Malawi Country Environmental Analysis

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Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
ANS	Adjusted Net Saving
APN	African Parks Network
BEST	Shire Basin Ecosystem Environmental Support Trust
CEA	Country Environmental Analysis
CECF	Community Environmental Conservation Fund
CO_2e	Carbon Dioxide Equivalents
CMC	Catchment Management Committee
CWON	Changing Wealth of Nations
DNPW	Department of National Parks and Wildlife
DoCCMS	Department of Climate Change and Meteorological Services
DoDMA	Department of Disaster Management Affairs
DoFi	Department of Fisheries
DoF	Department of Forestry
DoT	Department of Tourism
EAD	Environmental Affairs Department
EIA	Environmental Impact Assessment
EMA	Environment Management Act
ENR	Environment and Natural Resources
ENRM	Environment and Natural Resources Management
ENSO	El Niño Southern Oscillation (ENSO)
EPA	Environmental Protection Agency
EPI	Environmental Performance Index
ESIA	Environment and Social Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FISP	Farm Input Subsidy Program
FMNR	Farmer-Managed Natural Regeneration
FRIM	Forest Research Institute of Malawi
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoM	Government of Malawi
HAP	Household Air Pollution
HDI	Human Development Index
ICT	Information and Communication Technology

ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature
kt CO_2e	Kiloton of CO_2e
LCA	Life-cycle Assessment
LDF	Local Development Fund
LPG	Liquefied Petroleum Gas
LUCF	Land Use Change and Forestry
LULC	Land Use/Land Cover
MK	Malawian Kwacha
MGDS	Malawi's Growth and Development Strategy
MoNREM	Ministry of Natural Resources, Energy, and Mining
MEPA	Malawi Environmental Protection Agency
MoAIWD	Ministry of Agriculture, Irrigation, and Water Development
MoFEPD	Ministry of Finance, Economic Planning, and Development
MoH	Ministry of Health
MoLGRD	Ministry of Local Government and Rural Development
MoTPW	Ministry of Transport and Public Works
MSW	Municipal Solid Waste
NBSAP II	National Biodiversity Strategy and Action Plan
NCCIP	National Climate Change Investment Plan
NCCMP	National Climate Change Management Policy
NCCP	National Climate Change Program
NCE	National Council on Environment
NDC	Nationally Determined Contribution
NEAPW	National Elephant Action Plan for Malawi
NEP	National Environmental Policy
NFLR	National Forest Landscape Restoration
NGO	Nongovernmental Organization
NWRA	National Water Resources Authority
PES	Payments for Ecosystem Services
PPP	Public-Private Partnership
REDD+	Reducing Emissions from Deforestation and Forest Degradation Programme
ROAM	Restoration Opportunities Assessment Methodology
SADC	Southern African Development Community
SEA	Strategic Environmental Assessment
SLM	Sustainable Land Management
SPCR	Strategic Program for Climate Resilience
TCE	Technical Committee on Environment
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee

VNRMC	Village Natural Resources Management Committee
WCIU	Wildlife Crime Investigation Unit
WHO	World Health Organization
ZAMCOM	Zambezi Watercourse Commission Agreement

Preface

The purpose of this document

This Country Environmental Analysis (CEA) compiles and reviews existing analyses on Malawi's environment and natural resources (ENR) and explores what this evidence means for poverty and economic development. The report is designed to provide information in an accessible manner that can guide the development of policies and interventions. The CEA also identifies opportunities for managing natural resources to deliver improvements for livelihoods, reducing poverty, and building climate change resilience across all the environmental sectors.

Malawi's natural capital—its natural resources and environment—is under significant pressure on many fronts including population growth, agricultural expansion, and climate change. The Government of Malawi (GoM) recognizes the importance of the challenges posed by environmental degradation and climate change and includes these as key priorities in the latest Malawi Growth and Development Strategy (MGDS III) 2017–2021[1] and National Resilience Strategy.[2]

The approach to the analysis

The CEA is based on a review of recent literature, expert analysis, and technical consultations in Malawi with the government and other key stakeholders in 2017 and 2018. Rather than address every possible environmental variable, the report focuses on the key sectors that have the greatest impact on the current state of the environment in Malawi. It also explores where support for policy and institutional reforms and investments may also have the greatest influence over the next few years.

1 GoM. 2017(a). *The Malawi Growth and Development Strategy (MGDS) III.*

2 DoDMA. 2018. *National Resilience Strategy [Draft unpublished].*

How is this document organized?

The report has three main sections:

- The **Executive Summary** offers an overview of the environmental issues and challenges that Malawi faces and lists 10 key recommendations. It also shows in graphical form:
  - How the key drivers, pressures, and related environmental consequences work together in a complex and evolving environmental situation
  - How targeted interventions can support Malawi's journey toward more effective environmental management.
- **The State of the Environment** section provides a more detailed analysis of the cross-cutting issues and key ENR management themes
- **The Agenda for Change** section outlines the forward-looking agenda identified in each of the deep dive sections.

A well-managed environment protects and builds livelihoods benefiting all Malawians.

Malawi at a glance

Malawi is a small agriculture-dominated country in Southern Africa with a total geographical area of 118,484 km^2, 20% of which is Lake Malawi.

Malawi is one of the poorest countries in the world, ranked 170 of 188 countries on the global United Nations Development Programme (UNDP) Human Development Index (HDI).

Malawi's total population, urban populations, and population density have increased steadily since 1990. The population is currently around 18 million and growing at a rate of about 3% a year.

Natural resources underpin Malawi's productive sectors and are the main source of livelihood for most of the population. Renewable natural capital makes up 43% of Malawi's wealth.

Malawi has a tropical climate with relatively cool temperatures and rainfall patterns that are dependent on the movements of the Intertropical Convergence Zone (ITCZ) and the El Niño Southern Oscillation (ENSO).

Malawi is one of the world's most vulnerable countries to severe climate-related events. With more than 80% of Malawi's population dependent on rainfed agriculture, fluctuating weather patterns can have a disastrous impact on food security.

Mobile phone technologies are rapidly improving communication and services, with growing opportunities for informing Malawians of environmental issues.

Executive Summary

Malawi's environment: The drivers, challenges, and positive developments

THE DRIVERS AND CHALLENGES

Malawi currently faces an environmental cycle of decline and degradation. The challenges it faces are complex and interrelated, but there are two underlying drivers behind this decline. Population growth places huge demands on natural systems with more land being converted to agriculture and more forests being harvested for the wood fuel supply. Climate change magnifies these impacts by putting greater strain on land and forests due to increased incidents of natural disasters and extreme weather events. Proximate drivers of environmental degradation include weak land tenure security, unsustainable land management practices (driven in part by poorly designed and targeted agricultural subsidies), chronic shortages of public funding for environmental management, and weak institutions, particularly those at decentralized levels. These are discussed in more detail in the thematic sections that follow.

Land degradation is widespread and severe. Up to 60% of Malawi's land is currently affected by soil erosion and nutrient loss, and Malawi loses around 29 tons of soil per hectare per year.[3] This is extremely costly to the economy with an estimated annual cost equivalent to around 6.8% of gross domestic product (GDP).

Renewable natural resources are also under severe pressure. Over the last 40 years, more than half of Malawi's forests and woodlands have vanished, and those that remain are being 'thinned' through overextraction and more frequent forest fires. Yet, forests make a substantial contribution to livelihoods and the economy and are needed to protect vital ecosystem services. They also provide the bulk of Malawi's energy supply in the form of charcoal and firewood—a contribution worth USD 352 million in 2017, equivalent to 4.7% of GDP. Fish stocks and biodiversity are also declining, driven by overharvesting and illegal trade, and exacerbated by weak governance. Household air pollution (HAP) and poor solid and liquid waste management turn everyday activities into health hazards for large numbers of people.

These environmental challenges have placed Malawi onto an unsustainable development trajectory. The returns from the drawdown of natural capital have not been used to invest sufficiently in human and produced capital, such as education, health, and resilient infrastructure.

There are also positive trends and opportunities, and the introduction of bold new policy and institutional reforms could underpin a transformation toward more sustainable management of ENR. Land reforms introduced in 2016 should boost land tenure security and offer the prospect of increased investment in land stewardship if these reforms are implemented effectively. Pilot investments in sustainable land management (SLM) have also demonstrated that it is possible to restore degraded land back into productive use. Such investments have been shown to be inclusive, directly

3 Vargus and Omuto. 2016. *Soil Loss Assessment in Malawi.*

benefiting some of the poorest households, and have also boosted agricultural productivity. If taken to scale, SLM interventions in combination with stronger land tenure security could make a substantial contribution to addressing and reversing land degradation and protecting vital ecosystem services. Another significant reform is the introduction of a new National Charcoal Strategy[4] that seeks to reduce the pressure that leads to forest degradation by promoting alternative cooking fuels, efficient cook stoves, and sustainable charcoal production opportunity. This shift in policy provides, for the first time, an opportunity to legalize the charcoal value chain and move toward more sustainable charcoal production.

Malawi has made good progress in attracting private sector investment in protected areas. This has been achieved through the introduction of concessions, some of which are 'fully delegated' to private sector operators. These have demonstrated impressive results in terms of conservation outcomes and boosting revenues from tourism that benefit conservation management and local communities. Malawi has also made good progress in addressing wildlife crime driven by increasing international demand for illegally sourced wildlife products.

The recently approved Environment Management Act (EMA) 2017,[5] if implemented effectively, will be one of the most powerful legal instruments for environmental management introduced so far in Africa. This progressive legislation provides for the creation of an Environmental Protection Agency (EPA) with broad and substantial powers to strengthen environmental planning and risk management at national and decentralized levels. Whether the promise of improved environmental risk management is realized will depend to a large extent on whether the new agency will be provided with sufficient resources to ensure that the new legal framework is implemented effectively.

The CEA identifies the following 10 strategic recommendations to address the degradation of natural resources and the environment and to promote improved environmental management, investment, and expenditure practices:

STRATEGIC RECOMMENDATIONS

Productive land, forest, and fisheries resources

1. **Address land degradation:** Reform incentives for farmer-level scale-up of SLM practices through strengthening land tenure security and adjusting input subsidies.
2. **Overhaul fisheries management systems:** Strengthen fisheries comanagement arrangements in tandem with stronger enforcement against illegal fishing technologies and overfishing.

Environmental management

3. **Implement the new legal and institutional framework for the environment:** Provide sufficient public financing to support effective implementation of the new EMA (2017) and the creation of a semiautonomous EPA.
4. **Strengthen climate information services:** Implement a national and integrated program for improved uptake of climate information services.
5. **Support implementation of the National Charcoal Strategy:** Promote legalized charcoal value chains.
6. **Address Household Air Pollution (HAP) through education and subsidies:** Support and encourage markets and incentives for fuel switching for cooking to affordable clean fuels, including liquified petroleum gas (LPG) and electricity.
7. **Strengthen decentralized environmental management:** Accelerate and support the decentralization of environmental management functions.
8. **Boost environmental awareness:** Support GoM's environmental communication and education strategies.

4 GoM. 2017(f). *National Charcoal Strategy 2017–2027.*

5 GoM. 2017(i). *Environment Management Act, Act 19 of 2017.*

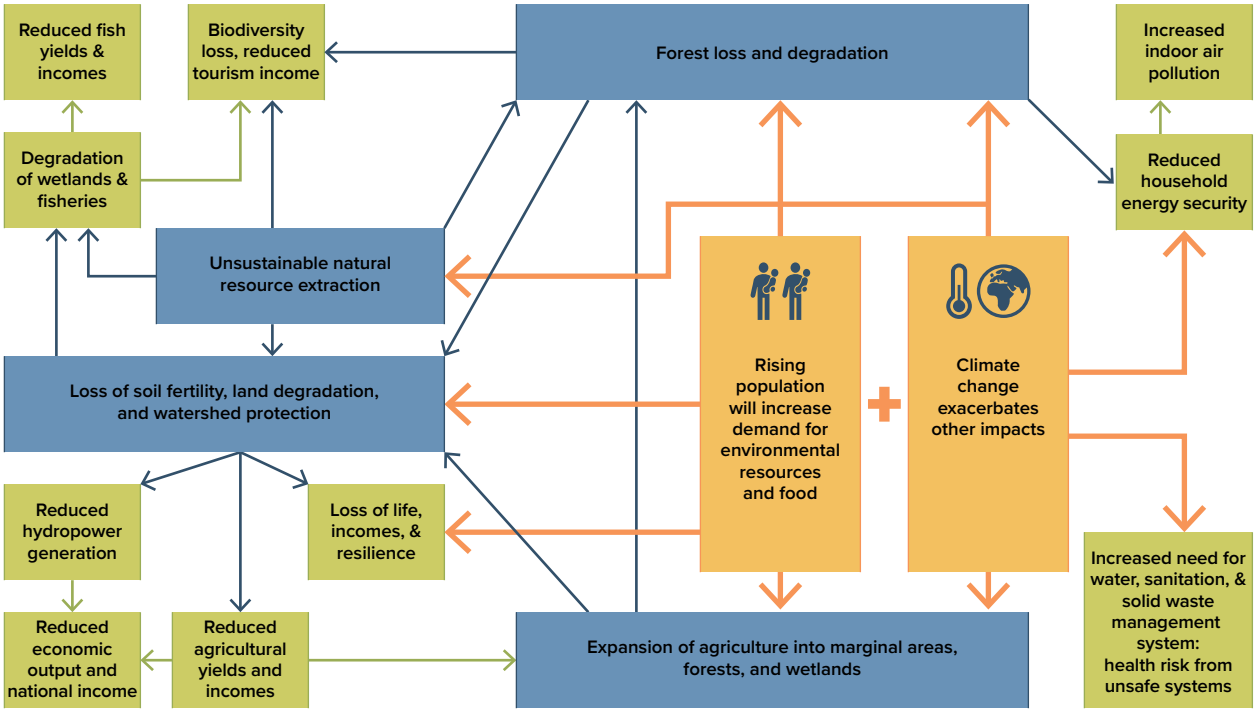
Environmental investment and expenditure

9. **Value natural capital in economic planning:** Develop natural capital accounts and use these to mainstream the values of key natural resources in national economic policy and planning.
10. **Increase private sector investment to address environmental challenges:** Use scarce public financing efficiently to leverage additional private sector investment to address natural resources management and environmental challenges.

A complex web of interrelated factors

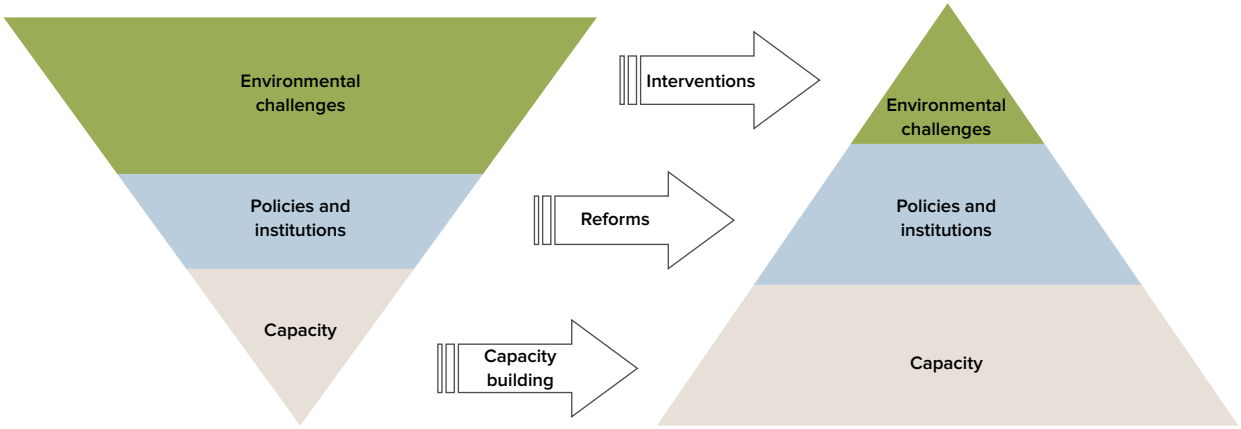
Infographic 1 shows the causal relationships between the drivers (in orange), the environmental pressures (in blue), and impacts (in green) that work together to create an environmental cycle of decline.

INFOGRAPHIC 1. Environmental drivers, pressures, and impacts



Infographic 2 shows how targeted interventions, reforms, and capacity building can support Malawi's journey toward more effective environmental management and reduced environmental challenges.

INFOGRAPHIC 2. A journey toward more effective environmental management



Background

This Country Environmental Analysis (CEA) provides an up-to-date systematic, evidence-based analysis of the state of Malawi's environment and natural resources. It is designed to inform the World Bank's strategy of engagement in Malawi and the government's own State of Environment reporting. It presents recent findings and trends on key environmental challenges and opportunities facing Malawi, the core of which lie at the nexus of high population growth, high dependence on resource-based incomes, and limited land. These and other drivers contribute to substantial challenges of natural resources and environmental degradation.

It is possible to reverse this pattern of decline by bringing multiple economic, livelihood, and environmental benefits to the lives of the poor and to the economy as a whole. This document offers an agenda for change that can be used to guide policymakers.

POVERTY AND INEQUALITY

Malawi is one of the poorest countries in the world, ranked 170 of 188 countries on the global United Nations Development Programme (UNDP) HDI.[6] More than 70% of the population lives below the international poverty line of USD 1.90 *per capita* per day and GDP *per capita* is just USD 372 (2015). Both inequality and poverty rates are high.[7] About 20.7% of the people are so poor that they cannot afford to eat a minimum daily recommended food intake, and at least 37% of children under five are chronically undernourished and stunted (low weight for age).[8] Poverty is also unequally distributed. The intra-regional variation is more pronounced in the south, where some districts have poverty rates over 80% and others under 20%.[9]

6 UNDP. 2016. *The Human Development Report 2016—Human Development for Everyone.*

7 World Bank. 2017(a). *Republic of Malawi Poverty Assessment.*

8 Concern Worldwide US. 2016. *Global Hunger Index—Getting to Zero Hunger.*

9 World Bank. 2017(b). *Republic of Malawi Poverty Assessment.*

POPULATION GROWTH IS THE UNDERLYING DRIVER OF ENVIRONMENTAL DEGRADATION

Malawi'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.[10] 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 environmental vulnerabilities.

HOW SUSTAINABLE IS MALAWI'S DEVELOPMENT TRAJECTORY?

While there are some indicators of growth, Malawi's wealth story is mixed. Wealth *per capita* increased by 52% between 1995 and 2014, mostly driven by growth in the value of cropland. However, this growth is based on an unbalanced portfolio of assets and gains in natural capital and thus total wealth. In addition, land value statistics do not capture declining soil fertility. For Malawi to experience growth going into the future, it needs improved productivity, sustainable management of its natural capital, and more efficient conversion of natural capital into human and produced capital.

Malawi's wealth *per capita*, USD 8,409 in 2014, is much lower than the average for other low-income countries (USD 13,629) or for Sub-Saharan Africa as a whole (USD 25,562). Much of Malawi's wealth is renewable natural capital (43%), mainly cropland with smaller shares contributed by pastureland, forests, and protected areas in 2014.[11]

Malawi's development pathway is not following a conventional trajectory. Usually, the transition from a low- to middle-income economy starts with an abundance of natural capital which is used to invest in infrastructure (produced capital) and education and health (human capital). At middle-income levels, produced capital roughly doubles its share and human capital grows rapidly to become the main asset. In Malawi, the opposite development occurred. Malawi is still highly dependent on its natural capital, which remained constant at 43% from 1995 to 2014, while human capital increased only slightly and produced capital shrank. Without complementary investments in produced capital (that is, transport, power, and water supply infrastructure) investments in human capital and improved natural capital management will struggle to contribute to economic growth and poverty reduction. In addition, the full impacts of climate change are not yet factored in.

POLICY AND INSTITUTIONAL FRAMEWORKS

Malawi policy and institutional frameworks relating to environmental management are diverse and elaborate. Environmental protection is enshrined in the Constitution and quoted as a long-term objective in Malawi's Vision 2020 document. In addition, recent legislation has been enacted to further strengthen environmental management and protection.

However, the ability to implement policy and legislation, both nationally and locally, is weak. Monitoring is often limited and ineffective, compliance is low, and the structures necessary for providing guidance and procedures are not in place. In addition, GoM's program of decentralization is struggling to make progress.

Land and agricultural policies play an important role in shaping natural resources management. The recent introduction of new land policies, including those for customary land, reflects a recognition that the lack of tenure security on customary land generates limited incentives for smallholders and businesses to invest in SLM practices. Agricultural policies and accompanying state interventions have also worked against crop diversification and sustainable agricultural development in various ways—contributing to land degradation and reducing resilience.

10 United Nations. 2017. *World Population Prospects 2017.*

11 The wealth accounts do not include fisheries or water at this time.

Expenditure analysis also shows that by 2012 the share of agricultural sector spending for extension support had declined to just 5%.[12] This is significant because extension support is crucial for promoting the uptake of SLM practices. One reason for this apparent drop in spending might be that historically national spending in the agriculture sector was dominated by the Farm Input Subsidy Program (FISP), which accounted for 75% of the budget for agriculture in FY2014/15.[13] This 'crowded-out' expenditures for other forms of agricultural spending that could have helped farmers address land degradation. However, more recent reforms have partially addressed this issue.

Weak institutional capacity for natural resources management is an issue, particularly at district and local levels. There appear to be two related reasons for this weak capacity. First, the slow pace of implementation of the government's decentralization policies constrains the extent to which district councils and extension services can support farmers to adopt SLM practices or Village Natural Resources Management Committees to protect and restore forest resources. Second, severe underresourcing constrains the effective functioning of institutions at district and local levels, limiting their ability to implement policy. The last available public expenditure reviews to 2012[14] indicated that Malawi allocated less than 1% of annual GDP on environment-related expenditures and that less than 1% of this is decentralized to the district level.[15]

The effectiveness of Malawi's Environmental Impact Assessment (EIA) framework is also constrained by weak capacity. There have even been a number of examples where projects have been authorized before an EIA was conducted. In addition, there are concerns that political considerations have undermined the integrity of the EIA system. These are some of the factors that led to the development of the EMA in 2017 and the ongoing review of Malawi's EIA guidelines and regulation of practitioners.

However, an ambitious new EMA (2017)[16] was approved recently by Parliament, and this represents an important new development. It is not yet clear when this act will come into force, but when it does, and if implemented effectively, it will be one of the most powerful legal instruments for environmental management introduced so far in Africa. The Act will enable the proposed Malawi Environmental Protection Agency (MEPA) to oversee the activities of all branches of government that have some environmental responsibilities. It will even provide this agency with a mandate to *"enforce the right to a clean and healthy environment."*

CLIMATE CHANGE

Climate change is likely to increase other environmental stressors and make the job of reducing poverty and boosting inclusive growth more difficult. Future climate change scenarios discussed in the **Climate change and resilience** section suggest that Malawi will see increasing climatic variability, higher temperatures, longer dry periods, and more erratic and intense rainfall events.[17] More intense flood events will cause greater soil erosion and land degradation. Hotter and drier periods will contribute to forest fire risks.

Droughts will continue to negatively affect food production. About 90% of Malawi's food production comes from one rainfed crop per year so drought can quickly increase the risk of food insecurity and poverty. Increased poverty then results in greater demands for more land and natural resources and puts extra pressure on the economy in general.

Climate shocks affect all economic sectors and geographical areas. For example, losses for agricultural GDP due to droughts are estimated to range from 1.1% to 21.5% for return periods of 5 and 25 years, respectively.[18] The agricultural

12 The last year for which agriculture sector expenditure analysis is available is 2012. In 2005, the share of agricultural sector on extensions services was 25%.

13 Record, Kumar, and Kandoole. 2018. *From Falling Behind to Catching Up: A Country Economic Memorandum for Malawi.*

14 This was the last date for which data is available.

15 In Mozambique, the comparable figure is 1.4%.

16 GoM. 2017(i). *Environment Management Act, Act 19 of 2017.*

17 GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

18 Pauw et al. 2011. *The Economic Costs of Extreme Weather Events: A Hydro-Meteorological CGE Analysis for Malawi.*

sector is the most at risk from direct climate change stressors[19] because it is highly sensitive to changes in temperature and precipitation.

The increased frequency of extreme weather events compounds these impacts. Between 2015 and 2017, floods in southern districts were followed by countrywide drought conditions, with the resulting loss and damage estimated at USD 335 million, equivalent to approximately 5% of GDP.[20] Infrastructure is also affected substantially. For the roads sector, median climate scenarios for temperature and precipitation changes through to 2050 suggest that, without adaptation measures, Malawi is facing a potential total annual average cost of USD 165 million[21] for maintenance and repair.

