainable harvesting practices. These systems are embedded in customary governance mechanisms such as closed seasons, sacred sites, and taboos, which have demonstrably sustained biodiversity over time. For example, community-enforced closed seasons at Mbenje Island have supported fish stock recovery, while sacred sites such as Chaone Island, Chidyamphiri Island, Phiri la Mtsatsi, and Mizimu Island function as de facto protected areas that safeguard breeding grounds. Similarly, Khulubvi Sacred Forest demonstrates how culturally grounded governance can achieve strong conservation outcomes, sometimes exceeding those of formally managed areas such as Mulanje Forest Reserve. However, these systems are increasingly undermined by modernization, youth out-migration, religious and educational shifts, and the absence of formal legal recognition. Despite constitutional provisions supporting cultural participation, ILK remains inadequately protected, with declining intergenerational knowledge transfer posing a serious risk to its continuity. Addressing this requires urgent action to establish a dedicated legal framework for ILK protection, formally recognize biocultural sites as conservation areas, and systematically weave ILK into national policies, education systems, and climate adaptation strategies.

KM 10. Community-based co-management in Malawi has demonstrated clear gains for fisheries, forests, and wetlands, but its effectiveness depends on strong enforcement, sustained support, and meaningful integration of customary governance and Indigenous and Local Knowledge (ILK) {3.2.4, 3.8.2, 3.8.2.1, 3.8.2.2, 3.8.2.3, 4.2.2.4, 4.9.3, 5.6.3}

Evidence from across Malawi shows that co-management approaches can deliver tangible conservation outcomes. Community-led fisheries management through Beach Village Committees and the Ecosystem Approach to Fisheries Management has contributed to increased fish diversity and stock recovery, with notable successes in Lake Chilwa and Lake Chiuta, where regulated fishing seasons, gear restrictions, and protected habitats are actively implemented. Similar collaborative governance models are emerging in terrestrial systems, including around Lake Kazuni and Zolokere. However, outcomes are uneven. At sites such as Khulubvi Sacred Forest, Mbande Hill, Hora Mountain, and Lake Kaulime, strong results are achieved where co-management aligns with customary institutions and spiritual norms. In contrast, in areas like Vwaza Wildlife Reserve, externally imposed bylaws have displaced traditional systems, resulting in weak compliance, limited ownership, and reduced effectiveness. Persistent challengesincluding weak law enforcement, inadequate funding, voluntary and unsupported committee structures, corruption, and climate-related damage to infrastructure such as during Cyclone Freddy (2023) continue to undermine progress. Strengthening co-management therefore requires not only scaling up these models, but also reinforcing enforcement, providing incentives and institutional support, embedding ILK and customary authority, and building climate-resilient management systems.
KM11. Women are central to natural resource use and stewardship in Malawi, yet systemic barriers to their participation in decision-making and benefit-sharing undermine both gender equity and the effectiveness of ecosystem management.

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KM 11. Women are central to natural resource use and stewardship in Malawi, yet systemic barriers to their participation in decision-making and benefit-sharing undermine both gender equity and the effectiveness of ecosystem management {3.9.3, 3.11.2, 4.1}

Across Malawi, women play a dominant role in collecting firewood, water, and wild foods, and are heavily engaged in fisheries value chains, particularly in processing and trading. Their dependence on natural resources is significantly higher than that of men, and with nearly a quarter of households being female-headed, ecosystem degradation disproportionately affects women's livelihoods and well-being. However, women remain underrepresented in governance structures and decision-making processes.

In some cases, policy and management interventions unintentionally exclude them for example, changes in approved fishing gear have reduced women's access to fisheries in areas such as Zolokere, where traditional methods previously used by women are no longer permitted. Despite their knowledge and daily interaction with ecosystems, women's voices are often marginal in co-management institutions, limiting the effectiveness and inclusivity of conservation efforts. Addressing these gaps requires deliberate integration of Gender Equality and Social Inclusion (GESI) principles into ecosystem governance, including ensuring mandatory and meaningful participation of women in decision-making bodies, equitable access to benefits, and improved data systems to better understand gendered resource use and dependencies.