Greenhouse gas emissions

By global standards, Malawi has very low greenhouse gas (GHG) emissions of around 1.4 tons CO_2 equivalents (CO_2e) *per capita* in 2015. Malawi's main GHG contributing sectors are agriculture, forestry, and other land use (AFOLU); energy; and industrial processes. Between 2015 and 2040, Malawi's total annual GHG emissions are expected to rise by around 38%. This means an increase from the current level of approximately 29,000 kt CO_2e to around 42,000 kt CO_2e. GoM's goal is to save between 14,000 and 16,000 kt of CO_2e per year by 2030 if a robust low emission development path can be followed.[22]

Key environmental themes

LAND DEGRADATION

The evidence presented in this report confirms that land degradation in Malawi is widespread and severe. The average annual national soil loss rates in 2014 were estimated at 29 tons per hectare,[23] and soil erosion and nutrient depletion are reported to affect more than 60% of Malawi's land area.[24] The key drivers of degradation are unsustainable farming practices, coupled with the increasing demand for agricultural land and wood fuels associated with a growing population.[25]

Chemical land degradation, including soil pollution and salinization/alkalization, has led to 15% loss in the arable land in Malawi in the last decade alone. The annual costs of land degradation between 2001 and 2009 have been estimated at USD 244 million per year[26]—an amount equivalent to 6.8% of Malawi's country's GDP. The same study also estimated that each dollar spent addressing land degradation would return about USD 4.3 over a 30-year period.

The government's 2017 Forest Landscape Restoration Opportunities Assessment estimated that restoring 2.4 million ha of degraded cropland would increase maize production by 1.55 million metric tons (mt) per year, an increase of 40%. These are broad and possibly high estimates as achieving scale-up in the adoption of SLM in practice can be challenging, to say the least. Experience elsewhere in Southern and East Africa indicates that poorer farm households (the majority of Malawi's rural households) often do not have the resources to gain the full benefits of investments, and there are high de-adoption rates for techniques such as conservation agriculture and agroforestry. This is usually because labor requirements are high and/or subsidies have ended. In Malawi, high levels of interventions in the markets for key agricultural crops may also play a role.

19 GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

20 GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report.*

21 Chinowsky et al. 2015. *Infrastructure and Climate Change: A Study of Impacts and Adaptations in Malawi, Mozambique, and Zambia.*

22 GoM. 2015(b). *Intended Nationally Determined Contribution.*

23 Vargus and Omuto. 2016. *Soil Loss Assessment in Malawi.*

24 Davies et al. 2010. *Perceptions of Land-degradation, Forest Restoration and Fire Management: A Case Study from Malawi.*

25 UNIQUE. 2018b. *Land and Natural Resources Degradation in the Upper and Middle Shire Valley, Malawi.*

26 Nkonya et al. 2016. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development.*

FORESTS AND WOODLANDS

Forest and woodlands provide a substantial contribution to Malawi's economy. They account for 5% of the country's total wealth and 12% of natural capital. However, these values will decline steadily as forest resources continue to be depleted. It is estimated that harvests exceed sustainable yield from forests by about 71%. The national income accounts suggest that the forest sector contributed only 1% of value added in 2010. Yet, if noncommercial uses are included, notably firewood and charcoal (which 98% of the population depends on for household energy), the figure rises to 7.9%.[27]

Over half of the natural forests of Malawi were lost between 1972 and 1992—a rate of 2.5% per year for this period. Since 1992, this rapid rate of decline did slow to an annual rate of 0.85%, and between 2000 and 2010 the annual rate of loss was only 0.08%.[28] Empirical data are not yet available on forest degradation, but observational evidence and information reported in Malawi's Nationally Determined Contribution (NDC) submission[29] suggest that forest degradation, caused largely by overharvesting of remaining forests for firewood and charcoal, now accounts for a much larger share of forest-sourced emissions than those from forest clearance and conversion.

Forests provide important environmental and economic benefits, and their depletion results in a range of adverse environmental and economic impacts. Loss of forests contributes to Malawi's emissions of GHGs and black carbon. Forests and trees make substantial contributions to livelihoods, jobs, and the economy, through the supply of biomass fuels, sources of soil fertility, prevention of land degradation, and protection of watersheds. Forests provide habitats for biodiversity and wildlife. Ecosystem services are not easily quantified and therefore tend to be overlooked in economic planning. Plantation forests, which have decreased in area since 1990, contribute royalties, concession fees, and license fees to the government. Finally, a decrease in natural forests could lead to higher prices of wood fuel and charcoal as supplies diminish.

BIOMASS ENERGY

Biomass energy (firewood, charcoal, and crop residues) dominates Malawi's energy sector and is used by 98% of the population, primarily for cooking.[30] Households use 92% of Malawi's biomass energy, while just a few industries—including tobacco processing and brick burning—use the remaining 8%.[31] Rural households rely almost exclusively on firewood, which is mostly self-collected.

Inaccessible, unreliable, and unaffordable electricity supplies are the main reason for this high dependency on biomass fuels. There is also a strong cultural preference for cooking with charcoal for certain foods.[32] As a result, up to 90% of households with access to electricity continue to use charcoal. The only other source of fuel suitable for cooking is LPG. However, market penetration is extremely low because it is relatively expensive compared to biomass energy. Malawi has one of the lowest rates of consumption of LPG in the world—ranked 163 out of 173 countries.[33] There have been some advances in the uptake of 'improved' cookstoves, though the overall impact on biomass fuel consumption remains unclear.

Charcoal is a fully commercialized commodity produced almost exclusively for urban markets. There are highly organized charcoal value chains, and yet around 80% of charcoal producers are rural based and operate on a small scale.[34, 35] Between 2008 and 2016, urban household demand for charcoal increased by 35%. Household demand was worth more than USD 66 million in 2016 and provided employment opportunities for over 235,000 people. The production and

27 Hecht and Kasulo. 2013(a). *Development of forest valuation systems in Malawi*.

28 FAO. 2013. *Atlas of Malawi Land Cover and Land Cover Change. 1990–2010.*

29 It is understood that NDC data are based on assumptions made on the basis of analysis in other countries of the region.

30 GoM. 2017(b). *Integrated Household Survey 2016–17*.

31 GoM. 2009. *Malawi Biomass Energy Strategy*.

32 Holmes. 2015. *Understanding Urban Fuel Choice. The Case of Zomba, Malawi*.

33 The Global Economy. 2012. *LPG Consumption—Country Rankings*.

34 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal Consumption, Trade and Production in Malawi*.

35 Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems in Malawi*.

transport of charcoal also provides rural households with additional and flexible livelihood options. It can help them earn more than the national minimum wage and can reduce their vulnerability to poverty, financial insecurity, and food insecurity.[36] However, corruption within the value chain is rife, and an estimated USD 38 million[37] is lost to bribes each year.

Historically, Malawi has implemented a punitive approach to wood fuel governance with politicians and law enforcement agencies actively discouraging the practice. Until recently, this negative perception of wood fuels made it impossible to enact policies that supported formalization and modernization of the sector. However, the 2017 National Charcoal Strategy[38] has introduced a considerably more coordinated and holistic approach and one that acknowledges the importance of cross-sectoral engagement to achieve national energy security.

HOUSEHOLD AIR POLLUTION

With almost the entire population (98%) using biomass fuels for energy, the level of HAP is extremely high. HAP is the world's number one environmental cause of death and affects two-thirds of the world's population.[39] Among the different sources of air pollution in Malawi, HAP poses the greatest threat to Malawians.[40] The levels of fine particulate matter in households are far above guidelines for outdoor air toxicity levels.[41] Medical research has identified a strong correlation between HAP and the occurrence of pneumonia among children across the developing world. In Malawi, pneumonia is the single biggest killer of children under five,[42] and the risk of contracting pneumonia in children is increased by a factor of 1.8 because of exposure to HAP.

The health burden of HAP for Malawians is significant, particularly for women and children. Lower respiratory infections are the second-highest cause of death and premature death in Malawi (after HIV/AIDS). Air pollution is considered the second-highest risk factor that drives death and disability (after poor water and sanitation) and is ranked the fourth-highest risk factor overall (after malnutrition, unsafe sex, and poor water and sanitation).

BIODIVERSITY AND FISHERIES

Wildlife is an important draw for tourism, providing a valuable source of livelihoods for a significant number of people—yet, terrestrial and aquatic biodiversity in Malawi is in decline. This decline is due to the same combination of underlying factors that have driven forest loss and degradation—a combination of increasing human pressure and poor governance of natural resources. For some particular species of wildlife (for example, African elephant *Loxodonta Africana,* listed as globally 'vulnerable') and tree species (for example, Mulanje cedar *Widdringtonia whyei,* listed as 'critically' endangered), illegal trade is also driving population declines. In addition, populations of conservation important species are increasingly confined to protected areas.

Over 50% of Malawi's elephant population, a terrestrial keystone species, has been lost in the last 25 years. According to the National Elephant Action Plan for Malawi (NEAPW),[43] elephant populations have only been increasing in Liwonde National Park and Majete Wildlife Reserve. The remaining elephant populations have gradually declined in numbers and in range due to habitat loss.

36 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal Consumption, Trade and Production in Malawi*.

37 This figure is derived from the author's projections based on data from Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal Consumption, Trade and Production in Malawi*.

38 GoM. 2017(f). *National Charcoal Strategy 2017–2027*.

39 According to the World Health Organization (WHO), household air pollution from cooking with solid fuels prematurely kills 4 million people worldwide every year.

40 WHO. 2018. *World Health Statistics Data Visualizations Dashboard.*

41 Jary et al. 2017. *Household Air Pollution, Chronic Respiratory Disease and Pneumonia in Malawian Adults: A Case-control Study.*

42 WHO. 2013. *Progress on Tackling Pneumonia and Diarrhoea in Malawi.*

43 GoM. 2017(g). *Malawi's National Ivory Action Plan 2015–2025*.

It is also now generally accepted that the fish stocks in Lake Malawi are declining. Decreasing catch rates (catch per unit effort) suggest this is the case, and in particular there is a decline of the endemic *Oreochromis* (*Nyasalapia*), or Chambo, of which there are three species. Chambo is listed as an endangered species according to the International Union for Conservation of Nature (IUCN) Red List. The total Chambo catch (for Lake Malawi, Upper Shire River, and Lake Malombe combined) has declined by over 70% over the last 10 years. A failure to properly regulate fisheries offtake lies at the heart of the decline of Lake Malawi's fish stocks.

Lake Malawi supports internationally significant aquatic biodiversity. It is the ninth-largest lake in the world and the third-largest in Africa. The lake is over 2 million years old and a center of endemism for the Cichlid fish with at least 800 species, of which 117 are classified as threatened by the IUCN. The lake contains the largest number of fish species in the world, 30% of all known cichlid species,[44] and 4% of the world's fish species.

However, in recent years, GoM has introduced new approaches that have made a substantial impact on conservation outcomes. For example, it has partnered with the African Parks Network (APN) through concessions to manage several of the protected areas in Malawi, and these arrangements have dramatically improved park management, resulting in growing wildlife populations and increasing wildlife-based tourism revenues.

Malawi has also adopted a much stronger stance on combating wildlife crime and strengthening law enforcement. Malawi now has some of the toughest penalties in the Southern African Development Community (SADC) region and has committed to enforcing a moratorium on domestic ivory sales, tougher penalties for wildlife crimes, and putting ivory stockpiles out of economic use.[45] There have also been notable policy reforms and some high-profile wildlife crime court cases. These have resulted in higher numbers of arrests of wildlife traffickers and traders and increased rates of conviction.[46] In January 2015, Malawi joined the Elephant Protection Initiative and agreed to implement a NEAPW.

WATER RESOURCES

Malawi's water availability is rapidly decreasing and has the lowest water availability *per capita* of its neighboring countries.[47] The rate of population growth, and thus water demand, far outpaces water availability. As a result, soon the country is likely to experience water stress (that is, when demand for water exceeds the available and accessible amounts of sufficient quality water). This situation could be made worse by climate change and insufficient water infrastructures and management systems such as dams, wells, and municipal extension services.

Deforestation and land degradation also put pressure on water resources. These are causing high rates of erosion and sedimentation, which, in turn, leads to high sediment loads and negative impacts on aquatic life. Biological and chemical pollution from urban areas and industrial waste are additional concerns. So is runoff from the overuse of fertilizers and pesticides (particularly during wet seasons).

The compounded economic impact of degraded water resources in Malawi is hard to estimate, but poor sanitation alone is estimated to cost the country USD 57 million per year (or 1.1% of GDP). For example, a cost-benefit analysis of increased investments in water supply and sanitation infrastructures estimates 1.4 times return for water supply and 1.2 times return for sanitation.[48] Flooding in recent years has cost the country the equivalent of 5% of GDP—a financial burden exacerbated by the absence of water regulating infrastructures and encroachment in high-risk flood zones.

44 UNESCO. 2018. *Lake Malawi National Park.*

45 In response to Malawi's listing as a country of 'primary concern' in terms of elephant ivory trafficking.

46 By contrast, between 2010 and 2014, approximately 60 trafficking convictions were made with an average fine of just USD 40 and no prison sentences.

47 GRID-Arendal. 2013. *Zambezi River Basin—Atlas of the Changing Environment.*

48 WSP. 2012. *Malawi—Economic Impacts of Poor Sanitation in Africa.*

SOLID AND LIQUID WASTE MANAGEMENT

The management of solid and liquid waste in Malawi is limited and inadequate. Only 10–15% of urban wastewater is collected through sewerage, and an estimated 70% of municipal solid waste (MSW) is not officially disposed of. The country has only two municipal landfills, no publicly managed trash incinerators, and few waste transfer stations. The major cities of Blantyre, Lilongwe, and Zomba and a few districts and municipalities have wastewater treatment plants, but their conditions are generally not known, although most are old, are poorly maintained, and do not have the capacity to deal with current levels of wastewater. Most district and municipal councils have no sewerage networks, and often sludge ponds or old quarry sites are used to dispose of sludge pumped from septic tanks.[49]

The rise in the number of people moving into urban environments adds a further challenge. Malawi is urbanizing at a slower rate than comparator counties.[50] However, while the growth rate of Malawi's urban centers remains slow, Malawi's population is still expected to double by 2040[51] so urban populations will rise accordingly. This means there is still a window of opportunity to invest in sustainable urban planning and development, including investments in solid waste management and sewerage.

There has been no detailed analysis of the costs of Malawi's current solid waste management status. The major environmental cost of poor waste management is the pollution of surface and groundwater and corresponding health hazards. Often household refuse is mixed with medical and industrial waste, unregulated dumping in unsuitable locations creates dust and litter, and untreated sewage pollutes waterways and groundwater.

Malawi has the necessary legislation to make waste management work, but there is a chronic lack of finance to manage waste effectively. The new EMA (2017) provides clear guidance and authority for waste management. The National Water Policy aims to ensure water of acceptable quality for all needs in Malawi. The Integrated and Sustainable Waste Management Framework calls for multi-stakeholder engagement. In addition, formalized national effluent standards exist. However, there is a limited capacity to enforce regulations, and implementation remains inadequate.

49 Chipofya et al. 2018. *Comparison of Pollutant Levels in Effluent from Wastewater Treatment Plants in Blantyre, Malawi.*

50 World Bank. 2017(a). *Malawi Economic Monitor: Harnessing the Urban Economy.*

51 United Nations. 2017. *World Population Prospects 2017.*

An agenda for change

The CEA identifies priority actions for different environmental sectors to address environmental challenges. These include policy and institutional reform measures as well as specific actions at sector levels. Ten strategic recommendations for transformational impact are presented below. These are by no means comprehensive, but a longer list, organized by sector and theme, is included in Annex 1.

PRODUCTIVE LAND, FOREST, AND FISHERIES RESOURCES

Recommendation 1: Address land degradation

Reform incentives for farmer-level scale-up of SLM practices by strengthening land tenure security and reforming input subsidies. The priority is to reform incentives for farmer-level scale-up of SLM practices by implementing land tenure reforms at scale in tandem with reforms to subsidy regimes. If land tenure reforms are implemented effectively, and at

scale, this will increase tenure security and incentives for landholders to invest in SLM measures. Improved land tenure security will reduce land degradation and increase productivity. Unfortunately, poorly targeted input subsidies currently work in the opposite direction and contribute to land degradation, directly (for example, by constraining crop diversification) and indirectly (for example, by crowding out fiscal space for investments in extension services). Therefore, reforms to subsidy regimes are also needed that better target limited public resources and create incentives for better land stewardship.

Recommendation 2: Overhaul fisheries management systems

Strengthen fisheries co-management arrangements in tandem with stronger enforcement against illegal fishing technologies and overfishing. Effective fisheries governance is prioritized in the revised Fisheries Policy, along with the recognition that improved institutional arrangements must be based on co-management with fishing communities. Successfully implemented, co-management interventions will empower primary stakeholders (mostly local fisherfolk) to manage the fishery on which their livelihood depends. These arrangements will enable the development of participatory Fisheries Management Plans, including regulations and penalties, and enforcement of these regulations to control access.

Recommendation 3: Support implementation of the National Charcoal Strategy

Support this ambitious and progressive reform (including its proposals to promote fuel switching to cleaner and alternative fuels such as LPG) to develop legal and sustainable charcoal value chains. There are opportunities to promote greater efficiency in consumption and a switch to alternative clean fuels. There are high-quality, modern cooking appliances that can be encouraged, and commercial and social enterprises could be encouraged to invest in Malawi's clean cooking sector.

Simplify or remove regulations to allow the wood fuel industry to transform from the informal to the formal economy. This ambitious and progressive reform should be supported, including its proposals to promote fuel switching to cleaner and alternative fuels (such as LPG) and to develop legal and sustainable charcoal value chains. For the latter, this would involve simplifying or removing regulations, reducing barriers to securing licenses for charcoal production and trade, and promoting sustainable practices through incentives. Examples of this include providing planting and tree stewardship grants and supporting co-management efforts. A functioning and legal charcoal industry could deliver significant fiscal returns to the state through the formal taxation system, which are not currently being captured, and encourage investment in modernization and efficiency improvement.

ENVIRONMENTAL MANAGEMENT

Recommendation 4: Implement the new legal and institutional framework for the environment

Provide sufficient public financing to support implementation of the new EMA (2017) and the creation of a semiautonomous EPA. These linked reforms provide an important window of opportunity for strengthening environmental management in Malawi. The aim of the new EMA is to align Malawi's management of environmental and natural resources with modern global standards. It also allows for the creation of a semiautonomous EPA with broad and substantial powers. Successful implementation of the new legal framework will depend in large part on whether the new agency is provided with sufficient resources to operate efficiently.

Recommendation 5: Strengthen decentralized environmental management

Accelerate and support the decentralization of environmental management functions. GoM is committed to decentralization but progress has been slow. The EMA (2017), along with the forthcoming establishment of the EPA, provides for a more localized distribution of funding and decision-making and an opportunity to speed up the decentralization process and improve coordination between officers and institutions at district levels and below. Decentralization will need to be

supported by strengthening capacity of local-level institutions, taking into account the fiscal/financial, political economy, and capacity constraints this may face.

Recommendation 6: Address HAP through education and subsidies

HAP can be tackled by raising public awareness through education and subsidies. Chronic and acute respiratory diseases resulting from HAP are preventable. Addressing these requires supporting and encouraging markets and incentives for fuel switching for cooking to affordable clean fuels, including LPG and electricity (links to **strategic recommendation 3**). In the short term, immediate interventions should include education and public awareness-raising strategies that make the severe health risks apparent. A continued emphasis is needed for urban and rural electrification, and for fuel switching to cleaner fuels such as LPG. However, affordability issues hamper uptake of both these technologies for many households. Subsidies for more efficient stoves and improved ventilation should be prioritized and supported at a greater scale making sure analysis is done to cost this carefully, as there may be little budgetary space for Malawi to fund such subsidies.

ENVIRONMENTAL ACCOUNTING AND EXPENDITURE

Recommendation 7: Value natural capital in economic planning

Develop natural capital accounts to mainstream the values of key natural resources in national economic policy and planning. Natural capital accounting is the process of measuring natural capital, recognizing its value, and incorporating that information directly into national economic accounts and statistics. For Malawi, this would require sufficient capacity in the National Statistical Office to produce these accounts. A good starting point would be the preparation of accounts that could best inform policy on priority environmental challenges—for example, land, forest, and water accounts. The accounts could then be used to generate analysis by the Ministry of Finance, Economic Planning and Development (MoFEPD) on key policy issues and questions—for example, to quantify the real contribution of natural assets and the ecosystem services they provide to the national economy; to quantify and track economic losses associated with land degradation, or to quantify the impact of the informal economy (for example, wood fuels extraction or fish harvesting) on the underlying resource base (for example, forests or fish stocks).

Recommendation 8: Increase private sector investment to address environmental challenges

Use scarce public financing efficiently to leverage additional private sector investment to address natural resources management and environmental challenges. Current levels of public investment in the forest sector for the foreseeable future will be inadequate to support effective management of Malawi's remaining forests and other natural capital. However, economic analysis shows that investments in sustainable forest management yield large public benefits to other economic sectors, particularly for hydroelectricity generation. Such investments would also help sustain Malawi's principal source of domestic energy in the face of growing deficits between supply and demand. For this reason, finding ways to increase forest sector financing will be needed if the National Forest Policy (2016) and the National Forest Landscape Restoration (NFLR) Strategy (2016) are to move from paper policies into implementation. Three examples of leveraging mechanisms are suggested:

1. Developing institutional and licensing frameworks for 'legalized' sustainable charcoal value chains[52]
2. Developing payments for ecosystem services (PES) mechanisms
3. Developing public-private partnership (PPP) for plantation forestry

52 Recent policy reforms have now made this possible.

Opportunities also exist for increased private sector investments in managing protected areas, marketing agricultural commodities, and recycling plastics and other solid waste. Small farmers and other rural producers are key private sector actors. Support for, and investment in, their productive activities could increase their economic contribution considerably.

KNOWLEDGE, INFORMATION AND AWARENESS

Recommendation 9: Strengthen climate information services

Enhance climate resilience by implementing a national and integrated program for improved uptake of climate information services. There is global consensus that climate services play a critical role in decision-making and planning for resilience and that more robust and timely data are required to support effective decision-making.[53] Several studies confirm that the returns on investing in climate services are high, on average 1:3, and for warning services the cost-benefit ratio is much higher.[54] In Malawi, improving the uptake of climate information is essential considering the country's exposure to climate change and extreme events. Climate information is vital for short-term decision-making (for example, responding to extreme events) as well as longer term planning across sectors—especially in agriculture, disaster risk reduction, land and water use, and energy.

Improved climate services could be achieved through the concerted integration of ongoing investments in climate services, alongside financing the emerging gaps across meteorology and hydrology information management. This would cost an estimated USD 17 million[55] although increased investments will also lead to increased maintenance and upkeep costs, so this figure would increase.

Strengthening Malawi's climate services should focus on three key priorities:

1. Improving institutional cooperation (both between the core climate service agencies and between these agencies and the private and public sectors)
2. Operationalizing information and communication technology (ICT) tools and collaborative platforms for data processing to produce sector/user-relevant information
3. Mobilizing additional funding to expand the infrastructures for collecting and processing weather and water data.

Recommendation 10: Boost environmental awareness

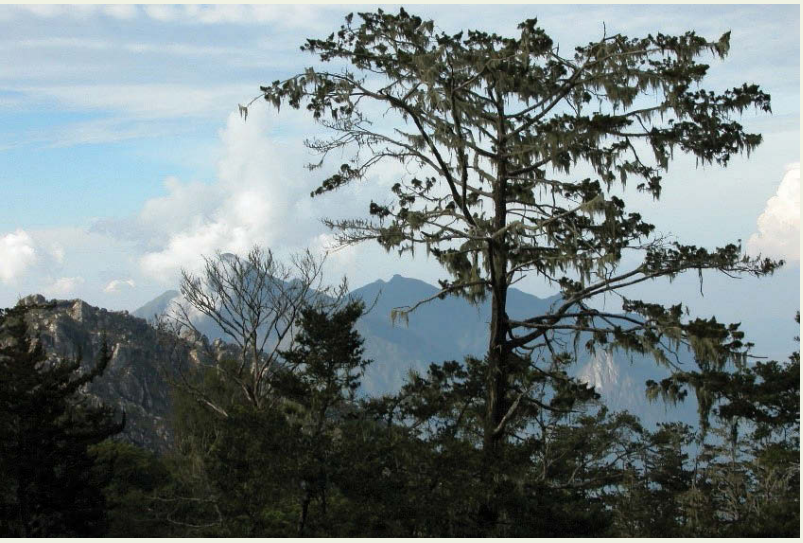
Support GoM's environmental communication and education strategies. Policies and institutional changes will not, on their own, bring about the major changes required to address key challenges. Wider behavior change is required that shifts citizens' understanding of environmental challenges and raises awareness of both the positive and negative roles they can play. Effective communication strategies and activities should be an integral part of all environmental interventions.

Incorporate the Internet and social media into traditional communication channels to accommodate their ever-increasing global communication role. The use of the Internet and social media is increasingly common, and communication strategies and activities should accommodate this.

53 IPCC Special Report. 2018. *Global Warming of 1.5°C. Summary for Policymakers*. Intergovernmental Panel on Climate Change.

54 World Meteorological Organization. 2015. *Valuing Weather and Climate: Economic Assessment of Hydrological and Meteorological Services*; World Bank. 2018 (b). *Assessment of the State of Hydrological Services in Developing Countries*.

55 Government of Malawi. 2017c. *Strategic Program for Climate Resilience.*



Malawi is highly dependent on renewable natural capital that includes forests, fisheries, agricultural land, biodiversity and water.

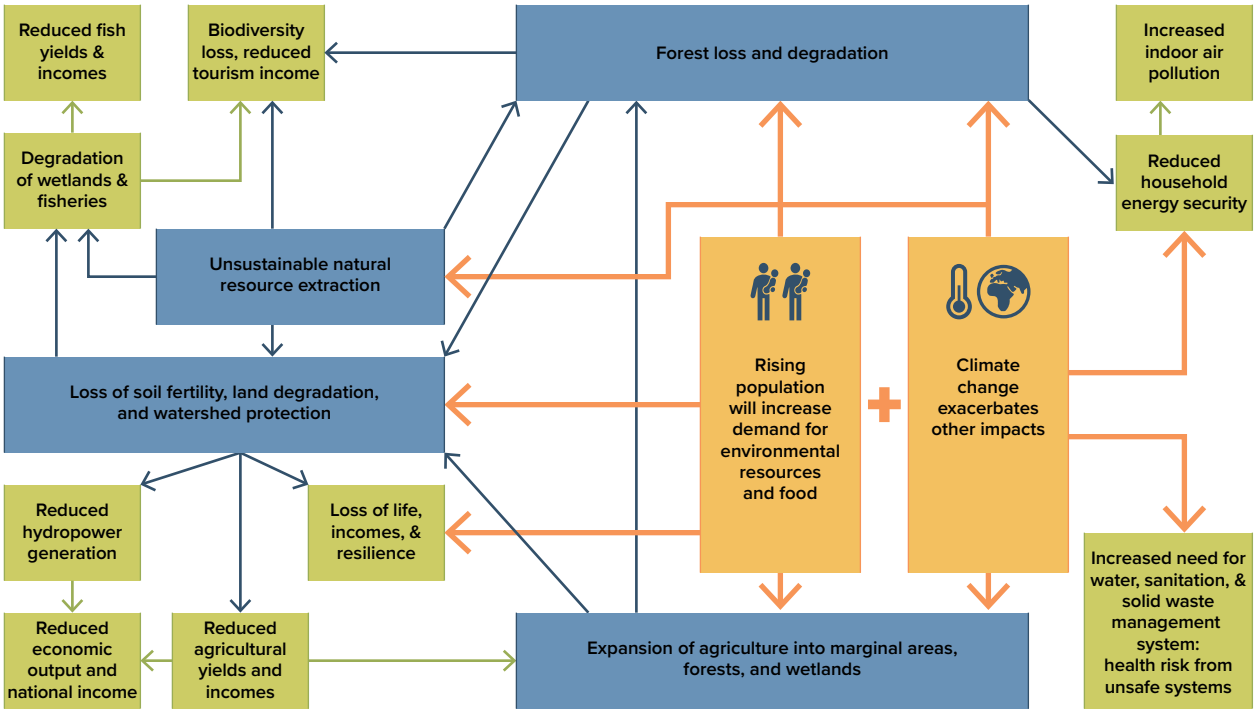
The State of the Environment

A complex web of interrelated factors

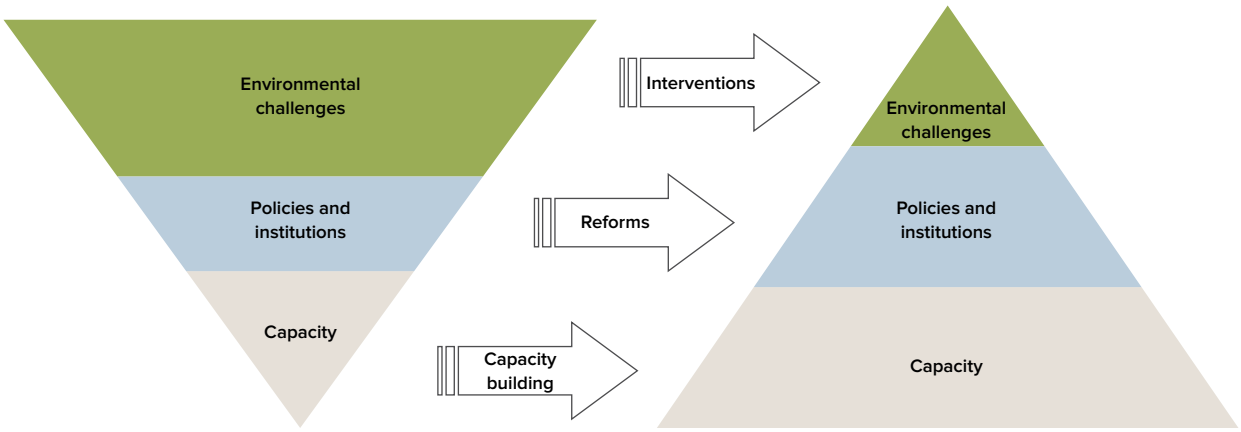
The drivers and pressures contributing to the current and future state of Malawi's environment are complex and interrelated. They cannot be viewed or tackled as single issues. Infographic 1 provides a visual representation of how these relationships work. It shows two distinct drivers (in orange) that exacerbate environmental pressures (in blue) that Malawi is experiencing. The impacts (in green) are a result of these drivers and pressures. In addition, some of these impacts make the environmental pressures worse, and hence the cycle of decline intensifies.

Breaking this cycle is possible only if Malawi has the institutional capacity to implement these policies. At present, GoM has policies in place and in the pipeline to tackle the environmental challenges it faces. Yet, institutional capacity and policies are often weak, and these constrain the effectiveness of Malawi's response to these challenges. Infographic 2 conceptualizes a transformation that could be achieved through targeted interventions that strengthen institutional capacities, adjust policies, and hence subsequently reduce environmental challenges.

INFOGRAPHIC 1. Environmental drivers, pressures, and impacts



INFOGRAPHIC 2. A journey toward more effective environmental management

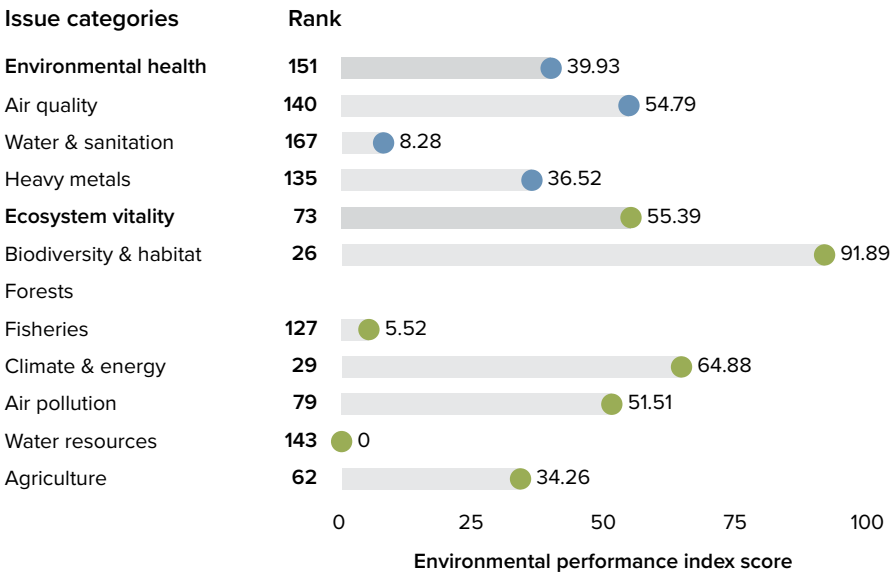


Malawi's overall environmental situation

Malawi is ranked 128 out of 180 countries by the 2018 Environmental Performance Index (EPI).[56] The EPI scores countries on 24 performance indicators across 10 categories that cover 'environmental health' and 'ecosystem vitality'.[57] Malawi's EPI scorecard is shown in Figure 1.

Malawi ranks particularly poorly on 'environmental health' indicators[58]—at 151 out of 180 countries. For household air quality, Malawi ranks 140 out of 180 and for water and sanitation, Malawi has a total score of just 8.28 out of 100. Malawi fares better for 'ecosystem vitality' indicators, with an overall ranking of 73 out of 180, but this is largely due to a high score on 'biodiversity and habitat'—a reflection of the legal framework for protecting species and habitats, rather than

FIGURE 1. Malawi's EPI scorecard



Source: EPI. 2018. *Environmental Performance Index.*

56 EPI. 2018. *Environmental Performance Index.*

57 'Environmental health' aggregates air quality, water and sanitation, and heavy metals while 'ecosystem vitality' aggregates water resources, agriculture, forests, water resources, biodiversity, climate, and energy.

58 EPI. 2018. *Environmental Performance Index.*

what happens in practice with habitat and species conservation and management. The scores for forests and water resources are particularly poor, and this provides a strong rationale for the further analysis included in this review.

While the EPI ratings provide a useful reference point and suggest that Malawi needs to improve on many important environmental indicators, care is needed when interpreting these 'broad-brush' indicators. The scores and ratings provide insufficient depth to understand the drivers of environmental change in Malawi and how these play out at national and subnational levels.

This CEA fills this gap by focusing on specific themes considered most important to Malawi's sustainable growth. The selection of these themes was guided by global indicator sets, such as the EPI, as well as through discussions with experts and various consultations—including in-country discussions held during the stocktaking exercise that preceded the drafting of the CEA.

The report includes an analysis of natural capital and wealth, institutional and policy frameworks, and constraints to policy implementation. Together, these provide the broader macro-level picture of natural capital and the policies and institutions that shape the management of these resources.

Climate change magnifies vulnerabilities in all sectors. The analysis presented here includes the specific impact of changes in climate and weather patterns on each key environmental resource. The interrelated themes of **land degradation** and the **loss of forest and tree cover** emerge repeatedly as priority themes throughout the analysis—driven by the ever-growing demand for agricultural land and (to a lesser extent) **biomass fuels.** This pattern of drivers, pressures, and consequences creates a complex web of interrelated factors (see Infographic 1) that eventually affects livelihoods, resilience, and vulnerability. Reversing this cycle of decline, for example, by increasing the productivity of land and forests and by transitioning to a well-managed and productive biomass fuels subsector, could bring multiple economic, livelihood, and environmental benefits.

Fisheries[59] is an important economic sector that plays a key role in nutrition and livelihoods in Malawi. Malawi supports the highest freshwater fisheries biodiversity worldwide and fish stocks and fishery biodiversity are at risk from overharvesting and poor fisheries management (exacerbated by substantial capacity challenges).

Biodiversity and habitats are looked at in some depth because of the role that habitat conservation can play in maintaining ecosystem services. Well-maintained ecosystem services provide numerous benefits, including the provision of water, prevention of floods, and support for Malawi's tourism sector. Sound management of protected areas provides a cost-effective means of protecting ecosystems services and, for global public goods, sequestering carbon, and protecting globally important biodiversity.[60]

Water resources underpin all economic sectors and the sustainable, and sound management of water resources is vital for energy generation, food production, and building resilience to climate change. The effectiveness of water management also has a strong impact on human health. **Solid and liquid waste management** is often overlooked as an environmental challenge in Malawi. It is an issue of growing concern and one that will become more significant with increasing urbanization. **Household air pollution (HAP)** is also reviewed. It is an important significant public health challenge, and yet Malawi scores near the bottom of the global rankings for HAP.

The following sections in this report provide a detailed analysis of the drivers, the resulting pressures these have on the environment, and the subsequent social and economic consequences. It concludes with a set of recommendations based on the analysis for addressing Malawi's key environment challenges.

59 Fisheries is not included in the EPI data sets.

60 IUCN. 2016. *Protected Planet Report 2016: How Protected Areas Contribute to Achieving Global Targets for Biodiversity*.

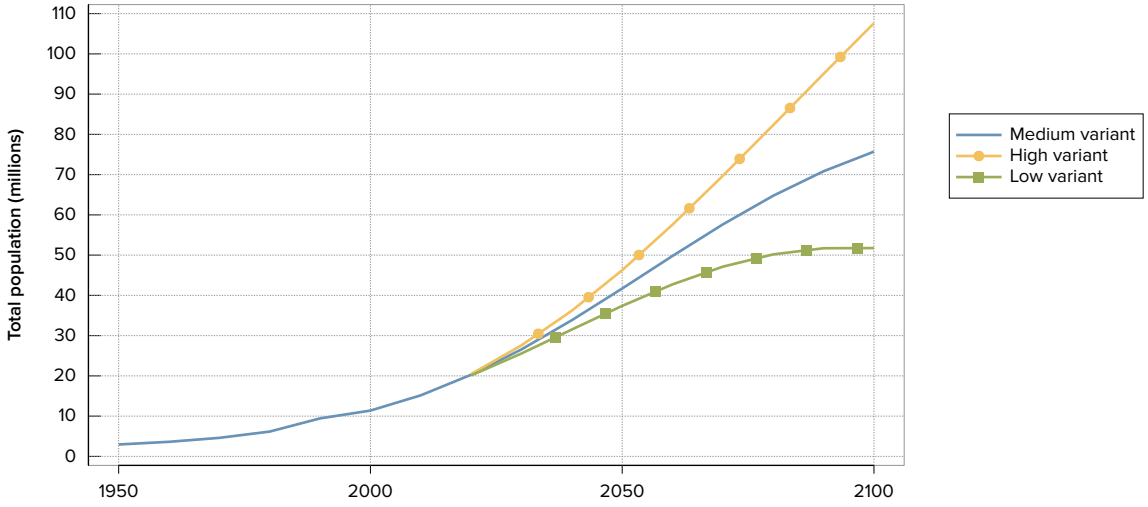
Malawi's population is young and growing rapidly.

Cross-cutting issues

1. POPULATION, POVERTY, AND LIVELIHOODS

Over the past 20 years, Malawi has faced rapid population growth and steadily increasing population density. The population is growing quickly having increased from just under 3 million in 1950 to over 18 million in 2017. It is anticipated that by 2050 the population will be over 40 million.[61] Figure 2 shows how Malawi's population has grown since 1950 and the direction it is predicted to take. Population density has also grown. Apart from Rwanda and Burundi, Malawi has the highest population density in the region, currently over 180 people per square kilometer. The population is also very young with a median age of 16.5.[62]

FIGURE 2. Malawi total population by variant



Source: United Nations. 2017. *World Population Prospects 2017.*

61 United Nations. 2017. *World Population Prospects 2017.*

62 World Population Review. 2018. *Malawi Population 2018.*

BOX 1. Gender, poverty, and livelihoods

- The majority of women in Malawi are informally employed in the natural resource sector, and their livelihood and food security are more likely to be adversely affected by deforestation, land degradation, and resource depletion.
- 90% of women above the age of 15 state they are reliant on natural resources for domestic activities (for example, collecting firewood, fetching water, and wild fruits for home consumption) in comparison to 24% of men.
- 24% of households in Malawi are headed by women. When resources are scarce, these households are disproportionately affected and more likely to fall into the poverty trap.
- It is reported that plots managed by women produce 25% less per hectare on average than male-headed households.[63]
- It is estimated that gender inequality in the agriculture sector alone is costing the country USD 100 million and 7.3% in crop production annually. Closing this gap has the potential to alleviate poverty for as many as 238,000 people.[64]

Malawi is urbanizing at a slower rate than comparator countries. The majority of the population are still rural-based, and it is anticipated that only 20% of Malawi's population will live in an urban environment by 2040.[65] Today, 83% of Malawi's poor still live in rural parts of the country and these numbers are rising.[66] Some regions face greater poverty issues than others and nearly half of Malawi's poor population live in the southern part of the country.

Growing population pressure is increasing environmental pressures and stress on the country's natural resource base. Forests, wetlands, and hillsides are converted into agricultural land, and because this land is often unsuitable for cropping, greater soil erosion occurs and water courses are silted up. Wildlife habitats and forests are lost or become more vulnerable to extreme events. Farm plots are split across generations and become unsustainable, causing increased poverty and reduced livelihoods.

Poverty and livelihoods[67]

In Malawi, over 20% of the population is 'ultra-poor' and over 50% of the population is moderately poor. The country as a whole is extremely poor. The impacts of poverty are exacerbated by limited access to education, employment, and markets, as well as high prevalence of diseases such as malaria and HIV/AIDS (9.2% infection rate).[68]

Natural resources are the main source of livelihood for most of the population. The majority of rural families depend directly and heavily on natural resources for their livelihoods, in particular woodlands and forests, for providing wood fuel (supplying nearly 90% of national domestic energy needs), enhancing soil fertility, generating cash income (for example, from charcoal), and supplying protein (for example, from fisheries).

Most Malawian households, including most of the poorest ones, are involved in agriculture. Diversifying income sources is an important livelihood strategy that spreads risk and increases income-earning opportunities. But in Malawi,

63 USAID. 2015(b). *Protecting Ecosystems and Restoring Forests in Malawi (PERFORM).*

64 World Bank. 2015. *The Cost of the Gender Gap in Agricultural Productivity in Malawi, Tanzania, and Uganda.*

65 World Bank. 2017(a). *Malawi Economic Monitor: Harnessing the Urban Economy.*

66 World Bank. 2017(b). *Republic of Malawi Poverty Assessment.*

67 This section draws on World Bank. 2017(b). *Republic of Malawi Poverty Assessment*

68 AVERT. 2018. *HIV and AIDS in Malawi.*

TABLE 1. Proportion of households obtaining income from the various sources, 2004, 2010, and 2013 (%)

	Malawi			Urban Areas			Rural Areas		
	2004	2010	2013	2004	2010	2013	2004	2010	2013
Agricultural									
Crop	77.2	85.9	83.8	35.7	43.1	52.2	83.4	93.2	89.3
Livestock	58.4	18.1	20.6	12.7	6.5	7.9	65.2	20.02	22.8
Agricultural wage	50.8	44.6	47.0	26.8	30.1	39.4	54.4	47.04	48.3
Nonagricultural									
Nonfarm wage	21.1	21.4	19.3	53.8	58	48.6	16.2	15.2	14.2
Self-employment	30.6	22.2	30.8	35.9	38.2	49.7	29.8	19.5	27.5
Transfers	85.9	28.4	36.5	64.4	34.1	52.2	89.1	27.5	33.8
Other	9.5	6.2	7.6	24.7	19.6	22.2	7.3	3.9	5.0

Source: World Bank. 2017(a). Malawi Poverty Assessment team calculations based on IHS2 and IHS3.

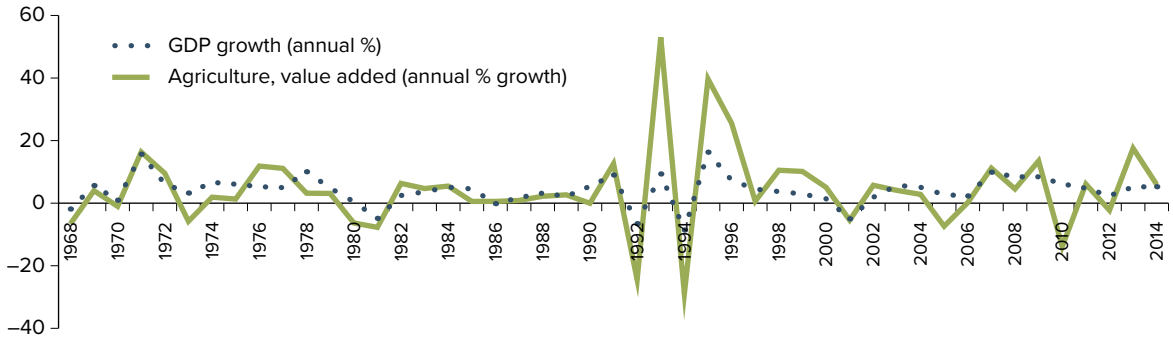
Note: IHS2 and IHS3 are household surveys conducted in 2004/05 and 2010/11, respectively, by the National Statistical Office, Malawi.

income sources are anything but diverse and about 85% of the population depend on farming.[69] Table 1 shows that in rural populations 89% of income came from cropping, over 20% from livestock, and 47% from agricultural wages. Despite the large numbers of people engaged in farming, agriculture contributes just 30% of gross domestic product (GDP). However, growth in GDP has historically followed growth in agriculture (see Figure 3).

Urban households' income sources are more diverse, with most income coming from wage labor and self-employment. However, a significant proportion of urban households still receive some income from agriculture, and this increased between 2004 and 2013, perhaps reflecting limited income-earning opportunities in the wider economy. This emphasizes how important natural capital assets are for both rural and urban households.

The overall picture confirms the importance of agriculture to rural and urban household incomes. It is a major driver of the continued pressure on land and other natural resources across the country, and this pattern does not appear to be changing at present. The relatively slow pace of urbanization suggests that this pattern will continue over the next few years, and any environmental policy reforms and investments need to be set in this context.

FIGURE 3. Malawi's growth in GDP closely follows growth in agriculture



Source: World Bank. 2016. *Malawi Economic Monitor: Absorbing Shocks, Building Resilience.*

69 Record et al. 2017. *Policy and Institutional Actions for Moving beyond "Business as Usual" to Achieve Stable and Sustained Growth and Poverty Reduction.*

2. WEALTH AND NATURAL CAPITAL[70]

While there are some indicators of growth, Malawi's wealth story is mixed. Much of its wealth is dominated by renewable natural capital (43%), mainly cropland, and produced capital is in decline. In addition, the extra pressures of land degradation, reduced forest land area, climate change, and other unpredictable and unforeseen impacts could further negatively affect Malawi's wealth.

The recent introduction of cheetah by African Parks at Liwonde National Park will make a welcome contribution to increasing natural capital.

This section explains the methodology used in defining how we measure wealth and what this means in the context of Malawi.

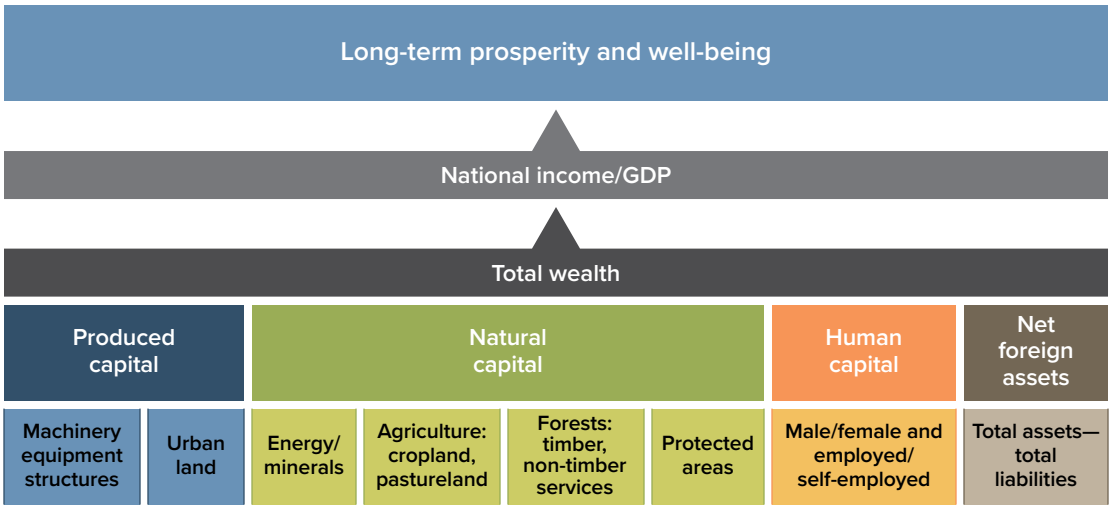
Why we measure wealth

National income and well-being are underpinned by a country's assets or wealth—measured comprehensively to include produced capital, natural capital, human capital, and net foreign assets. Viewed through the lens of wealth, development is a process of building and managing a broad portfolio of assets. Although a macroeconomic indicator such as GDP provides an important measure of economic progress, it measures only income and production and does not reflect changes in the underlying asset base. Used alone, GDP may provide misleading signals about the health of an economy over the long term. It does not reflect depreciation and depletion of assets, whether investment and accumulation of wealth are keeping pace with population growth, or whether the mix of assets is consistent with a country's development goals.