KM 12. Human Rights Based Approach (HRBA) in Biodiversity conservation is widely written into most environmental related policies but systematically absent in practice, creating a legitimacy crisis that undermines both HRBA and Biodiversity conservation in Malawi {1.1.1.2, 2.2, 2.4, 6.1.3}

Malawi's national and district policy frameworks extensively reference core Human Rights-Based Approach (HRBA) principles. Accountability, non discrimination, FPIC and participation appear in most policy documents. However, community-level evidence reveals a near-total breakdown in operationalization. The gap between policy rhetoric and lived reality is not minor it is structural. Communities bear the costs of conservation without receiving promised benefits. They are held strictly accountable while duty-bearers operate with impunity" This asymmetry does not merely violate HRBA principles, it actively disincentivizes conservation, erodes trust, and transforms potential stewards into reluctant or resistant populations. HRBA is understood in principle but not yet fully operationalized in practice. The lack of FPIC, persistent top-down management, weak accountability, and disregard for cultural rights hinder equitable and sustainable conservation outcomes." Without closing the policy-practice gap, Malawi's biodiversity governance will remain technically rights-respecting on paper but rights-violating in reality.

BACKGROUND THE NEXUS AND SCENARIOS

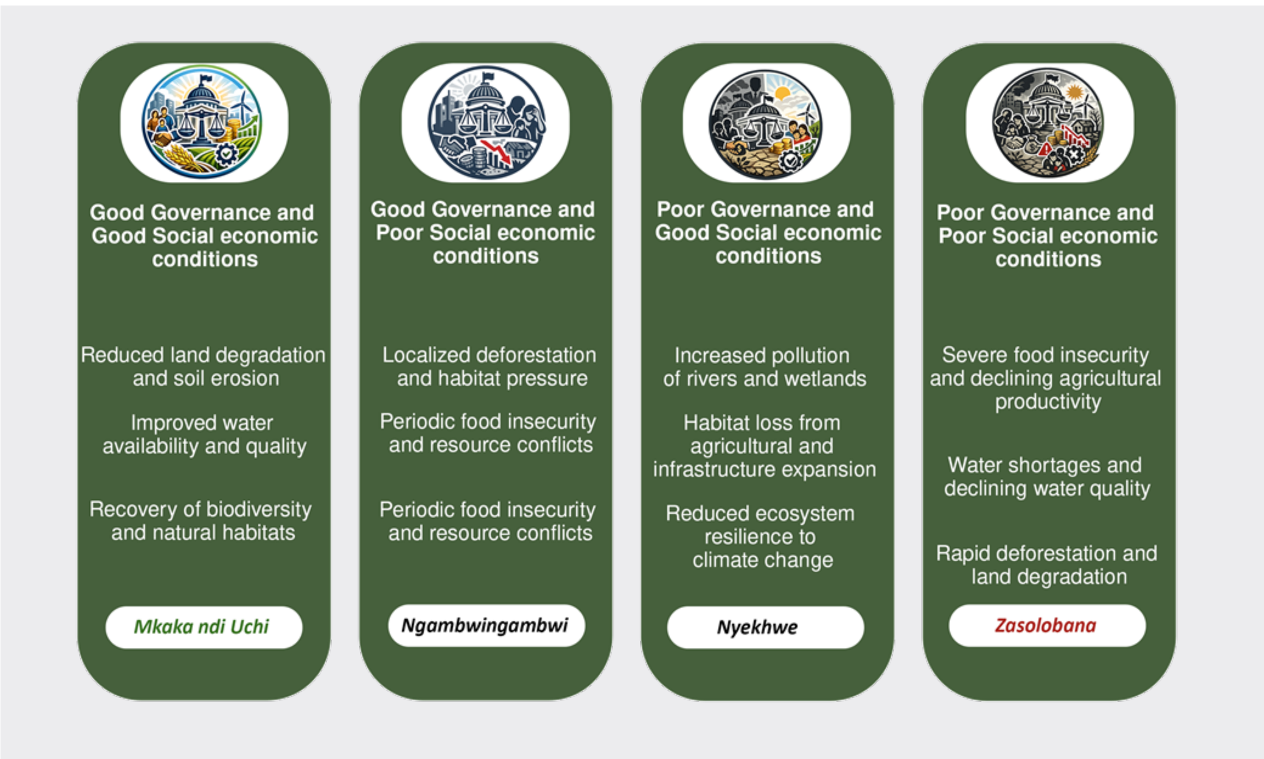
1. Ecosystem interconnectivity is critical but increasingly disrupted; Terrestrial, aquatic, and wetland ecosystems are highly interdependent, and disruptions in one system (e.g., through land-use change or water diversion) trigger cascading negative impacts across others, affecting biodiversity, water availability, food security, and human health {3.2.2, 4.2.1, 6.1, 6.2}.