If we want to maintain GDP in the future, we need to maintain the assets that produce it. GDP measures current national income—wealth measures the prospects for generating that income into the future. These are complementary indicators, and both should be measured to provide a more complete picture of national economic health and sustainability. It is for this reason that we measure wealth—it is a better measure of sustainability. Figure 4 illustrates how these assets

70 Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future*. Figures and tables in the Wealth and Natural Capital section were calculated using data from this database.

FIGURE 4. The assets and capitals that drive wealth and development



and capitals come together to form a measurement of total wealth that supports national income and the potential future prosperity and well-being of a country.[71]

Wealth accounts include the following asset categories, all measured in market prices and converted to 2014 U.S. dollars using market exchange rates:

- **Natural capital:**
  - Nonrenewable resources: 14 types of minerals and fossil fuels
  - Renewable resources: cropland, pastureland, forest timber, forest services (an estimate of non-timber forest products), watershed services, recreation values), protected areas (value estimated as the opportunity cost of converting to agriculture).
- **Produced capital and urban land:** infrastructure, machinery, buildings, equipment, and urban land[72]
- **Human capital:** measured as the discounted value of earnings over a person's lifetime
- **Net foreign assets:** the sum of a country's external assets and liabilities

Natural capital and development

Overall

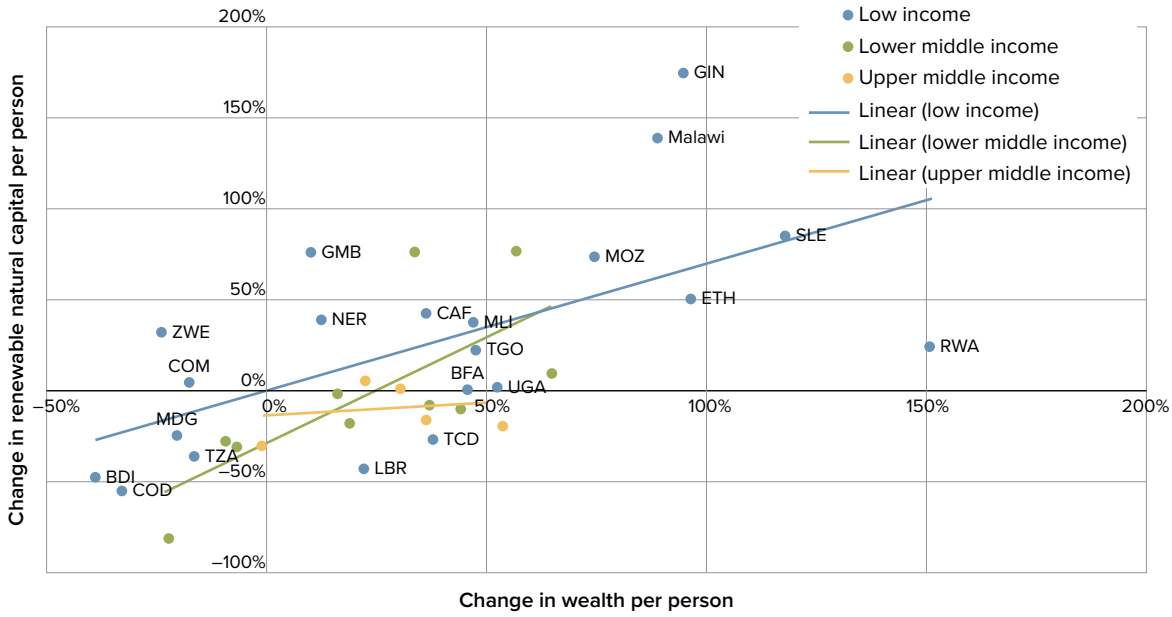
Natural capital is the most important asset for low-income countries, averaging 47% of wealth in 2014, and a major part of wealth in lower-middle-income countries as well (27%). As a 'gift from nature', natural capital has been the most abundant asset available to all countries at one point in their development. At low incomes, economies are largely built around this relatively abundant asset, mainly renewables, forests, and agricultural land. They can only move beyond subsistence production of food and shelter to manufacturing and services with the addition of scarce capital—human capital, infrastructure, other produced capital.

71 Measuring national wealth and changes in wealth is part of an ongoing effort by the World Bank to monitor the long-term economic well-being of nations. 'The Changing Wealth of Nations 2018' builds on two previous World Bank reports and provides wealth accounts for 141 countries for the period 1995 to 2014. All data are estimated from globally available data sets, such as those provided by the Food and Agriculture Organization of the United Nations (FAO) or the Penn World Tables. They may be less accurate than more detailed information available within a particular country.

72 For brevity, we use the abbreviated term 'produced capital' to include both.

However, development is about using natural capital more efficiently and making sure the management of renewable natural capital is sustainable. It is not about liquidating natural capital to purchase other assets. The value of renewable resources can increase by bringing more land into productive use or by using the resource more productively. Examples of this include improving crop yields and developing nature-based tourism on forest land. Figure 5 shows that on a *per capita* basis, as renewable natural capital grows, so does the growth of total wealth (and by implication GDP). Malawi, Ethiopia, Rwanda, and Mozambique all show this growth of both total wealth and renewables per person, while countries such as Burundi, Madagascar, and Tanzania show that total wealth and renewable natural capital both declined. A small number of countries such as Liberia and Chad achieved growth while depleting renewables, but these are typically resource-rich countries with economic growth that depends heavily on nonrenewable resources—mostly large energy and mineral resources.

FIGURE 5. Change in wealth versus renewable natural capital per person in Africa, 1995–2014 (%)



Source: Calculated from the database from Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

Malawi

Adjustments to Malawi's wealth accounts for agricultural land have been made to better reflect land degradation and how that might affect future crop yields and the value of agricultural land. The agricultural land accounts for Malawi, like all countries in the Changing Wealth of Nations (CWON) database, use data from the Food and Agriculture Organization (FAO) and reflect the very broad assumptions needed to construct a global database for 141 countries over 20 years. Yet, the FAO data do not include an estimate of land degradation at present, as it is not possible to incorporate much country-specific information in global calculations. However, in the course of this CEA, we were able to access critical country-specific information to provide a more accurate assessment of Malawi's wealth.

The greatest concern for Malawi's wealth accounts is agricultural land degradation. FAO data indicate growth in the value per hectare of Malawi's agricultural land. This may explain any number of factors from gains in yields to a change to higher-value crops or other improvements. But such gains will be temporary if the land is not managed sustainably and is, in effect, mined for its soil and nutrients. An in-depth assessment of land degradation in this report documents severe soil erosion and loss of nutrients. This land degradation undermines the ability to maintain crop production at such levels in the future. Additionally, the potential impacts of climate change may further threaten Malawi's agricultural productivity.

The global wealth accounts assume cropland productivity growth of 1.94%. However, to better reflect concerns about land degradation and any potential negative impacts of climate change in Malawi, we replaced the figures for cropland

value in the CWON with figures under the assumption of no future gains in crop productivity after 2014. Under this scenario, the total value of cropland in 2014 is reduced by nearly half relative to the CWON figure–from USD 71,445 million to USD 37,494 million.

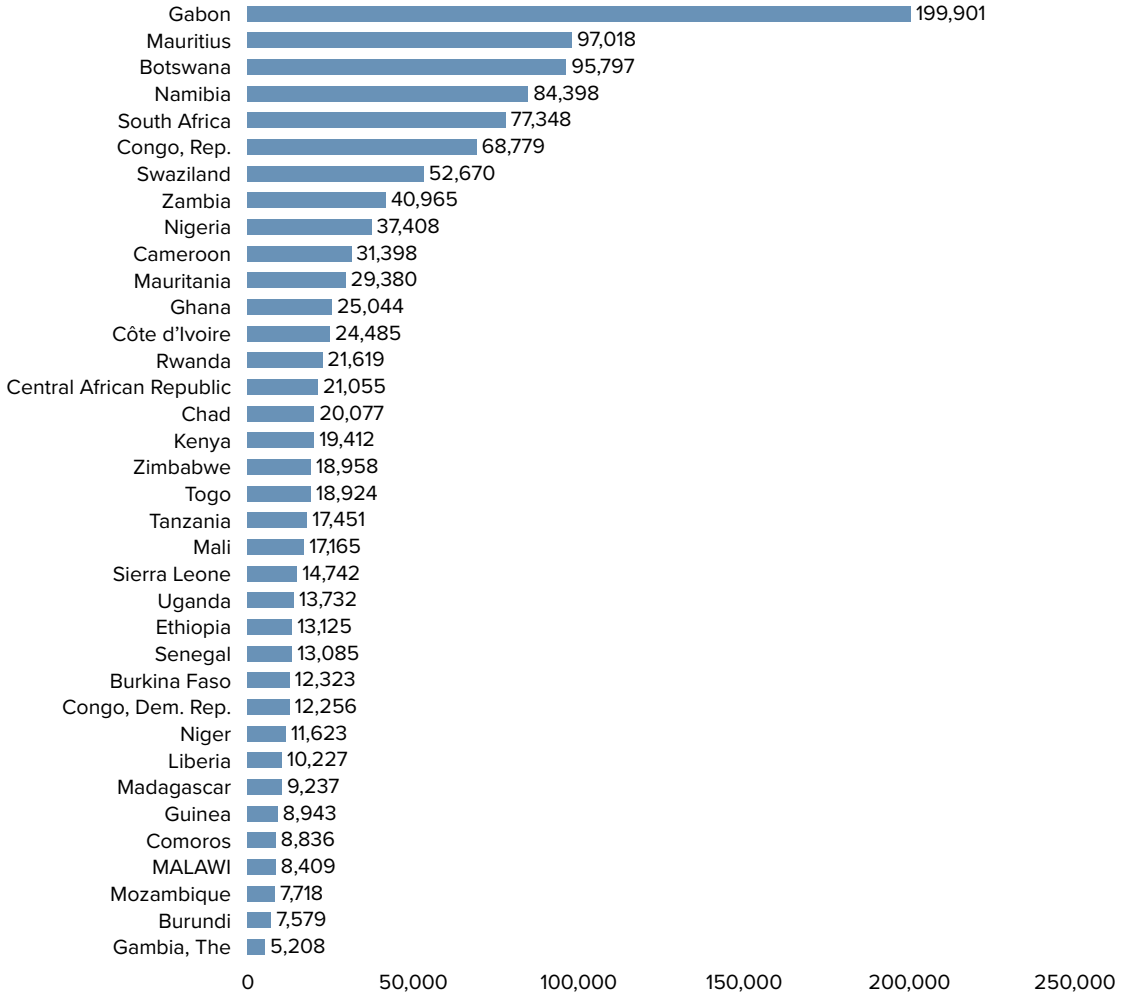
Having defined the lens through which we will make the analysis, we will now look at Malawi's national wealth and what that reveals about the country's growth trajectory, keeping in mind that the data are the best available from global data sources and should be interpreted in light of other more detailed country information provided in this CEA.

Malawi's national wealth

In 2014, Malawi's wealth *per capita* (USD 8,409) was much lower than average compared to other low-income countries in Africa (USD 13,629) and Sub-Saharan Africa as a whole (USD 25,562). (See Figure 6 and Table 2). Overall, in Africa *per capita* wealth ranges widely, but Malawi belongs to the small group of 24 countries that remained low-income countries over the 20 years from 1995 to 2014. This is in contrast to another 28 countries that were low-income countries in 1995 but developed to middle-income countries by 2014.

In 2014, 43% of Malawi's wealth was renewable natural capital. The majority of this was cropland with pastureland. Forests and protected areas accounted for 24% of natural capital (see Figure 7).[73] This is similar to the average for low-

FIGURE 6. Africa: wealth *per capita* in 2014 (constant 2014 USD *per capita*)



Source: Calculated from the database from Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

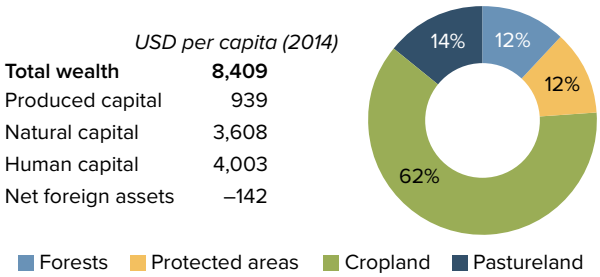
73 The wealth accounts do not include fisheries or water at this time.

TABLE 2. Wealth *per capita* in Malawi, low-income countries, and Sub-Saharan Africa in 2014 (constant 2014 USD *per capita*)

	Malawi	Low-Income Countries Worldwide	Sub-Saharan Africa
Total wealth per person	8,409	13,629	25,562
Produced capital	939	1,967	4,017
Natural capital	3,608	6,421	9,225
Renewable resources	3,604	5,853	6,403
Nonrenewable resources	4	568	2,822
Human capital	4,003	5,564	12,680
Net foreign assets	–142	–322	–360
Population	16,695,253	525,385,124	867,222,259

Source: Calculated from the database from Lange et al. 2018 with changes for Malawi as described in the text. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

FIGURE 7. Where is the wealth of Malawi (USD *per capita*)?



Source: Calculated from the database from Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

income countries worldwide (47%) and especially high for a country with no significant mineral or energy resources. Malawi's renewable asset endowment (USD 3,604 per person) is less than other low-income countries (USD 5,853 per person) and lower than the average for Africa (USD 6,403 per person).[74] The wealth gap between the average for other Sub-Saharan Africa countries results from a lack of nonrenewable resources, but even more so, from Malawi's low levels of human capital and produced capital per person, which are both substantially lower than the averages for Sub-Saharan Africa and other low-income countries. See Table 2.

For most low-income countries in Sub-Saharan Africa, growth in wealth between 1995 and 2014 was much higher than the global average—88% versus 66%. This is not surprising because low-income countries need to invest rapidly to catch up. However, population growth is also quite high in many low-income countries, and even countries such as Malawi with fairly strong gains in wealth (159%) saw a much smaller increase in *per capita* wealth (52%) (see Figure 8).

Among the low-income countries where renewable natural capital is most important, Malawi did not do as well as Ethiopia and Rwanda. However, Malawi matched growth in Uganda and did better than Mali and Burkina Faso. Furthermore, Malawi did particularly well compared to countries such as Tanzania and Burundi, where investment was so low that *per capita* wealth declined. Growth in *per capita* wealth was also considerably higher than that achieved by most lower- and upper-middle-income countries in Africa.

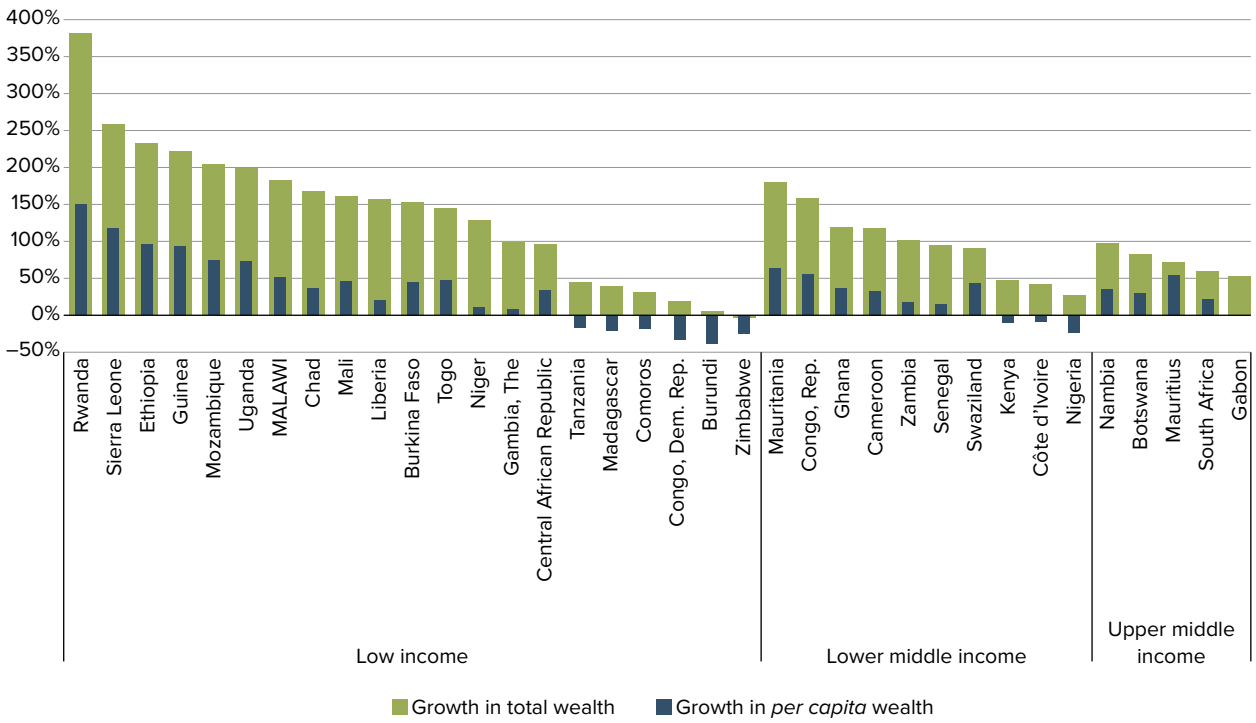
A closer look at wealth changes in Malawi and several comparator countries

On average, *per capita* wealth increased very little in low-income countries and actually declined in Sub-Saharan Africa overall (see Figure 9). Significant losses in renewable natural capital, both forest and agricultural land, as well as produced capital were partially, but not fully, offset by gains in nonrenewable wealth and human capital. Tanzania and Burundi largely demonstrate the same pattern.

Malawi did appear to do better than the average for low-income countries or Sub-Saharan African countries (as did Ethiopia) mainly through gains in renewable natural capital and human capital. However, the decline of produced capital in these countries, including Malawi, is of concern and an indication of unbalanced growth. Some economic gains can be achieved by improving the productivity of natural capital, as well as investing in human capital. In addition, there are huge infrastructure needs in all low-income countries, which means that the contribution of potential economic gains in

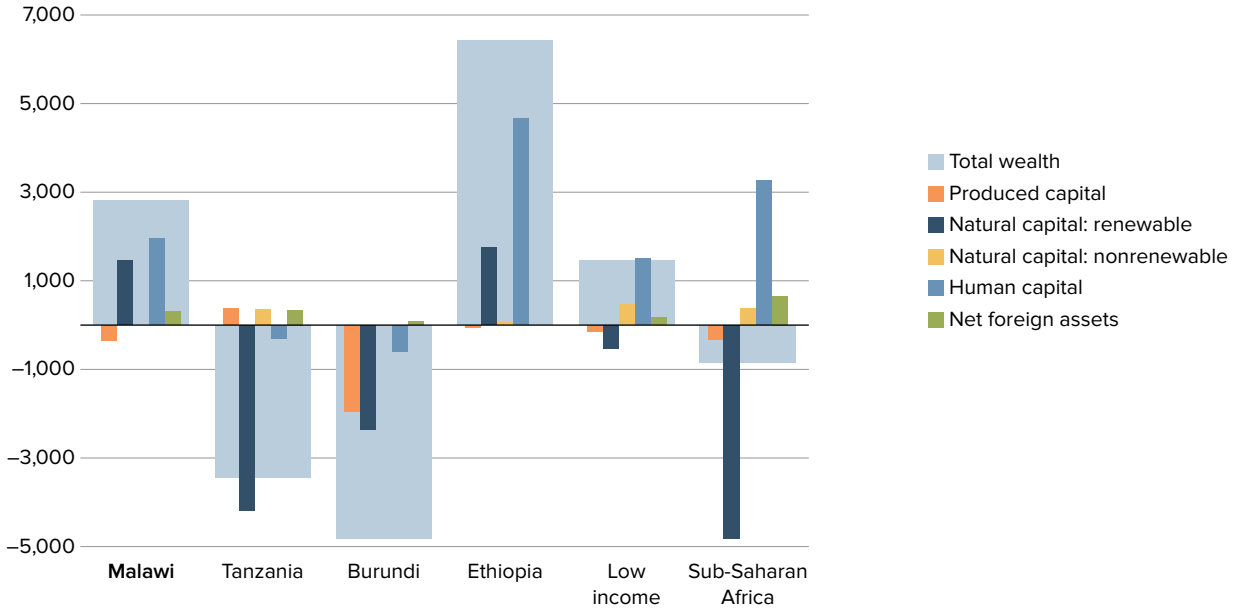
74 The figures for other low-income countries and Sub-Saharan Africa do not take into account possible land degradation in some countries, so the comparison may overstate Malawi's relatively weak performance.

FIGURE 8. Growth in total and *per capita* wealth in low-income countries in Sub-Saharan Africa, 1995–2014



Source: Calculated from the database from Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

FIGURE 9. Change in wealth *per capita* from 1995 to 2014 (USD per person)

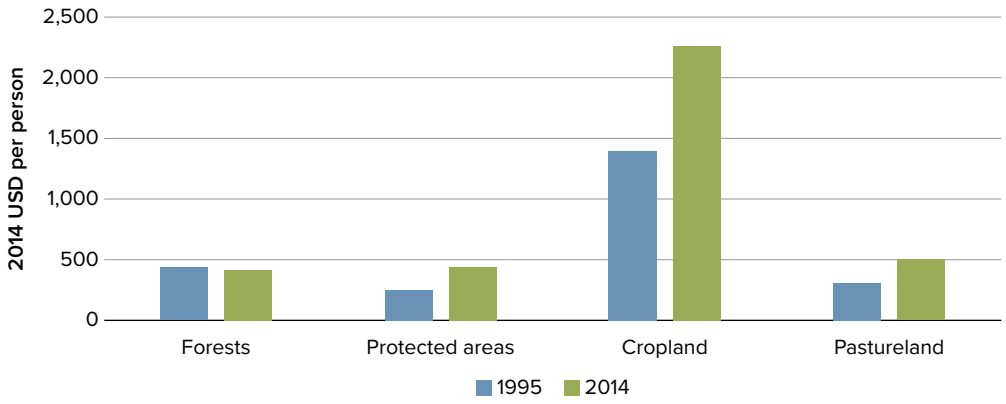


Source: Calculated from the database from Lange et al. 2018. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

other assets (human capital, natural capital) will be constrained without complementary investments in produced capital such as roads and transport, water and energy supply, and communications.

While the wealth accounts for Malawi seem to indicate slow but steady progress, there are some important caveats. The gains in wealth *per capita* are, in large part, driven by gains in renewable natural capital, dominated by cropland (see Figure 10).

FIGURE 10. Value of renewable natural capital *per capita*, 1995 and 2014



To understand this change in per capita asset value between 1995 and 2014, we need to examine further the four renewable natural resources (forests, protected areas, pastureland, and cropland) through the three components of this change in asset value:

1. Change in land area utilized
2. Change in land value per hectare (calculated as land area/land value)
3. Population growth (termed a 'population dilution effect')

Forests

***Per capita* value declined because the loss of forest land (15% decline during 1995–2014), combined with population growth of 70%, outweighed the gains in the value per hectare.** Roughly 80% of wood harvested is used for fuel, a major energy source in Malawi. Higher harvests from shrinking forest area will increase the value per hectare of forest in the short term, but, as noted elsewhere in the report, harvest has exceeded capacity, and this is not sustainable in the longer term. Overharvesting causes forest degradation and will eventually lower harvest per hectare.

Forest degradation is not yet captured in the FAO data used to construct the forest asset account, so the loss of forest natural capital is likely greater than estimated in the wealth accounts for Malawi. The omission of forest degradation figures from global data sets reflects methodological difficulties in estimating this figure at the country level. Further work is ongoing in Malawi that should help quantify losses related to forest degradation. Indeed, according to Malawi's National Determined Contributions submission,[75] forest degradation may account for a larger share of GHG emissions from the forest sector than forest loss. In addition, the economic losses may be much greater because the forest asset account does not reflect all the ecosystem services provided by forests, such as water supply, soil retention, and livestock grazing.

75 GoM. 2015(b). *Intended Nationally Determined Contribution*.

Pastureland and protected areas

For both these pastureland and protected assets, the value *per capita* increased as the increase in value per hectare outweighed the population dilution effect. In the case of protected areas, land cover increased slightly (6%), while for pastureland there was no reported change in land area.

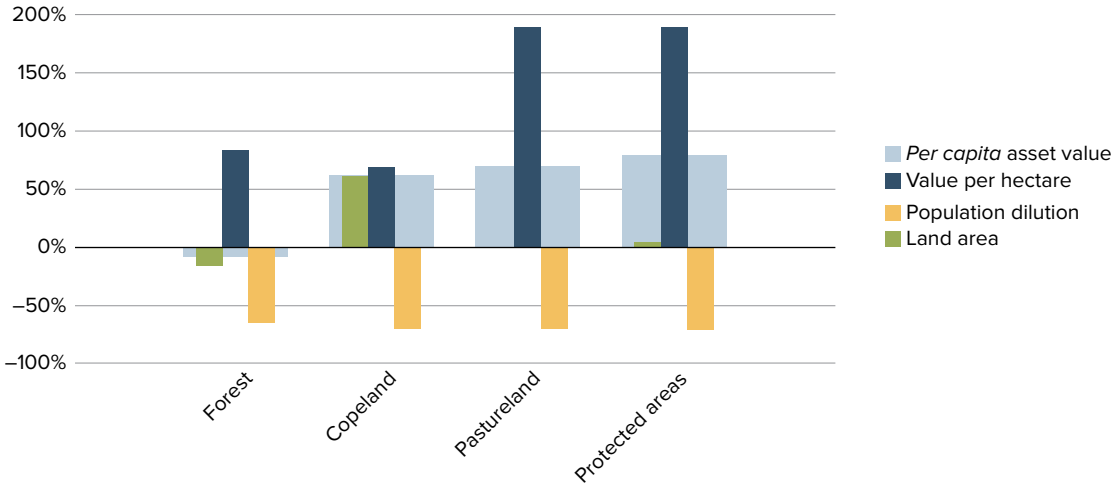
Cropland

The land area under cultivation expanded by 62%, partly due to the conversion of forest land. Land value increased due to an expansion of cultivated land and an increase in the value of crops produced per hectare. The value of cropland per hectare grew 72%. The gains in per hectare yields may indicate gains in crop productivity from 1995 to 2014, a change to higher value crops and/or other improvements. However, if the land is not managed sustainably, these gains will be temporary. Currently, agricultural land is effectively being mined for its nutrients and the resulting land degradation is intense. To understand the concerns about degradation asset value, we need to take a closer look at what goes into the calculation of land value per hectare.

Land value is calculated as the discounted sum of the rent it is expected to generate over its lifetime (in effect, in perpetuity). However, future valuations are dependent on assumptions about land productivity in the future. If productivity decreases, land value will decline. If productivity remains the same, land value will also remain the same. If productivity increases, land value increases.

Given the documented land degradation, together with the risks from climate change, it is prudent to assume that productivity, as well as land value, will decrease. Figure 10 and Figure 11 do show that the value per hectare of all land increased, and this played a major role in the increased value of forest and agricultural land. The significant increase in the amount of land converted to cropland also played a role, more than offsetting the loss of forest land.

FIGURE 11. Sources of change in natural capital per person in Malawi between 1995 and 2014 (USD per person)



Source: Calculated from the database from Lange et al. 2018 with revisions for cropland described in the text. *The Changing Wealth of Nations 2018: Building a Sustainable Future.*

Note: The broad blue bar represents percentage change in asset value while the thinner bars represent the components of change: change in land area, change in value/hectare, and population dilution effect (the population growth rate).

However, as mentioned earlier, serious concerns about land degradation and its impact on long-term productivity have been factored into wealth estimates, and hence future wealth estimates do not look as positive as the historic data might suggest.

Summing up

Malawi's wealth is still dominated by renewable natural capital (43%), largely cropland. Future growth will depend on reversing land degradation to improve productivity and sustainable management of its natural capital, especially forests, to maintain water resources. Its *per capita* wealth is lower than the average for low-income countries, but between 1995 and 2014 it grew rapidly.

At face value, Malawi appears to represent a positive growth story with *per capita* wealth increasing by 52% between 1995 and 2014. However, several trends suggest that Malawi's growth may not be as positive as it initially appears:

- Gains were driven primarily by growth in the value of cropland.
- Forest land area declined significantly, both in land area and value.
- Human capital grew modestly.
- Produced capital declined significantly, from USD 1,303 per person in 1995 to USD 939 per person in 2014.

The evolution of composition of wealth from 1995 to 2014 suggests that Malawi has built an unbalanced portfolio of assets that is less likely to support strong economic growth in the future. In most countries, the trajectory from low-income to middle-income often starts with an abundance of natural capital which is used to invest in infrastructure (produced capital), and education and health (human capital). At middle-income levels, produced capital roughly doubles its share and human capital grows rapidly to become the main asset. In Malawi, the opposite development has occurred. Malawi is still highly dependent on its natural capital, which remained constant at 43% from 1995 to 2014, while human capital increased only slightly and produced capital shrank. Without complementary investments in produced capital—transport, power, and water supply infrastructure—investments in human capital and improved natural capital management will not be able to reach their full potential in terms of contributing to economic growth and poverty reduction.

In addition, gains in natural capital, and thus in total wealth, are likely to be overestimated because forest land degradation is not captured in the wealth accounts at present. It must also be noted that the potential impacts of climate change, as well as exogenous impacts on assets such as drought, floods or other natural disasters, civil unrest, or other shocks, are also not factored into valuation of natural capital, and this will only exacerbate any declines in the future wealth of Malawi.

3. INSTITUTIONS, POLICIES, AND EXPENDITURE

Institutional assessment

This section summarizes the findings from an analysis of institutional frameworks undertaken as part of the CEA.[76]

Constitutional requirements for environmental protection

The Constitution of Malawi (1994, as amended) recognizes that responsible environmental management can make an important contribution toward achieving sustainable development, improved standards of living, and conservation of natural resources. The Constitution states that the environment of Malawi should be managed to:

- Prevent the degradation of the environment.
- Provide a healthy living and working environment for the people.
- Accord full recognition of the rights of future generations by means of environmental protection.
- Conserve and enhance biological diversity.

The constitutional provisions do not extend to linking such interventions to the attainment of poverty reduction aspirations.[77] However, around the same time as the Constitution, the government developed Malawi National Environmental Action Plan in 1994,[78] which provided the framework for integrating environmental protection and management in all national development programs with the view to achieving sustainable socioeconomic development. The Action Plan was used as a reference document to guide planners, developers, and donors[79] and sought to document and analyze environmental issues. It also was aimed at identifying measures to alleviate them, promote the sustainable use of natural resources, and develop an environmental protection and management plan.

More recently, Malawi's Vision 2020 presents the long-term development perspective:

> *"By the year 2020, Malawi, as a God-fearing nation, will be secure, democratically mature,* ***environmentally sustainable,*** *self-reliant with equal opportunities for and active participation by all, having social services, vibrant culture and religious values and a technologically driven middle-income economy."*[80]

The limited discussion of poverty-environment links in the Vision 2020 document is reflective of the lack of appreciation of the socioeconomic importance of the environment and natural resources (ENR) sector at household and national levels. This, in turn, results in a weakened cause or justification for ENR interventions.[81]

Legislation and institutions for environmental assessment and management

Malawi's institutional and policy framework for environmental management dates back over 20 years and is characterized by an elaborate and diverse set of policies, legal instruments, and institutional arrangements. As in all countries, the responsibility for environmental management is shared by many institutions, each with their own sectoral mandate (see Table 3).

76 Tarr. 2018. *Institutional Assessment for Environmental Management in Malawi.*

77 PricewaterhouseCoopers. 2016. *Overcoming Poverty in Malawi through Sustainable Environment and Natural Resource Management—Identifying Policy Options to Accelerate Poverty Reduction.*

78 Subsequently revised a number of times, most recently in 2016.

79 Spong and Walmsley. 2011. *Malawi Country Report in Environmental Impact Assessment in Southern Africa.*

80 NEC. 2000. *Vision 2020—The National Long-term Development Perspective of Malawi: A Summary.*

81 PricewaterhouseCoopers. 2016. *Overcoming Poverty in Malawi through Sustainable Environment and Natural Resource Management—Identifying Policy Options to Accelerate Poverty Reduction.*

TABLE 3. Institutions with responsibilities for environmental management and a brief summary of their legal mandates

Environmental Component	Responsible Agency	Main Legislation	Brief Summary of Key Purpose
Environment	Ministry of Natural Resources, Energy and Mining (MoNREM)	National Environmental Policy (NEP) (2004)	Integration of planning and management
		The EMA (No. 23 of 1996)	Makes Environmental Impact Assessments (EIAs) a statutory requirement and outlines the EIA process
		The EMA (No. 19 of 2017)	Replaces the 1996 EMA, establishes the Environmental Protection Authority (EPA)
Water resources	Ministry of Irrigation and Water Development	Water Resources Act (1969) National Water Policy (2005) Water Works Act (1995)	Water rights, abstraction, pollution control, water resources planning and development
Effluent (disposal)	Ministry of Irrigation and Water Development	Water Resources (water pollution control) Regulations	Controls water pollution
Waste	MoNREM Local Authorities	Various acts, regulations, and local bylaws control waste management Various local authority bylaws	Waste control, management, transport, treatment, recycling, disposal Towns manage municipal waste
Planning and zoning	Ministry of Development Planning and Cooperation	Physical Planning Act (2016) Part IV of EMA, sections 19 and 23	District Environmental Action Plans to be drawn up in conformance with the National Environmental Action Plan
Forestry	MoNREM	National Forestry Policy (1996) Forestry Act (1997) Forest Rules	Forest products, forest reserves, tree planting, and other enterprises
Energy	MoNREM	National Energy Policy (2003) Energy Regulation Act (2004) Rural Electrification Act (2004) Electricity Act (2004)	Energy development, supply, use, distribution, pricing, and governance
Mining and mineral resources	MoNREM	Mines and Minerals Act (1981) and Regulations Explosives Act (1966) and Regulations Petroleum Regulations (1984)	Mining and quarrying, exploration and production of petroleum, and provides for the protection of the environment
Wildlife and natural resources	MoNREM	Wildlife Policy of 2000 National Parks and Wildlife Act (1992), as amended, and Regulations	Wildlife conservation and management, benefit sharing, national parks, and hunting
Plants	Ministry of Agriculture and Food Security	Plant Protection Act (1969) Noxious Weeds Act (1936)	Controls the export and import of plants, eradication of noxious weeds
Agriculture	Ministry of Agriculture and Food Security	Special Crops Act (1972) Tobacco Act (1970) Cotton Act (1951)	Development and marketing of crops
Land	Ministry of Lands, Physical Planning, and Surveys	Land Act (1965) Customary Land Act (1967) Registered Land Act (1967) National Lands Policy (2002)	Customary, public and private land, and the sustainable use of such land
Fisheries	Ministry of Agriculture, Irrigation, and Water Development (MoAIWD)	Fisheries Conservation and Management Act (1997) Conservation and Management Regulations (2002) Fisheries and Aquaculture Policy (2016)	Regulation and control of fishing, aquaculture, conservation, and management
Industrial and urban development	Various	Industrial Development Act (1966) Electricity Act (2004) and (2016) Public Roads Act (1966)	Development of industry, clearing of land and for transmission lines, public roads, and compensation
Health (including HIV/AIDS)	Ministry of Health (MoH)	Public Health Act (1948) National HIV/AIDS Policy of 2013	Prevention of infectious diseases; sanitation and housing, sewerage, and drainage
Historic monuments	Ministry of Culture	Monuments Act (1991)	Protecting places of distinctive natural beauty, historic sites, and buildings
Decentralization	Ministry of Local Government and Rural Development (MoLGRD)	Malawi Decentralization Policy of 1998	Decentralization, accountability, and good governance
Gender	Ministry of Gender, Children, Disability, and Social Welfare	Gender Policy of 2008	Mainstream gender and enhance participation of women and men, girls, and boys
Climate change	MoNREM	EMA (No. 23 of 1996 and No. 19 of 2017)	EAD coordinates but various ministries implement activities

At present, institutional arrangements are still defined by the 1996 EMA, since substantive recent amendments approved by Parliament in 2017 have yet to come into force. The EMA (1996) established the Environmental Affairs Department (EAD) within the MoNREM. The Act further outlined statutory requirements and important regulatory procedures, such as Environment and Social Impact Assessments (ESIAs) and Environmental Licensing. The EAD is responsible for all issues relating to the environment. Figure 12 shows how the department is structured. However, many institutions have responsibilities and mandates of relevance to environmental management, and these are summarized in Table 3. Table 4 provides a breakdown of the specific responsibilities of the EAD and its divisions.

FIGURE 12. Structure of the EAD

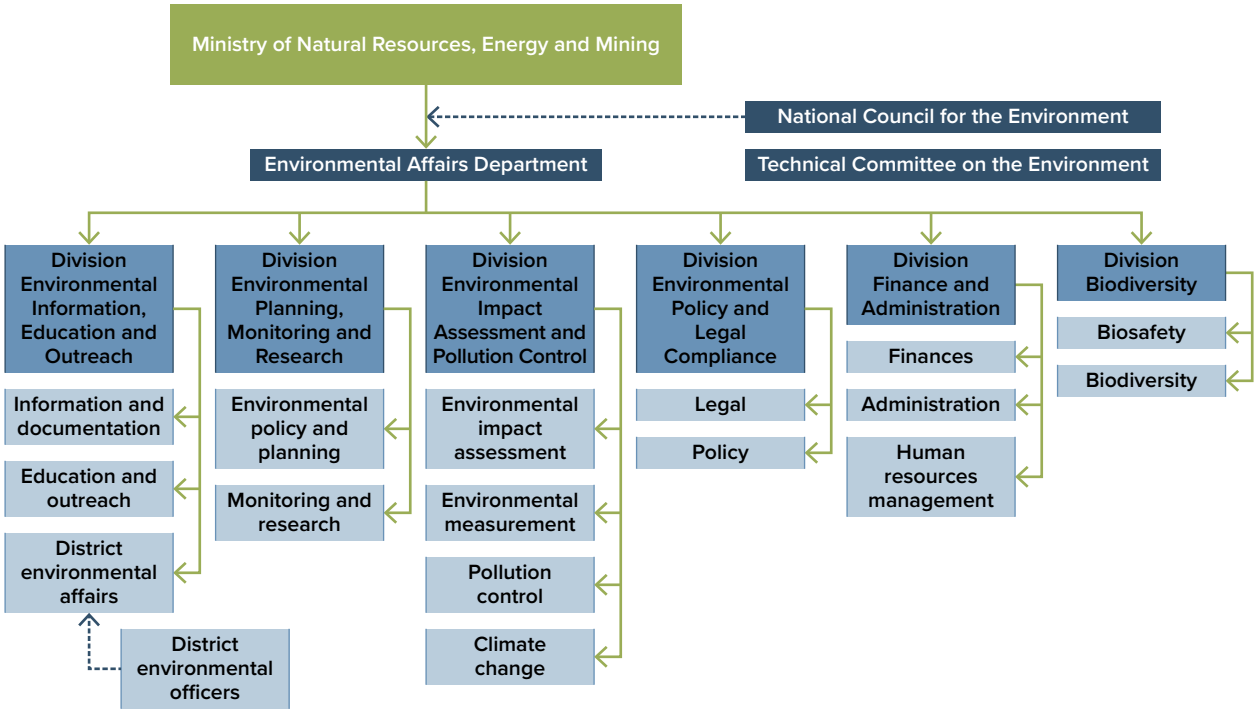


TABLE 4. Specific responsibilities of the divisions of the EAD

Division	Responsibilities
Environmental information, education, and outreach	● Coordinating and facilitating the implementation of activities on public environmental awareness ● Facilitating the production of environmental education and training materials ● Production of National and District State of the Environment and Outlook Reports ● Mainstreaming of the environment in formal education curricula
Environmental planning, monitoring, and research	● Forward planning and coordination review of ENR sectoral policies in line with national goals and international agreements[82]
Environmental assessment and pollution control	● Overseeing ESIAs and environmental audits, specifically administering the EIA process as outlined in the EMA (2017), advising developers on the ESIA requirements, reviewing ESIA application reports, issuing ESIA certificates, and monitoring projects for compliance with ESIA requirements ● Ensuring that development projects and programs are implemented in an environmentally friendly manner ● Interacting with the Technical Committee on Environment (TCE) and the National Council on Environment (NCE) on policy decisions associated with development matters
Environmental policy and legal enforcement	● Ensuring compliance and promoting enforcement of sectoral environmental legislation and bylaws, international legislation, conventions, and treaties in the country ● Advisory services to stakeholders on effective implementation of sectoral legislation
Finance and administration	● Financial management and administration
Provision of biodiversity conservation services	● Facilitate the preparation and implementation of programs and projects on biodiversity conservation in the country ● Facilitate the preparation of the National Biodiversity Strategy and Action Plan and the National Reports to the Convention on Biological Diversity ● Coordinate the implementation of biodiversity management programs and the review and approval of applications on access and export permits for biological and genetic resources.

The EAD relies heavily on the expertise and advice of the interagency TCE. For more complicated or controversial matters, the director may seek the advice of the National Council on Environment (NCE). With regard to guiding and managing EIAs, roles and responsibilities are shared within and between institutions (see Annex 3). The EIA process required by the EMA (see EIA Process Flowchart in Annex 4) is straightforward, logical, and similar to other countries in the region and globally.

As part of the government's decentralization efforts, section 20 of the EMA (1996) provides for the appointment of an Environmental District Officer as a member of the District Development Committee. This officer's tasks include undertaking environmental inspections, supervising the preparation of the five yearly District Environmental Action Plan, and providing environmental advice to the District Environmental Development Committee on natural resources management and environmental issues. However, as at the central level, these institutions are not operating optimally.

Under the provisions of the EMA (1996), the national EIA system suffers from numerous institutional deficiencies, and there are examples of where the EIA process has been circumvented. For example, there is no requirement for independence of practitioners, no requirement for independent review of EIAs, and no specific requirement for assessment of health and gender issues. In addition, the EMA (1996) is vague on accessibility of reports to the public and makes inadequate provisions for stakeholder consultation and project post-implementation monitoring by the EAD. There is also a potential conflict of interest since the EAD is part of a ministry that includes energy and mining—both important sectors of the economy and with direct reliance and impact on ENR. It was deficiencies such as these that resulted in Parliament approving amendments to the EMA in 2017.

Since there is limited compliance or effectiveness monitoring for the EIA, the existing system has not been adequately tested. However, a rapid assessment conducted in 2012 found a number of weaknesses. While a project-level EIA is relatively well understood in both the EAD and other government agencies, Malawi has had very little exposure to Strategic Environmental Assessment (SEA). Overall, the decentralization process for the EIA has been slow to take effect and virtually all decision-making on EIAs remains centralized at the national level within EAD. The numerous deficiencies in the EMA (2016) led to Parliament approving substantive amendments in 2017 and the eventual replacement of the EAD with a new EPA. These developments are discussed below.

The 2017 Environmental Management Act

The EMA (2017) provides every person the right to a clean and healthy environment and imposes a duty upon people to safeguard and enhance the environment. It also seeks to ensure that every person has a right to access environmental information. Lead agencies, the private sector, and nongovernmental organizations (NGOs) also have a duty to provide such information in a timely manner. This is a major step forward and, if implemented, will place Malawi at the forefront of transparency and governance with regard to environmental management.

Importantly, the EMA (2017) demands the mandatory establishment of the EPA,[83] with broad responsibilities and substantial powers. These include the investigation of any violation or potential violation of the EMA or any other written law relating to environment and natural resources management (ENRM). The Act also allows the EPA to take action to redress violations—similar to powers afforded to an ombudsman in other countries. The most important power given is the ability to enforce the right to a clean and healthy environment and monitor and enforce compliance with ENR-related policies and legislation by lead agencies. Implementing the EMA (2017) and transforming the EAD into the EPA will be a daunting task, possibly requiring months or years of careful planning and skillful negotiation.

82 See Annex 2 for a list of the international agreements Malawi is a party to.

83 Neither the EMA (2017) nor the EPA is operational yet.

BOX 2. The emergence of a robust institution for environmental management

The EMA (2017) provides the EPA with a very broad mandate and substantial powers. With proper implementation, it would make the emerging EPA one of the strongest, national-level environmental management institutions on the continent.

The EMA (2017) empowers the minister to develop a wide range of regulations pertaining to many components of the environment, SEA, and EIA. This should help strengthen the national system for environmental assessment and ensure that this becomes more resistant to political economy pressures. Previously, there have been examples of projects with environmental and social impacts that were authorized before an EIA was conducted, and there have been concerns that political considerations have undermined the integrity of the EIA system.

The EPA will be a semiautonomous body, and although there are omissions in the EMA (2017) regarding independence and certification requirements of EIA practitioners, the Minister of Environment is now empowered to proceed and implement the required regulations.

How do environmental policy, law, and institutions work together?

Malawi's policy framework governing the ENR sector has many contradictions and gaps. Much of Malawi's wealth (43%)[84] comes from renewable natural capital, which suggests a need for close alignment of policy and legal frameworks that guide the management of the country's natural resources.

Legal frameworks will become considerably stronger once the EMA (2017) comes into force. However, there is a high risk that implementation will be constrained by inadequate resources, resistance from interest groups, and low organizational capability.[85] Inadequate intra-ministerial coordination required to address multisectoral challenges hampers integrated management of natural resources. The development partners also need to play a role here by supporting the coordination and harmonization of institutional support for environmental management.

Some key sectors, such as agriculture and fisheries, do not yet have a concise national operational policy.[86] This leads to subjectivity in resource allocations, compromised inter- and intra-sectoral collaboration, policy inconsistencies along the commodity value chains, and inadequate collaboration between the government and NGOs.[87] For example, sustainable management in fisheries struggles against constraints in the legal framework.[88] While local beach village committees organize fishing at local levels, it is the Department of Fisheries (DoFi) and the courts that withdraw fishing licenses. The DoFi, with the support from the chiefs, can seize illegal gear but only with the support of the criminal law courts.

Almost all policies express GoM's commitment to private sector development. Yet there is limited engagement with the private sector and limited private sector participation in forestry investments, agricultural commodity marketing, and the water and energy sectors, among others. Further constraints on private sector development in Malawi include limited access to financial capital, low labor productivity, and delays in obtaining business licenses.[89] Most GoM policy statements confirming commitment to private sector development in the ENR sector are not backed by practical strategies on how to do it in practice.

84 2014 estimates.

85 Bridges and Woolcock. 2017. *How (Not) to Fix Problems that Matter: Assessing and Responding to Malawi's History of Institutional Reform. Policy Research Working Paper*.

86 PricewaterhouseCoopers. 2016. *Overcoming Poverty in Malawi through Sustainable Environment and Natural Resource Management—Identifying Policy Options to Accelerate Poverty Reduction.*

87 Ibid.

88 Kosamu. 2017. *Revisiting the 'three-pillared design' of a management system for the Elephant Marsh Wetland Fishery in Malawi*.

89 GoM. 2015–2018. *Financial and Economic Affairs Documents.*

Decentralization

The 1998 decentralization drive, aimed at diffusing overly centralized power and bringing services closer to citizens, has been slow to deliver results. The process of decentralization has been undermined by a slow and fragmented assignment of functions and resources to local authorities. With insufficient resources and weak capacity and incentives to perform, the local government has been unable to play an effective role in shaping environmental management, whether for efforts to address land degradation, restore forest cover, or implement effective control over fish stocks.

Environmental guidelines

Some sectors have produced sector-specific strategies for biodiversity conservation. Examples include the agriculture's draft Agrobiodiversity Strategy; the Irrigation, Rural Livelihoods, and Agriculture Development Initiative, which includes environmental safeguards for biodiversity conservation;[90] the Forest Biodiversity Strategy; the Strategy for Plant Genetic Resources for Food and Agriculture; and updated policies for climate change and forestry.[91] The Ministry of Education has also integrated Biodiversity as a subject into the secondary school curriculum.

Raising public awareness in the media, at schools, and in communities

The EAD runs a Public Awareness and Education Programme to inform the public on key environmental issues. The main communications channels are press releases, newspapers, radio/TV, and community meetings. Other media channels are also used to reach people, from the national to local levels. They include school environmental clubs, stakeholder consultative workshops, training workshops, and community meetings through decentralized structures such as District Environment Subcommittees in the 28 districts.

Raising the public's awareness, especially through schools and outreach communication, will be essential for shifting the mind-set on key environmental challenges. Building on the government's existing program of communication activities, it will be important to ensure that budgetary allocations are maintained and increased for communication and that new methods for spreading knowledge are explored—especially using social media. Incentivizing positive behavior in, for example, waste management or protection of forest reserves, also needs to align with economic incentives and disincentives such as 'polluter-pays' systems.

Environmental expenditures[92]

Overall, environmental expenditure represents a small share of Malawi's economy. Total expenditure on ENRM over 2007–2012 recorded in the national budget reached USD 278 million—or 3.15% of the national budget and 0.96% of GDP. This is lower than what Mozambique—an economy comparable to Malawi's—spent from 2007 to 2010, where public ENRM expenditures were around 4.3% of the national budget and 1.38% of GDP.

In addition, all ministries and departments record environmental and climate change expenditures under one code. As a result, it is not possible to distinguish between ENRM expenditures, climate change expenditures, and forestry expenditures. Besides, as around 50% of donor support during this analysis was off-budget, actual environmental and climate change expenditures might be somewhat higher than the cited figures.