Forests, mountains, and wetlands function as natural infrastructure that regulates hydrological cycles. Deforestation in catchments like the Linthipe and South Rukuru rivers has led to extreme soil erosion, with the Linthipe now delivering an estimated 30-40% of Lake Malawi's total sediment load. This sedimentation degrades aquatic habitats, reduces water quality, and silts up hydropower reservoirs, directly impacting energy production. Concurrently, the degradation of wetlands like Elephant Marsh reduces their capacity to attenuate floods and maintain dry-season river flows, increasing downstream communities' vulnerability to both droughts and floods. The causal links between land-use change in catchments and impacts on hydrology, sedimentation, and water quality are supported by extensive scientific studies, hydrological modelling, and long-term monitoring data across multiple river systems *(Well established)* {3.2.2, 4.2.1, 5.7.3, 6.2}.

2. Climate change is intensifying ecosystem degradation and associated risks. Declining carbon storage in forests and wetlands, together with ongoing land degradation, is increasing the frequency and severity of extreme events such as floods, droughts, and cyclones. This, in turn, is weakening ecosystem services and putting livelihoods at greater risk {3.2.2, 4.2.1, 5.7.3, 6.2}

Ecosystem degradation in Malawi is increasing climate-related risks and weakening the ability of natural systems to support livelihoods (well established). Deforestation and land degradation in key catchments have led to severe soil erosion and sedimentation, reducing water quality, degrading aquatic habitats, and affecting hydropower generation. At the same time, the degradation of wetlands such as Elephant Marsh has reduced their capacity to regulate floods and sustain dry-season water flows, increasing communities' vulnerability to both floods and droughts. These changes, combined with the broader loss of forests, fisheries, and wetlands, are undermining essential ecosystem services and creating significant economic and social costs Since Malawi's terrestrial, aquatic, and wetland ecosystems are closely interconnected, degradation in one system triggers cascading impacts across others, further weakening climate resilience, water security, and food production *(Well established)* {3.2.2, 4.2.1, 5.7.3, 6.2}.

3. The future of Malawi's ecosystems and the services they provide will be determined by the interplay between governance quality and socio-economic development, with the potential for either cascading benefits or reinforcing cycles of decline {6.5.1, 6.5.2, 6.5.3, 6.5.4}



The future of Malawi's ecosystems and the services they provide will be shaped by the interaction between governance quality and socio-economic development. Strong governance, characterized by effective institutions, transparent policies, and community participation, can ensure that development is aligned with sustainability, leading to cascading benefits such as improved biodiversity, climate resilience, and livelihoods. Conversely, weak governance combined with rapid, resource-intensive development risks reinforcing cycles of decline, where ecosystems are degraded through deforestation, pollution, and unsustainable land use, ultimately undermining food security, energy production, and economic stability. These dynamic highlights the critical importance of integrating ecosystem management into national development strategies, ensuring that governance frameworks are robust enough to balance socio-economic growth with ecological sustainability *(Well established)* {6.5.1, 6.5.2, 6.5.3, 6.5.4}.

4. Siloed management is a primary driver of ecosystem collapse; restoring terrestrial (forests) and aquatic (rivers) connectivity is a cost-effective form of natural infrastructure for water and energy security {6.1, 6.2, 6.3}

The assessment demonstrates a direct and powerful causal link between terrestrial degradation and aquatic ecosystem collapse, underscoring the critical interconnections between forests, rivers, and energy infrastructure {6.1, 6.2}. Deforestation in catchments such as the Linthipe River (which delivers an estimated 30–40% of Lake Malawi's total sediment load) and the South Rukuru River (recognized as one of Malawi's most severe soil erosion areas, producing a massive persistent turbidity plume into Lake Malawi) directly causes extreme sedimentation in Lake Malawi and the Shire River system {6.2}. This single chain of events degrades fish habitats by destroying nearshore spawning beds and macrophyte habitats, impacting food security and fisheries livelihoods for over 1.6 million Malawians, and silts up hydropower reservoirs and dams along the Shire River, which account for approximately 98% of Malawi's electricity generation *(Well established)* {6.1}.

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The economic costs of this disconnect are substantial. Power shut-downs resulting from weeds and debris, including water hyacinth exacerbated by nutrient loading from degraded catchments, are estimated to cost approximately $27,000 per day, with industrial losses valued at ten times this amount *Well established)* {6.1, 3.9.1.1}. Managing a forest is therefore not merely a conservation action but a direct investment in the nation's energy and fisheries infrastructure. Restoring terrestrial-aquatic connectivity through catchment restoration, riparian buffer protection, and sustainable land-use practices represents a cost-effective form of natural infrastructure that simultaneously delivers water security, energy reliability, food security, and biodiversity conservation outcomes far more cost-effective than engineered solutions alone *(Well established)* {6.2, 6.3}.

5. Without transformative action, the interplay of weak governance and poverty will lock Malawi into a "decline cycle" of environmental collapse, leading to irreversible loss of food, water, and energy security {6.1.3, 6.1.4, 6.1.5}

The future of Malawi's ecosystems depends almost entirely on the quality of governance and socio-economic conditions, as demonstrated by the scenario analyses for aquatic, terrestrial, wetland, and ILK systems The "Nyekhwe" (Hardship) scenario – characterized by weak governance (poor law enforcement, corruption, limited institutional capacity) and poor socio-economic conditions (persistent poverty, limited alternative livelihoods, low access to education) – creates a destructive feedback loop where environmental degradation deepens social vulnerability, which in turn drives further unsustainable exploitation. Under this scenario, declining fish stocks, degraded water quality, deforestation, and reduced ecosystem services exacerbate food insecurity, health risks, and poverty, while limited access to education and alternative livelihoods further entrenches unsustainable practices *(Established but incomplete)* {6.5.1}.

Conversely, the "Mkaka ndi Uchi" (Milk and Honey / Abundance) scenario – characterized by good governance (robust regulatory frameworks, participatory decision-making, accountability, transparency) and good socio-economic conditions (improved livelihoods, reduced poverty, strong social cohesion) – demonstrates that good governance can rebuild ecological wealth and break the cycle of poverty. Under this scenario, aquatic biodiversity increases, fish biomass recovers, forest cover is restored, and ecosystem services such as clean water provision and sustainable resource supply are enhanced. Strong governance enables co-production of knowledge, meaningful integration of ILK, and community empowerment to adopt sustainable practices, reinforcing a positive feedback loop between ecosystem health and human well-being *(Established but incomplete)* {6.5.1}.

The "Chonchobe" (Better, but Not Good Enough) scenario shows that good governance alone is insufficient if not accompanied by broad-based socio-economic development. Even with strong regulatory systems, persistent poverty and limited alternative livelihoods constrain communities' ability to engage in sustainable resource use, creating risks of gradual degradation. Similarly, the "Chiyembekezo" (Hope) scenario demonstrates that economic growth without effective governance leads to intensified pressures on ecosystems through industrial activities, urban expansion, deforestation, and pollution, increasing the risk of long-term ecosystem decline despite short-term economic benefits {6.5.1}. Together, these scenarios reframe environmental management not as a constraint on development but as a core strategy for socio-economic stability, highlighting that transformative action on governance is essential to avoid irreversible loss of food, water, and energy security *(Well established)* {6.5.4}.

6.Terrestrial, aquatic, and wetland ecosystems are highly interdependent. Disruptions in one system (e.g., through land-use change or water diversion) trigger cascading negative impacts across others, affecting biodiversity, water availability, food security, and human health {3.2.2, 4.2.1, 5.7.3, 6.1, 6.2}

Background information: Malawi's terrestrial, aquatic, and wetland ecosystems are closely interconnected rather than existing in isolation. Forests, mountains, and wetlands function as natural infrastructure that regulates hydrological cycles. Deforestation in catchments like the Linthipe and South Rukuru rivers has led to extreme soil erosion, with the Linthipe delivering an estimated 30-40% of Lake Malawi's total sediment load. This sedimentation degrades aquatic habitats, reduces water quality, and silts up hydropower reservoirs, directly impacting energy production over 95% of national electricity. Concurrently, the degradation of wetlands like Elephant Marsh reduces their capacity to attenuate floods and maintain dry-season river flows, increasing downstream communities' vulnerability to both droughts and floods. The causal links between land-use change in catchments and impacts on hydrology, sedimentation, and water quality are supported by extensive scientific studies, hydrological modelling, and long-term monitoring data across multiple river systems. Policy implication: Declare priority catchments (Linthipe, South Rukuru, Dwangwa, Shire River) as strategic natural infrastructure assets. Establish legally binding, cross-sectoral catchment management plans co-designed with local communities, moving beyond siloed, sector-based approaches toward integrated, cross-sectoral management. *(Well established)* {3.2.2, 4.2.1, 5.7.3, 6.1, 6.2,}.