90 GoM. 2014(a). *Fifth National Report to the Convention of Biological Diversity.*

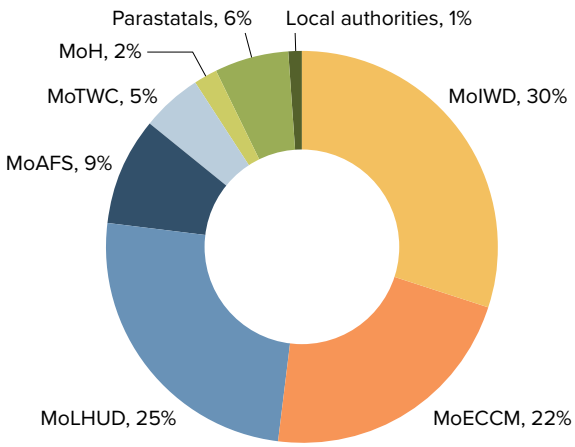
91 Ibid.

92 Available data on environmental expenditures (including those for climate change) are limited and are only available for 2007–2012. This discussion relies on a 2014 analysis of data for 2007–2012 of expenditures related to environmental management and climate change—including land management, water resources, forestry, environmental coordination, meteorological services, fisheries, and wildlife (ENRM). For methodological reasons, care should be taken when analyzing these results as data on budgets and expenditures relied on questionnaires, estimates (for budgetary data, the team used the Approved Estimates of Expenditure on Recurrent and Capital Budget), and feedback provided by ministries and responses from the Accountant General's Office.

Public environmental expenditures over 2007–2012 did follow a period of accelerated growth in the first four years, but this was followed by a period of economic contraction in the last two years. Between 2007 and 2010, expenditure increased by 74%, from USD 37.19 million to USD 64.89 million. However, this figure dropped by 50% between 2010 and 2012 due to governance issues, a series of political miss-steps, and a subsequent withdrawal of donor support. There was also a 50% devaluation of the Malawi Kwacha (MK) against foreign currency during FY2011/12.

The majority of the public environment expenditure (75%) was allocated to the Ministries of Water, Lands, and Environment, while the smallest allocation (1%) went to local councils. Over 2007–2012, water resources management accounted for 30% of total ENRM expenditures, the largest share of public environmental expenditures. This was followed by land management at 25%. This level of expenditure was mainly due to the financing of water projects under the National Water Development Program and the Community-Based Rural Land Development Program by development partners. Local authorities in all the ENRM-devolved sectors received only 1% of total environmental expenditures during the review period (see Figure 13).

FIGURE 13. Distribution of public environmental expenditures by ministries and institutions, 2007–2012 (%)



Source: GoM. 2014(b). *Report on Joint Public Expenditure Review of Malawi's Environment & Disaster Risk Management Sectors.*

Note: MoTWC = Ministry of Tourism, Wildlife and Culture; MoIWD = Ministry of Irrigation and Water Development; MoAFS = Ministry of Agriculture and Food Security; MoLHUD = Ministry of Lands, Housing, and Urban Development; MoECCM = Ministry of Environment and Climate Change Management.

Since its launch in 2005–2006, the FISP has accounted for 69% of the agriculture sector's budget and 51% of total public spending over 2007–2012, crowding out spending on important sustainable measures. In addition, the ministry does not have direct oversight of a large share of agricultural spending. During 2007–2012, agricultural expenditure under the supervision of other ministries, as well as off-budget expenditure, accounted for 31% of total agricultural spending. As a result, the Ministry of Agriculture was left with only 19% of total spending to dedicate to agriculture. This limited the ministry's ability to maintain a minimum level of activity in its traditional missions, which are to increase agricultural productivity and resilience to climate change through the promotion of new high-growth potential orientations such as climate-smart agriculture and SLM practices, as called for by the Agriculture Sector Wide Approach and the Economic Recovery Plan.[93]

93 World Bank. 2013(a). *Malawi Public Expenditure Review.*

Key recommendations

EMA (2017) AND THE NEW EPA

Robust support is needed to implement the EMA (2017) and the new EPA.

Institutionally, the new EPA will have a key role in championing the implementation of environmental policy, including the high-level objectives in the Constitution, and those detailed in the EMA (2017). Therefore, support is needed to ensure the EMA (2017) is operationalized and the EAD is transformed into the new EPA. This support needs to include the development of a new structure for the EPA, the establishment of a sustainable financing mechanism, and the assignment of staffing and capacity building to match its new mandate. Operational and technical support after initial establishment will be needed to develop internal institutional structures and prepare regulations for SEA, EIA, and the certification of EIA practitioners. Operational procedures also need to be developed, including guiding and defining relationships with other government agencies and establishing registries of EIAs.

DECENTRALIZATION OF ENVIRONMENTAL MANAGEMENT FUNCTIONS

The EMA (2017) and the establishment of the EPA is a unique opportunity to decentralize environmental management functions.

A more concerted approach to promoting decentralization is needed. GoM has given renewed attention to decentralization since local government elections in 2014, by increasing intergovernmental transfers and initiating the devolution of human resources. The EMA (2017) and the forthcoming establishment of the EPA provide an opportunity to accelerate the decentralization of environmental management functions, as does the integration of the Local Development Fund (LDF) and National Local Governance Finance Committee. The EMA provides for the appointment of environment officers at the district level as members of the District Development Committees. These developments could also provide an opportunity to strengthen compliance monitoring of EIAs and improve coordination with other officers and bodies at district and local levels, such as with District Forestry Officers and Village Natural Resources Management Committees (VNRMCs). The LDF also offers the possibility of increasing investments in interventions that tackle environmental degradation, for example, for SLM and forest regeneration.

REVIEW PUBLIC ENVIRONMENTAL EXPENDITURE AND THE INSTITUTIONAL USE OF DATA

Support can be provided to Malawian institutions to review public environmental and climate change expenditures and use valuation data better to frame policies, identify investments, and set budgets.

As discussed in the Wealth and natural capital, we recommend the use of natural capital accounts for key natural resources and ecosystem services. Using a robust and recognized methodology, an up-to-date review of environmental and climate change public expenditures would improve the alignment of policy commitments with sector budgeting.

EIA AND SEA CAPACITY BUILDING

Strengthening Malawi's EIA and SEA capabilities is also an important priority, including the need for regulations and the certification of EIA practitioners.

These should include:

- Procedures to maintain a record of SEAs/EIAs (for example, an interactive website), accessible to stakeholders
- Guidelines and procedures for project screening[94] and applications for environmental clearance[95]
- Guidelines and procedures for EIA review, scoping, and preparation of SEAs, EIAs, and environmental management plans[96]
- Criteria for accepting/rejecting EIA and SEA reports[97]
- Guidelines and procedures for monitoring and reporting (by proponents or others)
- Procedures for notification (for example, noncompliance) and communication at various levels[98]

94 There are examples of screening checklists that could be modified for Malawi.

95 Neither the 1996 or 2017 EMA set a limit for the validity of the clearance/authorization, though this may be set in the letter of conditions. In other countries, validity is set (for example, five years) and the proponent must apply for a renewal at the end of that period. This is a good way of revisiting the authorization in light of the proponent's performance in implementing agreed environmental safeguards.

96 There are examples of such systems, including from other African countries.

97 There are existing criteria, but these need updating.

98 In some countries, there may be dozens of templates that standardize the way that these communications are done. These range from bilateral communications with authorities in neighboring countries and international stakeholders to notices to an interested/affected individual in a project area.

Malawi is extremely vulnerable to severe weather shocks and climate change.

4. CLIMATE CHANGE AND RESILIENCE[99]

Malawi's changing climate

Malawi is highly vulnerable to the impacts of climate change. Most of Malawi's economy and livelihoods are directly dependent on rainfed agriculture. However, when climate variability impacts on soil health and land degradation, farm systems struggle to be productive. This can lead to an increase in poverty, and food insecurity in rural populations and coping and resilience strategies are weakened. Current climate variability (as well as future climate change) also has a greater impact due to high and increasing population densities, poor and unsustainable agricultural practices, increased deforestation, degraded ecosystems within watersheds, and the reclamation and degradation of wetlands, floodplains, and protected areas. This puts Malawi's socioeconomic well-being at greater risk.

Malawi does not have the institutional capacity to deal with current or future climate risks. This is made worse by inadequate databases, tools, and information systems that are unable to factor the risks of climate change into the design of both the 'hard' and 'soft' infrastructural foundation.[100, 101]

Climate models indicate that extreme weather events, triggering floods and droughts, will increase in both intensity and frequency. Floods and droughts have nationwide repercussions, threatening local and national food security, undermining livelihoods, damaging key infrastructure, and reducing economic activity and output.[102]

Data from Malawi's Department of Climate Change and Meteorological Services (DoCCMS) show a noticeable increase in maximum and minimum temperatures over the last 20 years or so. Mean temperatures have risen by an average rate of 0.21°C per decade, with comparative increases in evapotranspiration.[103] The largest shifts in maximum temperature are in November and December, with slightly lower increases in the late summer months of January and February.

99 This section draws on: GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

100 'Hard' infrastructure refers to physical items such as bridges, roads, and buildings; 'Soft' infrastructure refers to institutions that are essential to the economy and quality of life such as government, education, health, and financial services.

101 GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

102 See: IGAD (ICPAG). 2007. *Climate Change and Human Development in Africa—Assessing the Risks and Vulnerability of Climate Change in Kenya, Malawi, and Ethiopia;* World Bank. 2017(c). *Multi-Sectoral Investment Plan for Climate and Disaster Risk Management in Malawi [draft].*

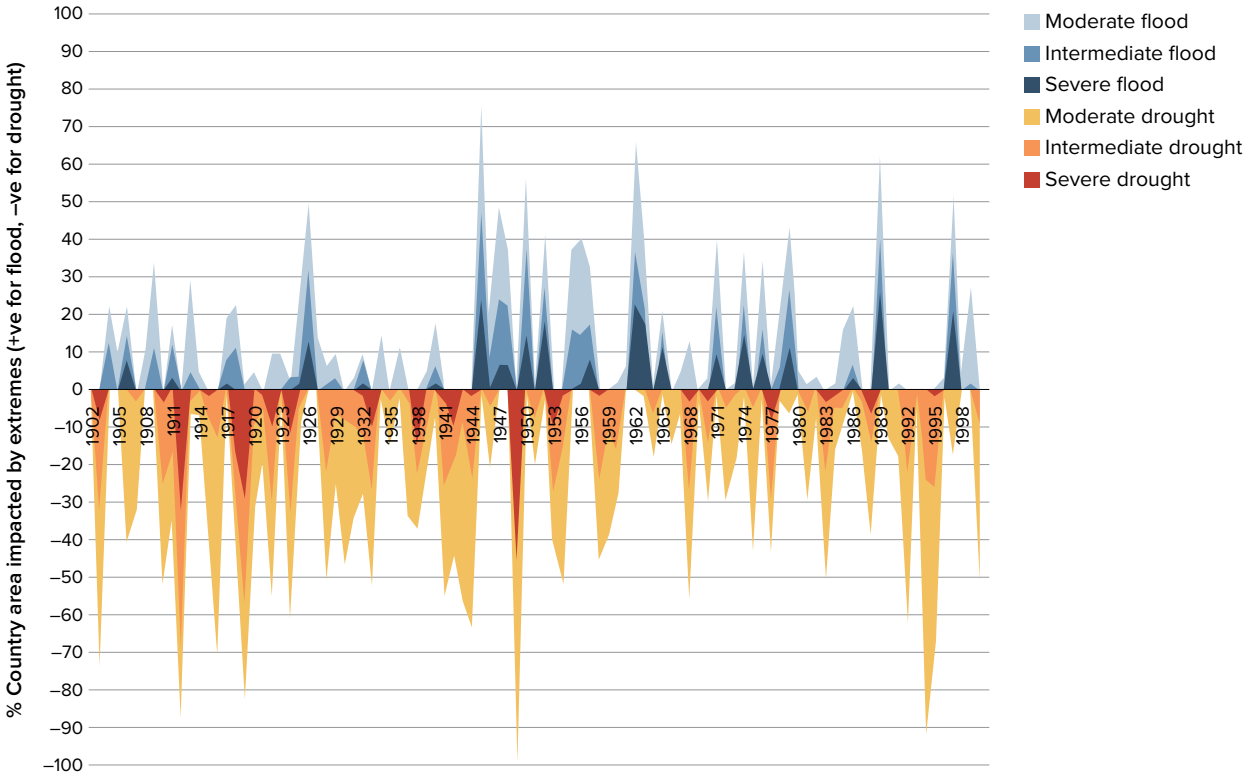
103 Vincent et al. 2014. *Analysis of Existing Weather and Climate Information for Malawi*.

Changes in rainfall patterns are more variable. Northern and Southern Malawi have experienced a drying trend since the early 2000s, while the center of Malawi has seen slightly increased rains.[104] Reports of extreme weather events (that is, droughts, heavy rains, and floods) increased from just one during the 1970s to 19 between 2000 and 2006.[105]

Farmers have also observed temperature and weather changes that match those officially reported. Weather patterns are important to them because of the impact they have on cropping. Recent community participatory rural appraisal-type assessments confirm that farmers believe that the weather is changing and temperatures are increasing.[106]

Modelling of climate change scenarios predicts significant medium- and long-term changes to Malawi's climate, in terms of both temperature and rainfall.[107] Changes to climate are not new for Malawi (Figure 14), but most climate models agree that temperatures will rise. Analysis of 34 climate change models projecting up to 2090 suggests more frequent dry spells and a reduction in both the number of rainy days and the amount of rainfall on each day.[108] It also shows a greater likelihood of flooding. These changes are likely to threaten livelihoods, increase the risk of food insecurity, and negatively affect economic growth.

FIGURE 14. Historic climate variability



Source: The International Resources Institute for Climate and Society at Columbia University, derived from the Climate Research Unit at the University of East Anglia, the United Kingdom.

Note: Yellow-red shading (drought) shows the percentage of the country that would experience lower than normal rainfall (to different degrees). Blue shading (floods) indicates the percentage of the country that would experience higher than normal rainfall linked to floods.

104 UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi*; Zulu. 2017. *Existing Research and Knowledge on Impacts of Climate Variability and Change on Agriculture and Communities in Malawi*. Both reports provide an excellent overview of numerous studies of Malawi's weather patterns and climate.

105 ActionAid. 2006. *Climate Change and Smallholder Farmers in Malawi: Understanding Poor People's Experiences in Climate Change Adaptation*.

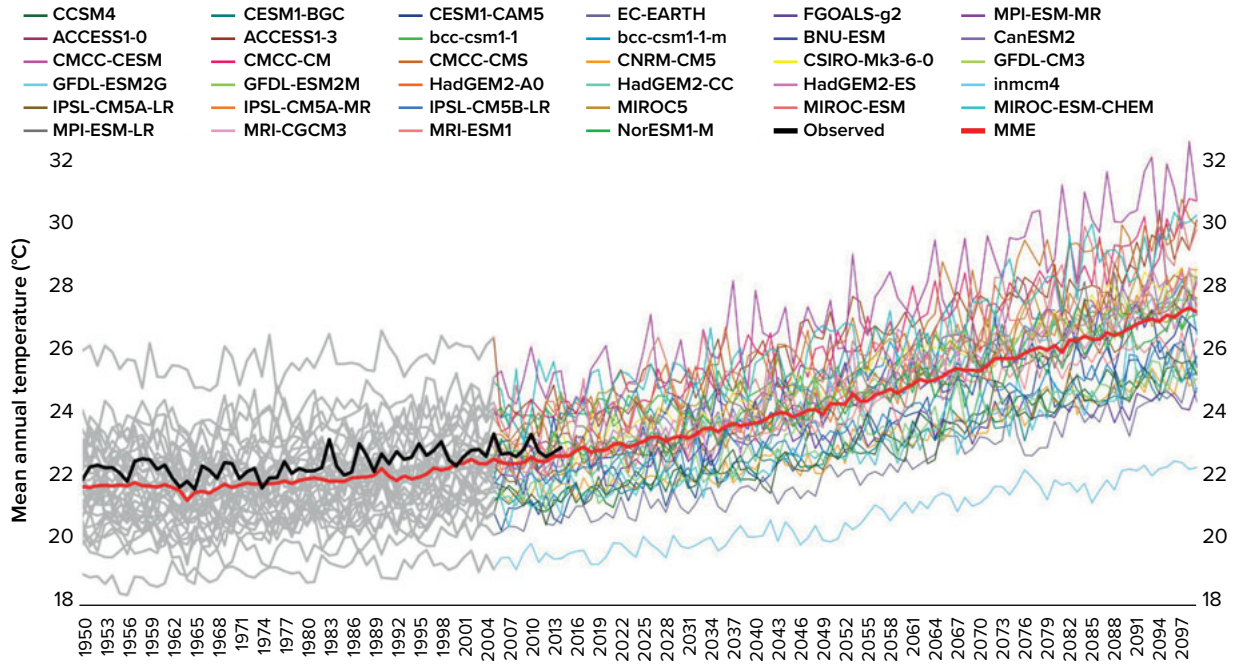
106 Wood and Moriniere. 2013. *Malawi Climate Change Vulnerability Assessment*; Zulu. 2017. *Existing Research and Knowledge on Impacts of Climate Variability and Change on Agriculture and Communities in Malawi*.

107 Wood and Moriniere. 2013. *Malawi Climate Change Vulnerability Assessment*.

108 UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi*.

Climate change projections can be uncertain, but there is significant and growing confidence regarding the projected rise in temperature (the changes in rainfall are less certain). Figure 15 shows the projections of 34 climate change models and their ensemble. The bold red line shows the trend for 1950–2099 and the bold black line are observations for 1950–2014.[109] The consensus emerging from these multiple models is clear: annual temperatures will rise in the range of 0.5 to 1.5°C by the 2040s.[110] The World Climate Research Program also presents similar estimated temperature changes in Malawi for 2030 and 2040. As modelling advances, confidence and consensus on rising temperatures have grown and become more specific.

FIGURE 15. Time series of mean annual temperature (C°) for 34 CMIP5 models



Source: UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi.*

Note: CMIP = Climate Model Intercomparison Project.

Extremes in temperatures (that is, hot and very hot days) are also more likely to occur more frequently. Figure 16 shows the potential highs and lows Malawi may face during 2030s and 2040s. These extremes in temperatures can negatively affect the vulnerable, such as the old, the young, people living in poverty, and those with health issues. Extreme heat can make it harder to work (especially outdoor work) and livestock can suffer causing reduced production of meat, milk, and reproduction rates. Extreme temperatures can also reduce water quality, cause surges in algal growth, and negatively affect aquatic ecosystems, including fish.[111]

Changes in annual rainfall are less clear with projections showing wetter periods and some showing dryer periods. The UMFULA project[112] reviewed 34 models showing that 38% of these models projected reductions in rainfall during 2030s and the other 62% projected more rainfall. However, 58% of the models predicted less rainfall by the 2070s. Figure 17 shows these variable rainfall projections as percentage changes between recent decades and the last three decades of this century.

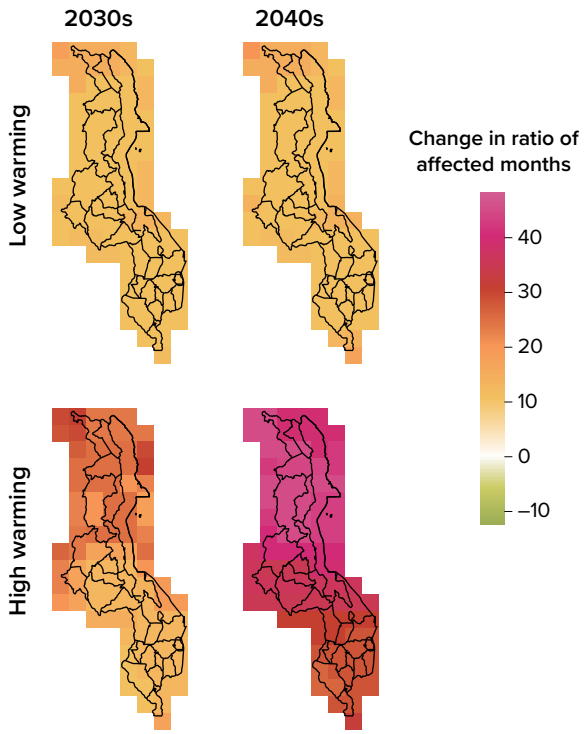
109 Climate Research Unit (CRU), University of East Anglia, United Kingdom.

110 UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi*.

111 There has not been detailed research on the impact of water temperature on Malawi's lakes to confirm that warming water temperature affects ecosystems and fisheries. However, recent studies on Lake Tanganyika, in neighboring Tanzania, show that declines in commercially important fishes and endemic molluscs have accompanied lake warming. See: Cohen et al. 2016. *Climate Warming Reduces Fish Production and Benthic Habitat in Lake Tanganyika, One of the Most Biodiverse Freshwater Ecosystems*.

112 See: http://www.futureclimateafrica.org/project/umfula/

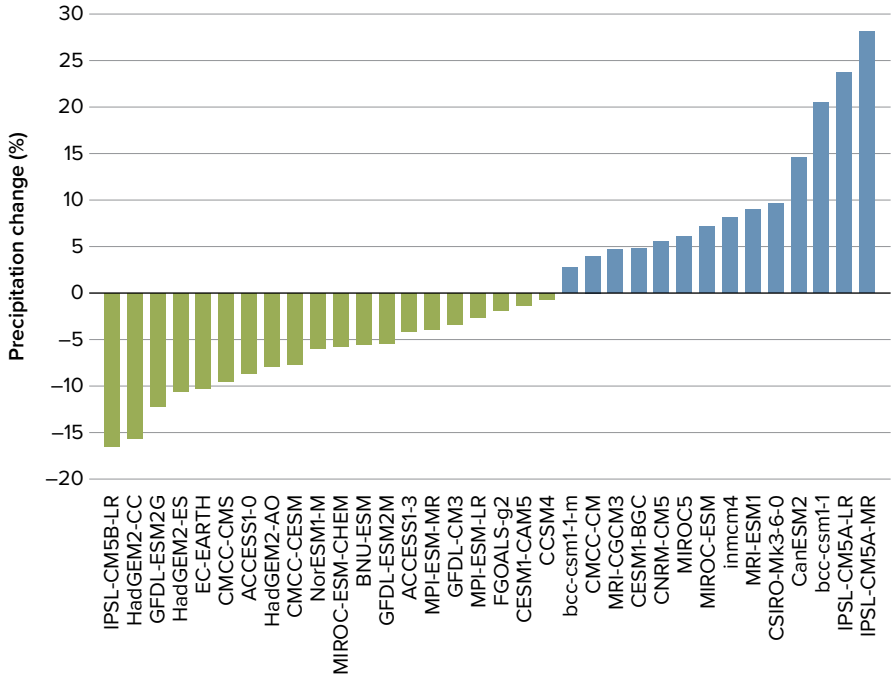
FIGURE 16. Changes in heat extremes



Source: World Bank. 2017(c). *Multi-Sectoral Investment Plan for Climate and Disaster Risk Management in Malawi [draft].*

Note: Projections of exposure to heat extremes, as illustrated for 2025–2045 ('2030s') and 2035–2055 ('2040s'), as the increase in the frequency of historically unprecedented heat extremes (two standard deviations above the historical mean in 1986–2005) is measured for both warming scenarios for the annually warmest three-month period.

FIGURE 17. Percentage change in annual mean rainfall across Malawi between the GCM-simulated current period (1976–2005) and 2070–2099 for 34 GCMs



Source: UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi.*

Developing downscaled (locally specific) climate models for Malawi is challenging due to the limited availability of long-term weather data. More than 50% of Malawi's 761 rainfall stations have less than 10 years of information.[113] Malawi's also sits between Eastern equatorial Africa and Southern Africa, and both these regions have opposing climate responses, making it harder to predict which direction Malawi's weather may take. An added complication is the influence of the El Niño Southern Oscillation (ENSO) phenomenon (which changes the sea surface temperatures of the Indian Ocean) and the movement and location of the ITCZ, neither of which follows a regular yearly pattern.[114]

Short-, medium-, and long-range weather forecasting made available to farmers, government, and other stakeholders is often not sufficiently reliable, relevant, detailed, and timed. Forecasts made by the DoCCMS and the Water Resources Department are usually made available through newspapers, through district offices, or across the radio, but they often come too late for important decisions such as purchasing seeds or planning harvests. Improving the delivery, accuracy, quality, and timing of these forecasts would go a long way to improving the ability of stakeholders to respond and adapt to Malawi's changing climate.