7. Climate change acts as a threat multiplier, exacerbating existing pressures on all ecosystem types through rising temperatures, altered water flows, and more frequent extreme events, with significant impacts on water security, fisheries, energy production, and livelihoods {3.4.2, 3.9.1, 4.2.4, 5.8.2, 5.8.7}

Climate change is increasingly disrupting Malawi's ecosystems across all realms. Rising temperatures, erratic rainfall, prolonged droughts, floods, and extreme events affect water availability and ecosystem stability. Shallow lakes such as Chilwa, Malombe, Chiuta, and Kazuni are highly vulnerable, experiencing fluctuating water levels and more frequent drying events *(Well established)* {3.4.2}. Lake Chilwa has experienced twelve recession periods between 1900 and 2012, with complete dry-ups becoming more frequent. In Lake Malawi, warming temperatures and stronger winds are driving more frequent fish kills. Hydropower generation faces increasing risk due to changing water levels in Lake Malawi and Shire River flows the source of over 95% of national electricity. Cyclone Freddy (2023) destroyed fish sanctuaries and breeding sites, removed physical barriers, and directly reduced fish stocks across multiple water bodies. In terrestrial ecosystems, rising temperatures and erratic rainfall are accelerating deforestation, land degradation, and loss of soil fertility. Wetlands, which serve as critical buffers for floods and droughts, are increasingly drying or becoming degraded due to prolonged dry spells and changing hydrological regimes *(Well established)* {3.9.1}. Disease outbreaks have become more frequent in wetland-dependent communities, and conflicts over limited fisheries and water resources are increasing. Future projections for Southern Africa indicate worsening conditions. Policy implication: Integrate nature-based solutions into National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs), emphasizing reforestation, wetland restoration, sustainable land management, and ecosystem-based adaptation. Strengthen early warning systems and community resilience-building in climate-vulnerable ecosystems, particularly floodplains, lakeshores, and mountain catchments *(Well established)* {4.2.4, 5.8.2, 5.8.7}.

8. The future of Malawi's ecosystems and the services they provide will be determined by the interplay between governance quality and socio-economic development, with the potential for either cascading benefits or reinforcing cycles of decline {6.5.1, 6.5.2, 6.5.3, 6.5.4}

Background information: The scenario analysis for all ecosystems consistently identifies governance and socio-economic conditions as the two most critical drivers of future change. Under the "Mkaka ndi Uchi" (Milk and Honey/ Abundance) scenario characterized by good governance and good socio-economic conditions aquatic biodiversity increases, fish biomass recovers, ecosystem services are enhanced, and improved livelihoods reduce pressure on natural resources. Under the "Nyehkwhe" (Hardship) scenario, weak governance and persistent socio-economic hardship, poor law enforcement, corruption, and limited institutional capacity lead to unmanaged resource extraction, land degradation, invasive species, and severe pollution *(Well established)* {6.5.1}. Declining fish stocks, degraded water quality, and reduced ecosystem services exacerbate food insecurity, health risks, and poverty, creating a reinforcing cycle of environmental degradation and social vulnerability. The governance of Malawi's natural resources is currently fragmented, with policies promoting agricultural expansion and irrigation often directly conflicting with those aimed at forest and wetland conservation. This siloed approach fails to recognize that restoring a forested catchment (a terrestrial action) is one of the most cost-effective ways to improve water quality for a fishery (an aquatic benefit) and regulate flow for a downstream hydropower plant (an energy benefit). Policy implication: Adopt the "Mkaka ndi Uchi" (Abundance) scenario as the official national planning target under Malawi 2063. Require all major infrastructure, land-use, and investment proposals to undergo scenario-based risk assessment (including the "Nyehkwhe" hardship scenario) before approval. Strengthen cross-sectoral policy coherence under the Environmental Management Act (2017) *(Well established)* {6.5.2, 6.5.3, 6.5.4}.