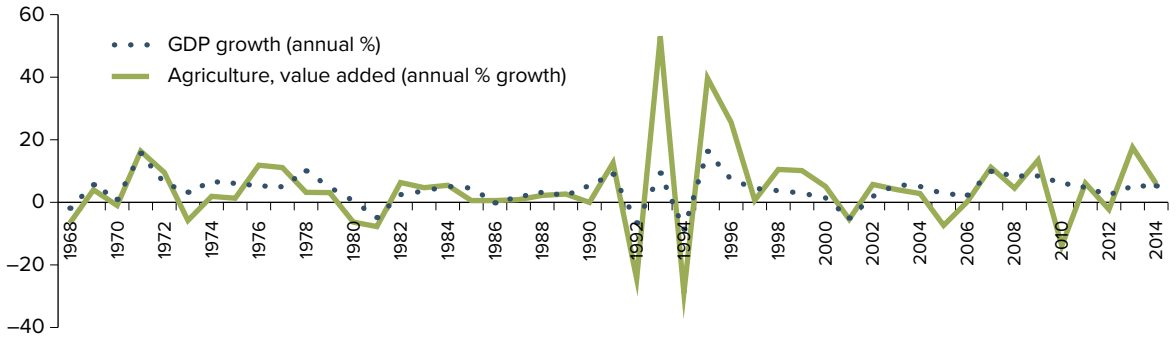
Projected economic impacts[115]

Malawi's economy is vulnerable to climate shocks, and this risk affects all economic sectors and geographical areas. In relative terms, the northern region faces a particularly high risk because of its lower population and high reliance on agriculture. However, in terms of absolute financial exposure, the central and southern regions will be affected the most, with the central region facing the worst overall risk across all the economic sectors. Economic growth is largely dependent on expanding agriculture, manufacturing, wholesale and retail trade, utilities, and transport sectors. Most of these sectors are directly or indirectly adversely affected by the recurring floods. Losses for agricultural GDP due to droughts, for example, are estimated to range from 1.1% to 21.5% for return periods of 5 and 25 years.[116]

The agricultural sector is the most at risk from direct climate change stressors.[117] This is because it is sensitive to the projected changes in temperature and precipitation. Figure 18 and Figure 19 illustrate the close link between rainfall levels, agricultural production, and GDP. For example, between 2015 and 2017 floods in southern districts were followed by countrywide drought conditions, with the resulting loss and damage estimated at USD 335 million, equivalent to approximately 5% of GDP.[118]

The combination of flood and drought caused a major decline in agricultural production. Maize, the most important crop for food security purposes, had a 30% year-on-year drop in production. However, climate change may result in some winners too. Recent crop modelling projections suggest that between 2040 and 2070, climate change will increase maize production in the Mzimba district, with over 50% of farmers registering increased yields.[119]

FIGURE 18. Malawi's growth in GDP closely follows growth in agriculture



113 Vincent et al. 2014. *Analysis of Existing Weather and Climate Information for Malawi.*

114 Zulu. 2017. *Existing Research and Knowledge on Impacts of Climate Variability and Change on Agriculture and Communities in Malawi.*

115 This section draws on: World Bank. 2017(c). *Multi-Sectoral Investment Plan for Climate and Disaster Risk Management in Malawi [draft].*

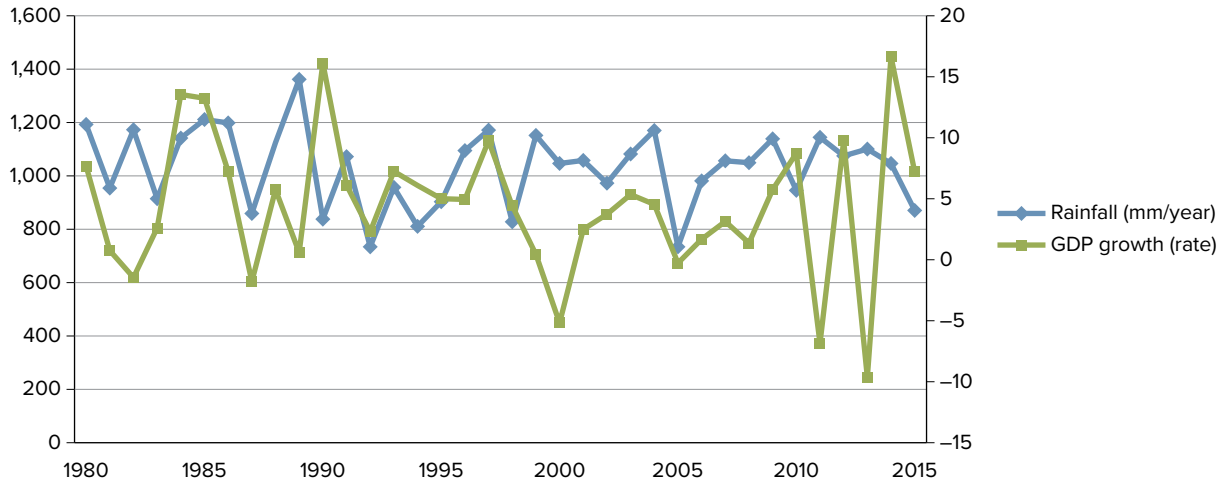
116 Pauw et al. 2011. *The Economic Costs of Extreme Weather Events: A Hydro-Meteorological CGE Analysis for Malawi.*

117 GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

118 GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report.*

119 Gama et al. 2014. *Modelling Potential Impacts of Future Climate Change in Mzimba District, Malawi, 2040–2070: An Integrated Biophysical and Economic Modelling Approach.*

FIGURE 19. Annual precipitation and GDP growth rates, 1980–2015



Source: GDP Growth from data.worldbank.org; precipitation from http://sdwebx.worldbank.org/climateportal.

About 90% of Malawi's food production comes from one rainfed crop per year and this is dependent on regular and reliable rainfall. However, the incidence of extreme droughts and flooding and extreme heat events is expected to rise. Agricultural households are some of the poorest in the country, and this increased economic vulnerability will discourage saving and encourage the liquidation of assets. Under future climate scenarios, poverty may increase and there may be an increase in rural to urban migration, causing further economic pressures across sectors. In this scenario, the movement of a climate-affected rural population to urban centers increases the pressure on land, water, and energy. An increasing demand for urban land for housing speeds up land degradation and exposes urban environments to an increased risk of flooding. All this results in greater demands being made on already constrained resources, such as social services, health, and nutrition.[120]

Climate change affects major infrastructure and is projected to slightly reduce the growth rate of GDP.[121] Severe flooding in particular causes considerable damage to infrastructure, including roads, bridges, schools, and health facilities. Costs for repair and restoration of infrastructure place an added burden on overstretched public expenditure budgets. For example, the 2015 floods highlighted the vulnerabilities of the transport sector with serious damage caused to the infrastructure. For the transport sector, the total damages and losses due to the disaster were approximately USD 60 million, while the cost of recovery was approximately USD 130 million,[122] the highest among all the sectors. Based on a broad analysis using median climate scenarios directly related to temperature and precipitation changes through to 2050, it has been estimated that, without adaptation measures applied to the planning, construction, and maintenance of road infrastructure, Malawi is facing a potential total annual average cost of USD 165 million.[123]

The increased pressure on services and sectors could negatively affect industry too. Energy supplies could be more variable and less reliable, as could access to water. A struggling industry means less employment opportunities and increased poverty. The continuing increase in the number of climate shock events could further exacerbate this vicious cycle.

At a macroeconomic level, climate-driven disruptions to services will result in a more volatile economy. This in turn could increase poverty, reduce growth, increase inflation, put strain on the currency and banking system, and increase fiscal pressures on the government.

120 World Bank. 2017(c). *Multi-Sectoral Investment Plan for Climate and Disaster Risk Management in Malawi [draft].*

121 Arndt et al. 2014. *Climate Change and Economic Growth Prospects for Malawi: An Uncertainty Approach.*

122 GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report.*

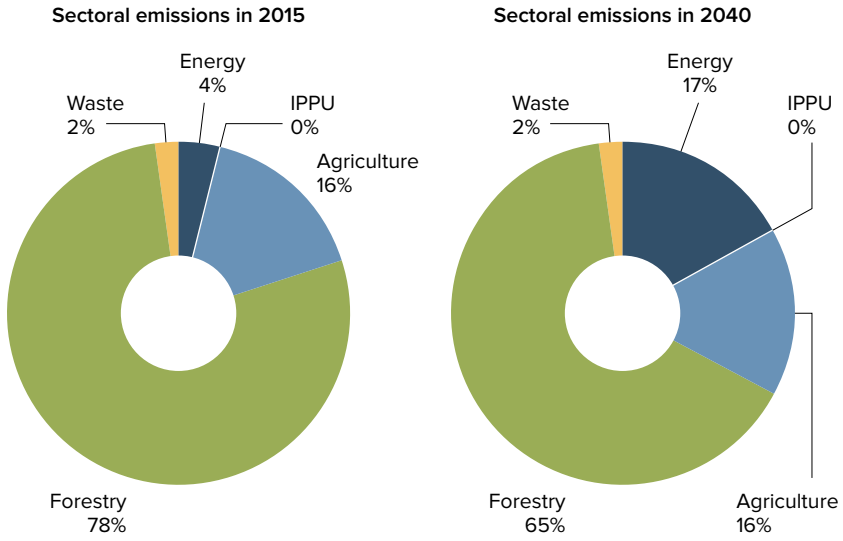
123 Chinowsky et al. 2015. *Infrastructure and Climate Change: A Study of Impacts and Adaptations in Malawi, Mozambique, and Zambia.*

GHG emissions

By global standards, Malawi has very low GHG emissions of around 1.4 tons carbon dioxide (CO_2) equivalents (CO_2e) *per capita* in 2015. Nonetheless, GoM has made a firm commitment, through its NDC to the United Nations Framework Convention on Climate Change (UNFCCC), to move the country's development pathway toward a green economy. Malawi's main GHG-contributing sectors are agriculture, forestry, and other land use (AFOLU), energy, and industrial processes. Emissions from these sectors are increasing at different rates. For example, the average annual change in total emissions between 1990 and 2011 was 0.7%, while sector-specific average annual changes were forest and other land use (−0.6%), agriculture (3.8%), waste (2.3%), and industrial processes and product use (IPPU) (2.6%).[124, 125]

Between 2015 and 2040, Malawi's total annual GHG emissions are expected to rise by around 38% (see Figure 20). This means an increase from the current level of approximately 29,000 kilotons CO_2 equivalents (kt CO_2e) to around 42,000 kt CO_2e. There is a level of uncertainty about future emissions, particularly beyond 2020. Predictions are based on varied assumptions of economic growth and the anticipated capacity and technical support from development partners. GoM's goal is to save between 14,000 and 16,000 kt CO_2e per year by 2030 if a robust low emission development path can be followed.[126]

FIGURE 20. Malawi's GHG profile for 2015 and projected profile for 2040



Source: GoM. 2015(b). *Intended Nationally Determined Contribution.*

Institutional and policy frameworks

Malawi has a number of existing institutional structures in place that support the implementation of climate change mitigation and adaptation policy. The Malawi constitution explicitly requires support for the environment, and the Malawian government has addressed climate change at national, ministerial, and departmental levels. In addition, it is recognized that civil society, NGOs, the private sector, and development partners all have a role in supporting this policy. According to 'Climate Action Intelligence',[127] over 200 institutions/organizations are involved in climate change activities in Malawi.

Malawi is also a signatory to various international treaties and instruments that cover climate change. These include the UNFCCC and the Kyoto Protocol. These treaties and instruments oblige the country to take various actions to address climate challenges.

124 World Resources Institute Climate Analysis Indicators Tool (WRI CAIT 2.0, 2016), cited in USAID. 2016. *Greenhouse Gas Emissions in Malawi.*

125 2017 data on sector GHG emissions from the EAD expected July 2018.

126 GoM. 2015(b). *Intended Nationally Determined Contribution.*

127 EAD. 2013. *Climate Action Intelligence (CAI) Actions & Actors Guidebook: Understanding Who Is Doing What, Where on Climate Change in Malawi.*

GoM has a range of strategies and policies that seek to tackle the challenges of current climate variability, shocks, and future climate change. These include high-level strategies, such as Malawi's Vision 2020 and the MGDS III. There are five policy instruments that provide the primary guide to the reduction of climate change risks and disasters:

- The Nationally Determined Contribution (NDC)
- The National Climate Change Management Policy (NCCMP)
- The National Climate Change Investment Plan (NCCIP)
- The National Adaptation Program of Action (NAPA)
- The National Disaster Risk Management (NDRM) Policy

There are also three main environmental-based policies that support these main instruments:

- The EMA
- The NEP
- The National Environment Action Plan

Other climate change-focused policies include the National Agricultural Policy and the (forthcoming) National Resilience Strategy (2018–2030).[128]

The Ministry of Finance, Economic Planning, and Development (MoFEPD) coordinates climate change activities under the National Climate Change Programme (NCCP). The activities of the NCCP are largely supported and directed by the National Climate Change Technical and Steering Committees.

The MoNREM leads on climate change policy development in Malawi. This is exercised through the EAD that is responsible for coordinating national and international climate-change-related issues.[129] The DoCCMS collaborates with the EAD to coordinate national and international climate change issues. The EAD in turn coordinates closely on climate change with the MoAIWD, MoLGRD, and MoFEPD. The Department of Disaster Management Affairs (DoDMA) coordinates the implementation of disaster risk management at the national level and is responsible for preparedness and response to weather and climate-related disasters such as droughts and floods. DoDMA is also drafting a National Resilience Strategy that will include climate resilience.

The MGDS establishes working groups to coordinate climate change and other sectoral priority areas. Under the MGDS II 2011–2016, the Working Group on Natural Resource, Land, and Environment was established. It was later renamed 'Climate Change, Environment, Natural Resources, Mining, and Energy' (CC and ENRM). MGDS III 2017–2022 was approved by GoM in September 2017. It makes the need to respond to the challenge of climate change one of the highest priorities for the country and confirms the continuation of special working groups to coordinate policy.

Challenges

Coordination between government agencies is crucial because climate change is a cross-cutting issue that affects most sectors, such as agriculture, human health, energy, fisheries, wildlife, water, forestry, and gender. Unfortunately, it can also be a challenge. For example, DoDMA, the National Disaster Preparedness and Relief Committee (NDPRC), and the National Disaster Preparedness and Relief Fund all have responsibility for disaster risk management, which includes climate-change-related hazards. The NCCMP has outlined measures to address institutional coordination, but providing the leadership to bring together institutions will be extremely challenging to manage.

128 GoM (forthcoming). *National Resilience Strategy (2018–2030). Breaking the Cycle of Food Insecurity in Malawi.* Office of the President and Department of Disaster Management Affairs.

129 The EAD is the focal point for the UNFCCC, as well as for the United Nations Convention on Biological Diversity (UNCBD) and the United Nations Convention to Combat Desertification (UNCCD), and is the Designated National Authority for the Clean Development Mechanism (CDM).

The overlapping mandates of some GoM departments can make it difficult to know which government institution or agency is best placed to coordinate climate change management programs in the country.[130] This is especially an issue for external agencies and development partners and increases the risk of negatively affecting relationships of climate-change-related sectors.[131] Also, some policies create perverse incentives that counteract resilience goals. For example, agricultural policies that subsidize fertilizer and maize can sometimes increase exposure and vulnerability. At present, it remains a challenge for Malawi's government structures to coordinate effectively across sectors.

Malawi has identified a range of climate-change-related projects, but they are not prioritized. The NCCIP identifies 11 major programmatic initiatives, with a notional total budget requirement of just under USD 1 billion. A major challenge in the NCCIP is the inclusion of climate change initiatives that are neither prioritized nor linked to sources of finance. GoM's Strategic Program for Climate Resilience (SPCR)[132] attempts to address this by prioritizing a set of investments to build resilience (Box 3). There is also a need for better coordination in identifying and selecting climate change adaptation initiatives, to avoid fragmenting efforts and increasing transaction costs. There is a similar need for focused analysis of successful approaches to tackle climate-change-related challenges, to share the lessons learned more effectively, and then scale up successful approaches.

There is a mismatch between the NCCMP framework and sector priorities on the one hand and national development planning and implementation on the other. In addition, sectors and district councils hardly appreciate the content of climate-change-related policy documents and yet they are closer to where resilience should be built. District budgets are very small and fragmented across small initiatives. This results in limited integration of climate change into sector plans and budgets at the district level.

BOX 3. SPCR: Priority investments

Climate-resilient integrated watershed management: Scaling up integrated catchment management to the national level as a cross-cutting approach to managing several sectors and environmental resources at risk of climate uncertainty—food productivity, forestry, flooding, drought, rural energy access, and the management of waterways, siltation, and ecosystem services.

Building climate change resilience in selected agricultural value chains in Malawi: Improving agricultural production and productivity in the value chains of high-value and drought-tolerant crops through incorporating climate-smart agricultural production systems and managing key agricultural risks, including weather and climate change through scaling up climate-resilient technologies.

Sustainable fisheries sector and fisheries value chain in Malawi through improved climate-resilient lake ecosystem conservation and management: Ensuring sustainable management of fisheries resources and communities against the impacts of climate change through conserving and sustainably managing immediate lake catchments and shoreline ecosystems.

Strengthening climate resilience of smallholder farmers in Malawi: Increasing the resilience of smallholder farmers and related livelihoods to the effects of climate change and thereby enhancing food and nutrition security and contributing to poverty reduction in rural areas of Malawi under a changing climate.

Operationalizing Malawi's climate services center: Establishing and operationalizing a climate services center for Malawi and improving the management of climate data at the national level.

130 Todd. 2013. *End of Programme Evaluation for the National Programme for Managing Climate Change in Malawi and the Malawi Africa Adaptation Programme*.

131 Reddy and Gondwe. 2016. *Malawi NAP Stocktaking Report, Final Report, prepared for EAD, Govt. of Malawi with support from UNDP.*

132 GoM. 2017(c). *Strategic Program for Climate Resilience: Malawi, Pilot Program on Climate Resilience (PPCR).*

Skills and expertise in climate change mitigation and adaptation are limited. Most sectors designate staff from other functions to address climate change issues, such as participation in the National Technical Committee on Climate Change. Many sectoral staff at policy and program levels lack the multiple skills and expertise that the interdisciplinary nature of climate change requires.

There are also barriers that constrain communities' ability to participate and capacity to adapt. These include abject poverty, low levels of education, lack of skills, lack of appropriate technologies, environmental degradation, and lack of water availability. Adaptation projects need to respond to the perceived and experienced needs and vulnerabilities of the given community.

Natural disasters

Malawi is ranked among the countries most at risk of natural disasters in the world. After the floods of 2015, Malawi was categorized by the Climate Change Index as the third-most vulnerable country to climate change,[133] and the country is ranked as the 16th most vulnerable country globally for humanitarian crisis and disasters in the INFORM's Global Risk Index 2017.[134] Between 1980 to 2017, Malawi has experienced eight major droughts and 33 floods.[135] The floods of 2015 were the worst in 50 years and this was followed by a drought in 2016–17. This drought affected 6.5 million people, which is over a third of the total population. An overview of disasters since 1990 is provided in Annex 5.

Natural disasters, such as extreme weather and recurring floods and droughts, put economic growth and people's livelihoods at risk, and add strain to environmental resources and ecosystem services. Other natural disasters, such as hailstorms, lightning, earthquakes, pest infections, and wildfires increase these risks. These disasters are also hard to predict, manage, and recover from. In addition, Malawi's women and children are particularly vulnerable to natural disasters such as droughts due to disproportionate gendered responsibilities for food production and livestock.[136]

Natural disasters, such as extreme weather and recurring floods and droughts, put economic growth and people's livelihoods at risk.

133 Kreft et al. 2017. *GLOBAL CLIMATE RISK INDEX 2017—Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2015 and 1996 to 2015.*

134 INFORM. 2017. *Malawi.*

135 EM-DAT. 2018. *The International Disaster Database.*

136 GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report.*

Environment

Floods and droughts directly and indirectly reduce Malawi's natural capital by exacerbating environmental degradation and the loss of natural resources. Although the impact of natural disasters on the environment is hard to estimate, the 2015 Malawi Post Disaster Needs Assessment[137] showed a wide range of destroyed and deteriorated assets. During this one natural disaster event, 71,500 ha of forests and energy resources were lost. Water resources were affected by high siltation, accumulated debris, and salinization of irrigated land, and fertile riverine areas were waterlogged. In addition, exposure to disasters is also increasing due to more people living and working in flood-prone areas.

Cost/economic impact

Since 2012, floods and droughts in Malawi have cost the economy and the country over USD 1 billion. Lost production caused by droughts and floods cost the Malawian economy on average 1.7% of its annual GDP,[138] and the recent floods of 2015 and subsequent drought cost the economy over 5% of annual GDP.[139] Although the effects of floods can be more immediate and localized compared to droughts, both have an impact across the whole economy. Climate change is likely to increase the frequency and intensity of extreme weather events, and it is not possible to determine their future patterns. This complicates estimating the probable additional effects of climate change on disaster impacts.

The economic impact of floods and droughts also disproportionately affects the income of poorer households compared to the non-poor, and increases the number of people living in poverty. After the floods of 2012–13, research found that floods resulted in reduced incomes in four of every five affected households.[140] Compared to the non-poor, natural disasters have been found to affect poor populations worse.[141]

The agriculture, transportation, and water sectors face the worst economic impact. The economic cost of severed natural capital and resources is significant but difficult to estimate. Annual agricultural production damage and losses after the 2015 floods were estimated at USD 365.9 million and required recovery interventions estimated at USD 500.2 million. The transport sector also suffered USD 60 million in losses and USD 130 million in reconstruction costs.

The agriculture sector experiences uncertainty and fluctuations from droughts. Damaged and lost crop yields cause rapid food price increases, inflation, and volatility. For example, in the droughts of 2015–2016, crop and livestock losses amounted to 70% of all losses (60% and 10%, respectively). Such volatility varies across districts (for example, 4% in Blantyre and 6.8% in Machinga). After agriculture, the two most drought-affected sectors were water resources and sanitation (36%) and the environment and forestry (12%).

137 Ibid.

138 Pauw et al. 2010. *IFPRI Discussion Paper. Drought and Floods in Malawi—Assessing the Economy-wide Effects.*

139 GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report.*

140 World Bank. 2017(b). *Republic of Malawi Poverty Assessment.*

141 Ibid.

Key recommendations

ENHANCE CLIMATE RESILIENCE BY IMPLEMENTING A NATIONAL AND INTEGRATED PROGRAM FOR IMPROVED UPTAKE OF CLIMATE INFORMATION SERVICES

There is an urgent need to increase investments in Malawi's weather and climate services capacity.

For example, of the 140 key surface water monitoring stations (of a national total of 176), 70% are not producing data.[142] A global assessment led by the World Meteorological Organization shows that climate services investments can have a cost-benefit ratio of 1:3 in protection and productivity of assets, industries, and livelihoods.[143] In some cases (for example, warning services), the benefit ratio is much higher.[144] However, benefits are contingent on the delivery and use of quality services. Information on weather, water, and climate is vital for decision-making on climate change risks, opportunities, and responses to support planning in the short, medium, and long term. At all levels, from household to national, actions are currently taken with little or low-quality climate information. The information and communication technology (ICT) infrastructure necessary to provide information in a timely manner is not in place, and there is still inadequate technical capacity for generating and integrating multiple streams of validated climate data and producing and delivering sector-specific information products.[145]

MGDS III identifies improving climate services as a strategic priority.[146] The financing for recent and forthcoming investments in Malawi's climate services has increased as climate services' contribution to building resilience is acknowledged. For example, in 2017, the Green Climate Fund, UNDP, and GoM approved USD 16.3 million for early warning systems. It is now important to integrate various streams of investments and fill the financing gap to achieve national coverage and strengthen the entire value chain of climate services across sectors and government agencies (that is, from data collection through to the uptake of relevant climate information in decision-making and planning). To achieve such integration, Malawi could explore the potential of ICT tools and platforms to make climate information more accessible. Improved access to information could be achieved by using social media and mobile phone communication, in addition to traditional communication channels such as bulletins. The uptake of climate information could be strengthened by producing more sector-relevant information (made possible by integrating local data and capitalizing on free online climate information products) in a messaging format and language that are user-friendly.

LAND MANAGEMENT PRACTICES

Improvements to land management practices could make a major contribution toward reducing the rate of land degradation and deforestation while also slowing the drawdown on natural capital.

Changes to climate and weather patterns exacerbate existing vulnerabilities of Malawi's natural resource base. This is already under threat and the accompanying rapid drawdown on natural capital will reduce opportunities for wealth creation in the future. Investments in SLM practices have already proven successful at reversing land degradation trends (or at least slowing them significantly). Benefits of investing in improving land management have a high rate of return in economic terms[147] and have also been shown to accrue to small farmers and poor rural households.[148] Much of the damage of floods and droughts can be reduced by good land management practices that increase the water holding capacity of soils, reduce runoff, reduce the siltation of rivers and streams, and protect natural catchments such as wetlands.