9. Indigenous and Local Knowledge (ILK) systems embody sophisticated understanding of aquatic, terrestrial, and wetland ecosystems, providing invaluable historical baselines and sustainable management practices, but they face accelerating erosion due to modernization, out-migration, policy neglect, and inadequate legal protection {3.2.7, 3.5.2, 3.5.3, 3.6.9, 4}

Indigenous and local communities possess detailed knowledge of fish behavior, breeding grounds, migration patterns, environmental indicators, sustainable harvesting techniques, and customary governance systems. Traditional management systems include closed seasons, sacred sites, taboos, and customary rules. At Mbenje Island in Lake Malawi, a community-managed closed season from December to March, enforced through elaborate ceremonies and traditional sanctions, has sustained fish stocks and unique fish diversity for decades. Sacred sites including Chaone and Chidyamphiri Islands in Lake Chilwa, Phiri la Mtsatsi in Lake Chiuta, and Mizimu Island in northern Lake Malawi function as de facto protected areas where cultural beliefs prohibit fishing, enabling undisturbed fish breeding and population recovery. At Khulubvi Sacred Forest, customary bylaws enforced through chiefs and spiritual beliefs demonstrate effective ILK-based governance with measurable biodiversity outcomes that exceed formally managed sites like Mulanje Forest Reserve *(Well established)* {3.3, 3.8.2, 3.12, 4.8}. However, ILK systems face accelerating erosion driven by modernization, out-migration of youth, influence of monotheistic religions that devalue traditional practices, formal education systems that exclude ILK, and policy neglect. The absence of formal recognition and legal protection for ILK, despite Constitutional provisions in Section 26 guaranteeing the right to participate in cultural life, leaves traditional knowledge vulnerable to exploitation and loss. Intergenerational knowledge transfer is declining, threatening the continuity of traditional conservation practices *(Well established)* {3.4.6,3.11.1,4.8.1,4.8.2,4.8.3,4.8.4}. Policy implication: Within 24 months, draft and enact a sui generis legal framework for the protection of communal ILK, operationalizing Section 26 of the Constitution. Pilot three community-led “Bio-Cultural Atlas” projects (e.g., Lake Chilwa, Linthipe catchment, Mulanje Mountain) to formally recognize ILK-defined sanctuaries, sacred sites, and customary breeding grounds as official conservation areas (OECMs or CCAs) with legal backing under the Environmental Management Act. Systematically document and mainstream ILK into national biodiversity strategies, management plans, education curricula, and climate adaptation frameworks *(Well established)* {3.8.3, 4.10.3, 4.10.4}.

10. Community-based co-management approaches have shown positive impacts on fisheries recovery, forest conservation, and wetland management, but their effectiveness is persistently undermined by weak enforcement, inadequate funding, limited institutional support, and the displacement of customary governance by externally designed bylaws {3.2.4, 3.8.2, 3.8.2.1, 3.8.2.2, 3.8.2.3, 4.2.2.4, 4.9.3, 5.6.3}

Community-based fisheries management through Beach Village Committees (BVCs) and the Ecosystem Approach to Fisheries Management (EAFM) has demonstrated measurable success. Between 2016 and 2019, community-managed sanctuaries across 56 sites covering 1,022 hectares contributed to a 24% increase in observed fish species species *(Well established)* {3.8.1}. In Lake Chilwa, co-management established in 2000 regulates fishing seasons (closed December–March), restricts gear types, and protects critical habitats. In Lake Chiuta, traditional governance combined with co-management has produced notable conservation outcomes *(Well established)* {3.8.2.1}.. In terrestrial ecosystems, Village Natural Resource Management Committees (VNRMCs) collaborate with the Department of Parks and Wildlife at Lake Kazuni and Zolokere *(Well established)* {4.9.3}. However, this assessment reveals a two-tier reality. At sites like Khulubvi Sacred Forest, Mbande Hill, Hora Mountain, Lake Kaulime, and Zolokere Chiefdom burial sites, customary bylaws enforced through chiefs and spiritual beliefs demonstrate effective ILK-based governance *(Well established)* {4.8}. Conversely, the majority of community-based organizations now operate under externally designed bylaws no longer grounded in ILK. At Vwaza Wildlife Reserve, formalized management structures introduced by conservation organizations have displaced customary governance systems *(Well established)* {4.2.2.4}. Enforcement remains weak: committees report that offenders are often released without meaningful sanctions, corrupt practices erode trust, and committee members serve voluntarily yet patrol duties compete with livelihood activities *(Well established)* {3.8.2.2, 3.8.2.3}. Physical infrastructure remains vulnerable to climate extremes Cyclone Freddy (2023) destroyed sanctuary markers and barriers in Lake Chilwa *(Well established)* {3.8.2.2}. Policy implication: Formalize and scale up community-based co-management models with strengthened enforcement mechanisms, accountability, and adequate support (including compensation or incentives) for voluntary committee members. Ensure that co-management arrangements are grounded in and respect existing customary governance systems and ILK, rather than displacing them. Build climate resilience into fisheries and natural resource management infrastructure *(Well established)* {3.8.2.3, 4.9.3, 5.6.3}.

11. Women play crucial roles in aquatic and terrestrial resource use and management but face systematic barriers to participation in decision-making and benefit-sharing, undermining both equity and conservation outcomes {3.9.3, 3.11.2, 4.1}

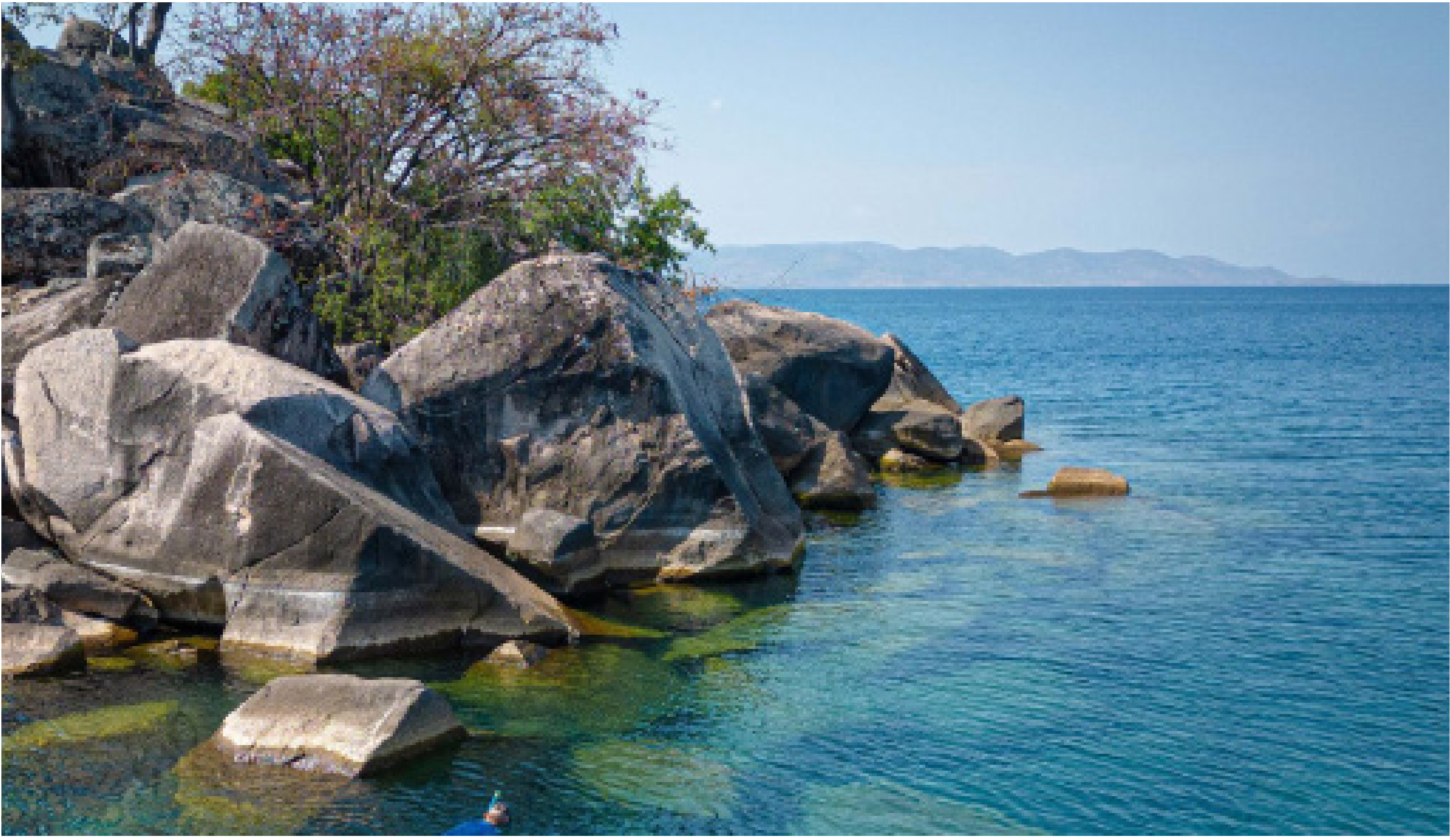
Approximately 90% of women over age 15 rely on natural resources including firewood, water, and wild foods for domestic needs, compared to only 24% of men. About 24% of households in Malawi are female-headed, making them particularly vulnerable to resource scarcity and increasing their likelihood of falling into poverty when ecosystems degrade. Women dominate fish processing and trading, yet their roles in fisheries management decision-making remain limited *(Well established)* {3.9.3, 3.11.2}. In fishing communities, approved fishing gear changes can exclude women where new gear requires skills and physical capacity many women lack at Zolokere, women previously fished using baskets, but recommended gear changes reduced their access to fishing grounds and affected their livelihoods *(Well established)* {3.8.2.3}. Women remain underrepresented in co-management structures and decision-making spaces, despite their central roles in resource use and stewardship *(Well established)* {3.9.3, 3.11.2}. Conservation initiatives that fail to address women's unique challenges risk limited impact. Data on household dependence and benefits derived from different ecosystems remains inadequate, hindering effective programming and integration of gender equality and social inclusion considerations. Policy implication: Strengthen women's participation in natural resource governance, recognizing their knowledge systems and ensuring equitable benefit-sharing. Integrate Gender Equality and Social Inclusion (GESI) criteria into all ecosystem management policies, programs, and monitoring systems. Ensure that co-management structures have mandatory representation and meaningful participation of women (*Well established)* {3.9.3)

12. HRBA is Widely Written into Policy but Systemically Absent in Practice, creating a Legitimacy Crisis That Undermines Both Human Rights and Biodiversity Conservation in Malawi {1.1.1.2, 2.2, 2.4, 6.1.3}

The Human Rights-Based Approach (HRBA) is a transformative framework that integrates international human rights norms into development and environmental governance. Unlike needs-based models that focus on what people lack, HRBA centers on the rights that people possess and the obligations of duty-bearers (government institutions, traditional authorities, project implementers) to respect, protect, and fulfill those rights. Its core principles include non-discrimination, equality, meaningful participation, transparency, accountability, access to justice, access to information, and Free, Prior and Informed Consent (FPIC). Each principle was systematically assessed across 14 policy documents and six communities in Malawi *(Well established) {*2.2, 2.4}.

Constitution (1994) guarantees equality, participation, and state accountability, providing a strong legal foundation for HRBA. The country is also a signatory to international instruments including UNDRIP, CEDAW, CRPD, CBD Article 8(j), and the African Charter *(Well established)* {1.1.1.2}. Despite this robust framework, the compendium report identifies a significant gap between policy commitment and documented practice – evidence of effective HRBA application in biodiversity management has remained sparse. The Malawi National Ecosystem Assessment (NEA) therefore initiated this case study across six communities (Nsanje, Salima, Mzimba, Rumphi, Nkhatabay) to document on-the-ground realities using desk reviews, community dialogues, key informant interviews, and a multi-stakeholder validation workshop (*Well established)* {6.1.3}.

Applying HRBA to biodiversity conservation is essential for sustainable outcomes. Communities living near protected areas are not passive beneficiaries but active rights-holders and custodians of biodiversity, possessing Indigenous and Local Knowledge (ILK) that has sustained ecosystems for generations. Conservation succeeds only when communities perceive fairness, receive tangible benefits, and participate meaningfully in decisions affecting their lands and livelihoods. Without HRBA, conservation can become exclusionary or culturally destructive as seen in Zolokele, where communities were denied access to ancestral graveyards for cultural rites *(Well established)* {6.1.3}. The Kunming-Montreal Global Biodiversity Framework and CBD Article 8(j) explicitly require rights-based approaches, including FPIC and equitable benefit-sharing *(Well established)* {2.2}.



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