142 Authors calculations based on mission findings, August 2017.

143 World Meteorological Organization. 2015. *Valuing Weather and Climate: Economic Assessment of Hydrological and Meteorological Services.*

144 World Bank. 2018 (b). *Assessment of the State of Hydrological Services in Developing Countries.*

145 Vincent et al. 2015. *Identifying Climate Services Needs for National Planning: Insights from Malawi.*

146 GoM. 2017(a). *The Malawi Growth and Development Strategy (MGDS) III: Building a Productive, Competitive and Resilient Nation.*

147 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

148 LTS. 2013(a). *Land Use Scenario Analysis, Task 3 Report: Integrated Assessment of Land Use Options for Climate Change Mitigation & Adaptation.*

LOCAL–LEVEL CAPACITY

Building capacity of both government and community institutions at local levels will support resilience to climate change impacts.

Policies and actions will have to be tailored for specific and varied impacts and needs based on local conditions, and no single set of interventions will work in all locations. Building the capacity to respond in this way requires local response capacity to understand both climate risks and possible responses. While the central government can provide leadership and direction, without adequate local implementation and decision-making capacity, informed choices that allow local-level responses to the changing climate will be limited. Building capacity of local-level government institutions is not just about strengthening technical capacity to implement but also looking at accountability and monitoring capacity. This will require skills that ensure transparency in reporting being central to capacity-building initiatives.

BUILT ENVIRONMENT—CLIMATE PROOFING

Improved planning of the built environment, to include design that takes account of climate impacts, can protect against the damage caused by extreme weather events.

Adequate 'climate proofing' should, at a minimum, be part of building and design regulations for public buildings such as schools and hospitals and economically important infrastructure such as major roads and bridges.

'BUILD–BACK–BETTER'

Focusing on the environment as a one of the key priorities for building resilience to natural disasters will help develop a 'build–back–better' approach.

In the aftermath of the recent droughts and floods of 2015–2017, GoM identified the environment as one of six key priorities for building resilience to natural disasters. Specifically, interventions should focus on afforestation and reforestation, natural regeneration, water points for wildlife, and early warning systems.[149]

149 GoM. 2017(j). *National Disaster Recovery Framework—Building Back a Disaster-Affected Malawi Better and Safer.*

Key environmental and natural resources management themes

Land degradation in the Shire Valley is particularly severe and has major cost impacts on hydropower generation.

5. LAND DEGRADATION

Land degradation is a continuing challenge faced by Malawi with over 60% of Malawi's land affected. It affects the livelihoods of millions of farmers and costs the equivalent of 6.8% of the country's GDP. It is caused by unsustainable land management practices and is exacerbated by increasing demographic pressures, climate change, and poorly designed agricultural support policies. It also has major impacts on a number of other sectors—including water resources, energy generation, agriculture, and fisheries.

Land degradation is defined here as "long-term loss of on-site and off-site terrestrial ecosystem goods and services, which humans derive from them."

Source: Millennium Ecosystem Assessment. 2005. Global Assessment Reports.

Efforts to address land degradation have a long history in Malawi. Large soil conservation research programs were introduced during the colonial era between 1953 and 1965 to investigate erosion and runoff and the effectiveness of conservation and types of land use. A Land Husbandry Branch was formed in 1960, which introduced a more holistic concept of 'land husbandry'. Despite these early efforts, land degradation has grown to become a major constraint to social and economic development in Malawi and limits the country's ability to cope with severe weather events, natural disasters, and longer term climate change.

However, there are promising options available to help address this challenge. In 2016, Malawi's Parliament passed 10 new laws[150] that will make fundamental changes to the status and registration of land rights. The new framework introduces a decentralized land administration and registration system and, for the first time, provides for the formalization and registration of customary rights. This new framework presents both opportunities and challenges for transformation in natural resources management and agriculture. The major opportunity is that the new legal framework offers the potential for strengthening land tenure security and thus increasing investments in more SLM approaches.

150 The Land Bill, 2016; Customary Land Bill, 2016; Physical Planning Bill, 2016; Land Survey Bill, 2016; Registered Land (Amendment) Bill, 2016; Land Acquisitions (Amendment) Bill, 2016; Local Government (Amendment) Bill, 2016; Malawi Housing Corporation (Amendment) Bill, 2016; Forestry (Amendment) Bill, 2016; and Public Roads (Amendment) Bill, 2016.

Malawi has also piloted SLM approaches that show promising results. If implemented at scale, these would boost agricultural productivity, build resilience, and protect and restore environmental services. To sustain and scale up pilot-level activities, reforms are needed to policies that currently work against sustainable land management. Establishment of results-based payment systems are also needed to create incentives over the longer term for improved land stewardship.

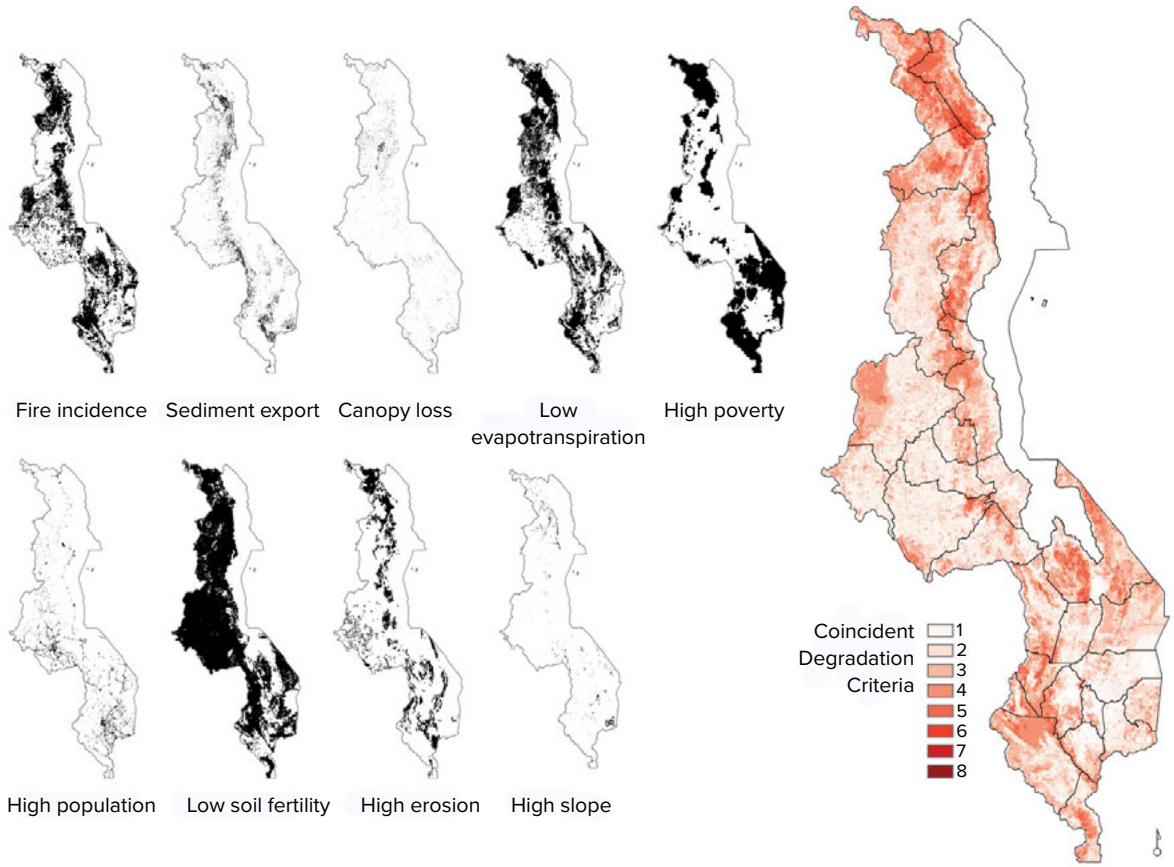
A growing challenge

Land degradation has reached alarming levels in Malawi. Evidence of the severity of land degradation in Malawi shows estimated costs of USD 244 million per year (in 2007 prices) over 2001–2009. This is equivalent to about 6.8% of the country's GDP. This figure becomes even larger when costs associated with sediment management to maintain hydropower development are factored in.

Land degradation 'hot spots' cover about 41% of the land area in the country, of which the Shire River basin is the most affected. Soil erosion and nutrient depletion are major forms of land degradation that are reported to affect more than 60% of the entire land area. The average annual national soil loss rates in 2014 was 29 tons per hectare.[151] Chemical land degradation, including soil pollution and salinization/alkalization, has led to 15% loss in the arable land in Malawi in the last decade alone.

The condition of the land, and its associated erosion and flooding, severely affect both the landscape and the livelihoods of local communities. There is also a strong correlation between areas with highly degraded land and those with a high incidence of poverty, although there is currently insufficient evidence to point to a causal link (see Figure 21).

FIGURE 21. Map showing hot spots of land degradation across Malawi



GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

151 Vargus and Omuto. 2016. *Soil Loss Assessment in Malawi.*

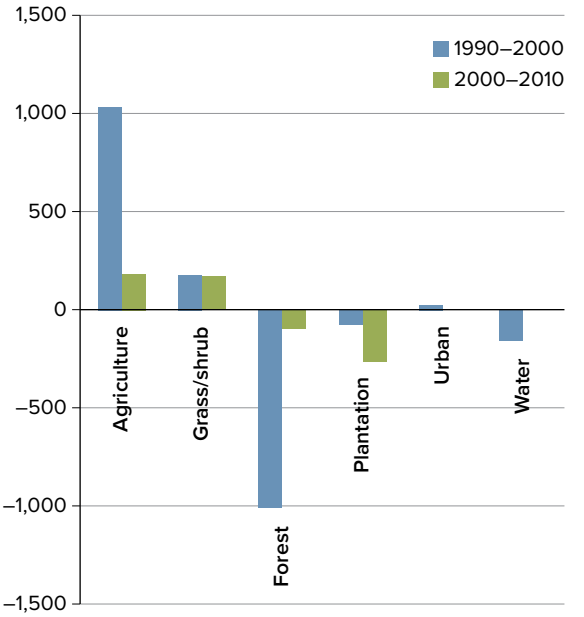
Increasingly fragile upper catchments have been cultivated as agricultural land has expanded into forest areas over recent decades, albeit at a slower rate since 2000 (see Table 5 and Figure 22). This has resulted in significant erosion, loss of soil fertility, and siltation of water bodies. Unsustainable agricultural intensification has also taken place along riverbanks and in wetlands. This degrades natural habitats, exacerbates downstream flooding, and increases exposure to weather shocks. In addition, the impact on forests has been substantial.

TABLE 5. Land use/cover in km^2 and change as % of total area of Malawi, 1990–2010

	1990	2000	2010	1990–2000	2000–2010
Agriculture	47,053	48,094	48,277	0.88%	0.16%
Grass/shrub	11,379	11,559	11,729	0.15%	0.14%
Forest	32,740	31,729	31,635	−0.86%	-0.08%
Plantation	1,239	1,162	899	−0.07%	−0.22%
Urban	1,362	1,387	1,390	0.02%	0.00%
Water	23,853	23,695	23,695	−0.13%	0.00%
Total	117,626	117,626	117,626		

Source: FAO. 2013. *Atlas of Malawi: Land Cover and Land Cover Change 1990–2010.*

FIGURE 22. Change in land use and cover, 1990–2010, in km^2



Source: FAO, 2013. *Atlas of Malawi: Land Cover and Land Cover Change 1990–2010.*

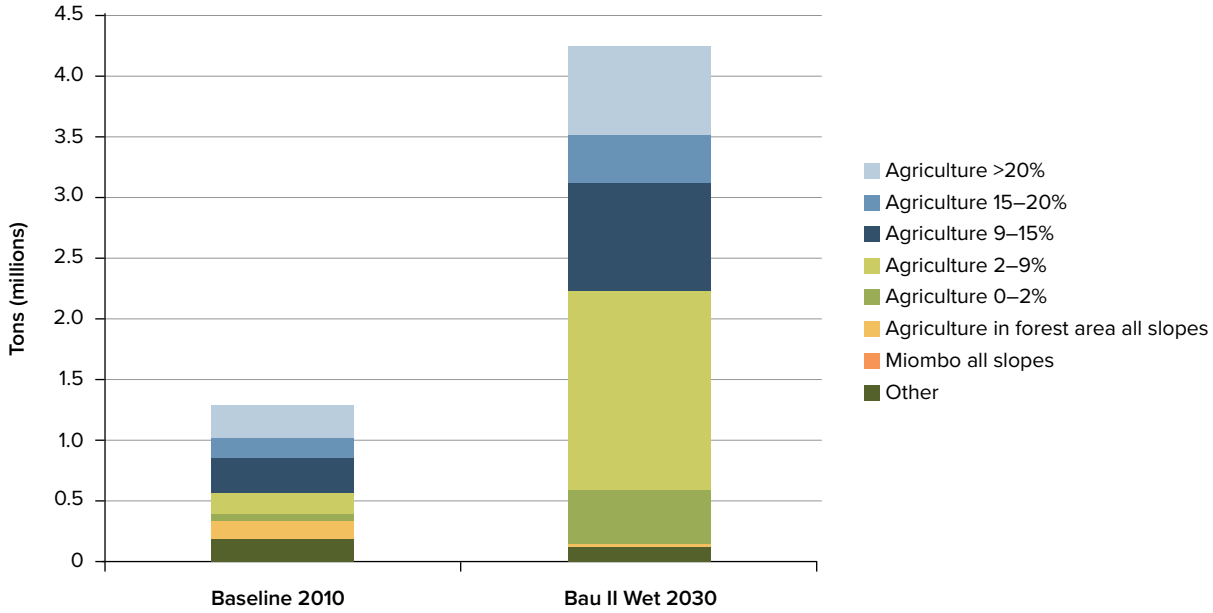
In the past, most smallholders practiced an extensive form of agriculture comprising crop-fallow systems that would replenish soil nutrients after cropping. High population growth and increasing rural population densities have led to the abandonment of these practices and generally, farmers no longer use fallow periods nor crop rotations that alternate maize with grain legumes. Manure is not widely available or used due to low numbers of livestock.[152] As a result, mono-cropping with maize has resulted in large-scale loss of soil nutrients in the soils, particularly nitrogen. Projections for future land degradation and soil loss under different climate and population growth rate scenarios suggest that land degradation will become increasingly severe. Figure 23 shows projections for the Linthipe-Nkhotakota basin, comparing the 2010 baseline with projections that assume a continuing high population growth rate and wet climate scenario.[153] This suggests that overall rates of soil loss will increase by between three and four times 2010 baseline levels. This implies high costs associated with inaction to address land degradation. Nkonya et al. (2016)[154] present such data on a district by district basis, and data for districts in the Shire basin are shown in Box 4.

152 LTS. 2013(a). *Land Use Scenario Analysis, Task 3 Report: Integrated Assessment of Land Use Options for Climate Change Mitigation & Adaptation.*

153 LTS. 2013(b). *Integrated Assessment of Land Use Options in Malawi. Land Use Investment Plan. Annex 5b. Linthipe-Nkotakota Lake Shore Data Annex.* Submitted to World Bank and Government of Malawi.

154 Nkonya et al. 2016. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development.*

FIGURE 23. Quantity of soil loss per slope class projected to 2030 assuming high population growth and wet climate scenario

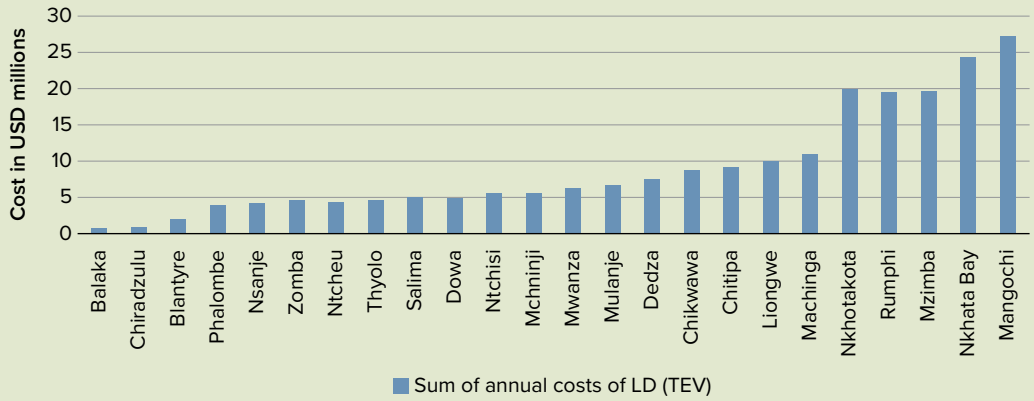


Note: Total soil yield for January (millions of tons) for Linthipe-Nkhotakota lakeshore for key land uses by slope class. January monthly data for five-year average 2001–2005 (for Baseline 2010) and 2027–2031 (for BAU II Wet 2030 Scenario)—high population growth and wet climate.

BOX 4. Land degradation in Shire River basin

The Shire River basin is the most prominent hot spot of land degradation in Malawi. Deforestation, soil erosion, and sedimentation form the most serious threats to the ENR base in the Shire River basin. High loads of sediments are deposited in river beds, reservoirs, and floodplain wetlands, affecting irrigation canals, fisheries, and hydropower generation. Water resources are increasingly degraded through silt loads, sedimentation, eutrophication, biological contamination, and effluents. As an example, the Mangochi district in the upper catchment of the Shire River basin experiences the highest costs of land degradation and inaction nationwide (Figure 24). Given the economic and social importance of the Shire River basin for economic growth, poverty reduction, and food security, it is critical to address the root causes of the deteriorating ENR base in the basin.

FIGURE 24. Land degradation in Malawi: Cost of action and inaction (USD, millions)



Source: Nkonya et al. 2016. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development.*

Note: LD = Land degradation; TEV = Total economic value.

Impacts from agriculture interventions have had mixed results. FISP has been subsidizing fertilizer and (mostly) maize seeds since 2005. Yields initially increased, but these initial gains have now levelled off. These input subsidies also worked against diversification by encouraging the planting of maize in areas that are often poorly suited to this crop, including marginal areas on steep slopes. Only comparatively recently has the choice of seeds provided through FISP been diversified. Furthermore, indiscriminate use of fertilizers has not been enough to compensate for failing soil fertility,[155] and the resulting modest increase in yields and returns was often insufficient for farmers to reinvest in fertilizer in subsequent years.

The combined result has been an ongoing loss of soil fertility and farmers continually searching for new land for cultivation—often at the expense of forests. The enormous cost of FISP has also left little capacity to fund other initiatives that could help farmers reduce dependence on unsustainable farming practices. FISP accounted for 75% of the budget for agriculture or 3% of GDP in FY2014/15.[156] Further analysis is needed to confirm the impacts on land degradation of these agricultural interventions.

Poor and eroded soils have been shown to thwart poverty reduction.[157] Various mechanisms link degraded soils to increased poverty:

- Lower soil productivity reduces incomes and capital accumulation, making it harder for households to access and invest in nutrients to boost soil productivity.[158]
- Loss of soil nutrients reduces the micronutrient content of crops, which can impair human health.[159]
- Land degradation increases exposure to climate shocks and associated price volatility.[160]
- Pests and weeds that decimate cropland are more common in degraded soils.[161]
- Land degradation increases costs to farmers since additional investments are needed to reduce erosion and nutrient depletion.

Drivers of land degradation

Many underlying factors drive land degradation in Malawi. These include growing demand for agricultural land, insecure land tenure, unsustainable land management practices, a weak policy environment and weak institutions, and limited access to markets and rural finance. Important biophysical factors affect land degradation, including topography, land cover, climate (especially erosive rainfall), and soil erodibility. The greater the length and steepness of slope, the greater the soil erosion. Sloped lands are particularly vulnerable to soil erosion if they have inadequate vegetative cover and no physical barriers to prevent runoff. River and streambanks, for example, only cover 0.4% of Malawi's land area. Yet their wide-scale degradation has effectively removed natural sedimentation traps and vital buffer functions against floods and natural disasters.[162]

Land tenure insecurity among smallholders, especially women, is high. In the 2016–17 Integrated Household Survey by the World Bank, 33% of households indicated that they lacked confidence that they would still possess their plot of land in 10 years' time.[163] Insecure tenure reduces incentives to invest in higher-value crops or soil conservation measures and results in lower levels of productivity and land degradation. Female-managed plots are 25% less productive than plots that are managed by males, constrained by lower use of inorganic fertilizer and adult male labor and restricted access to agricultural tools.[164]

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155 Record et al. 2017. *Policy and Institutional Actions for Moving beyond "Business as Usual" to Achieve Stable and Sustained Growth and Poverty Reduction.*

156 Record et al. 2017. *Policy and Institutional Actions for Moving beyond "Business as Usual" to Achieve Stable and Sustained Growth and Poverty Reduction*. From *Falling Behind to Catching Up: A Country Economic Memorandum for Malawi.*

157 World Bank. 2018(a). *Hidden Dimensions of Poverty: Economic Development and Sustainability [draft].*

158 Barrett and Bevis. 2015. *The Self-Reinforcing Feedback between Low Soil Fertility and Chronic Poverty*; Eswaran et al. 1997. *An Assessment of the Soil Resources of Africa in Relation to Productivity.*

159 Bevis. 2015. *Soil-to-Human Mineral Transmission with an Emphasis on Zinc, Selenium, and Iodine*.

160 Barrett and Bevis. 2015. *The Self-Reinforcing Feedback between Low Soil Fertility and Chronic Poverty*.

161 Ayongwa et al. 2011. *Host-Parasite Dynamics of Sorghum Bicolor and Striga Hermonthica—The Influence of Soil Organic Matter Amendments of Different C:N Ratio*.

162 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

163 World Bank. 2017(a). *Malawi Economic Monitor: Harnessing the Urban Economy*.

164 World Bank. 2013(b). *Caught in Productivity Trap. A Distributional Perspective on Gender Differences in Malawian Agriculture.* Policy Research Working Paper No. 6381.

Poor land management practices, including the clearing of forests and river banks, annual burning, and heavy footpath use, continue to accelerate soil erosion. Deforestation is associated with continued demand for agricultural land, charcoal and wood fuel extraction, and unsustainable timber production. Unsustainable agricultural land management practices include slash and burn with short rotations and hillside and riverbank cultivation,[165] and most smallholder farmers still cultivate using unimproved traditional methods. There are limited improved inputs, land husbandry is minimal, and water and soil conservation is not widely practiced. Ridging is generally practiced, except in the lower-lying regions, but only about 12% of cultivated land has ridges on contours, which is the recommended method.

Access to credit and finance can substantially improve prospects for adoption of SLM. Until recently, local options for borrowing have been confined mainly to Village Savings and Loans Associations,[166] cash-earning opportunities from day labor ('ganyu') and the sale of firewood/charcoal, and traditional rotating savings groups (for example, Chilemba or Chiperegani).[167] Recent experience in the Shire Valley also demonstrated that village-managed revolving funds can play a key role in boosting adoption rates (Box 5).

BOX 5. Creating incentives for farmer adoption of SLM practices

SLM integrates land, water, biodiversity, and environmental management to meet rising food and fiber demands while sustaining livelihoods and the environment. It typically involves activities that

- Preserve and enhance the productive capabilities of cropland, forestland, and grazing land (such as upland areas, downslope areas, flatlands, and bottomlands);
- Sustain productive forest areas and potentially commercial and noncommercial forest reserve conservation zones;
- Maintain the integrity of watersheds for water supply and hydropower generation needs and water conservation zones; and
- Maintain the ability of aquifers to serve the needs of farm and other productive activities.

With World Bank support, Malawi has prepared national catchment management guidelines[168] that incorporate SLM approaches, and these are being applied in the Shire River basin. Participatory planning at sub-catchment and village levels, supported by investments in SLM and infrastructure to improve market access, has shown promising results in the four sub-catchments targeted under the Shire River Basin Management Program (Figure 25).[169]

Adoption rates were improved by the introduction of the Community Environmental Conservation Fund (CECF).[170] Unlike other similar approaches, which have paid people based on the delivery of specific conservation works, the CECF works by providing money for the establishment of a credit fund to communities that have collectively agreed to implement an environmental management plan.

Using this approach, environmental management work is promoted, undertaken, and monitored by whole communities to ensure receipt of the credit facility. The money itself can be borrowed and used for any purpose, for example, from paying school fees and hospital and doctors' bills to investments and other activities. Thus, the provision of the fund delivers improved environmental management because it enables improvements in livelihoods by removing barriers to accessing credit and not by prescribing specific actions. This proved much more effective than 'traditional' conservation funds because livelihood priorities are very dynamic and dependent on the status of a household at any point in time.

165 World Bank. 2006. *Sustainable Land Management: Challenges, Opportunities and Trade-offs.*

166 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

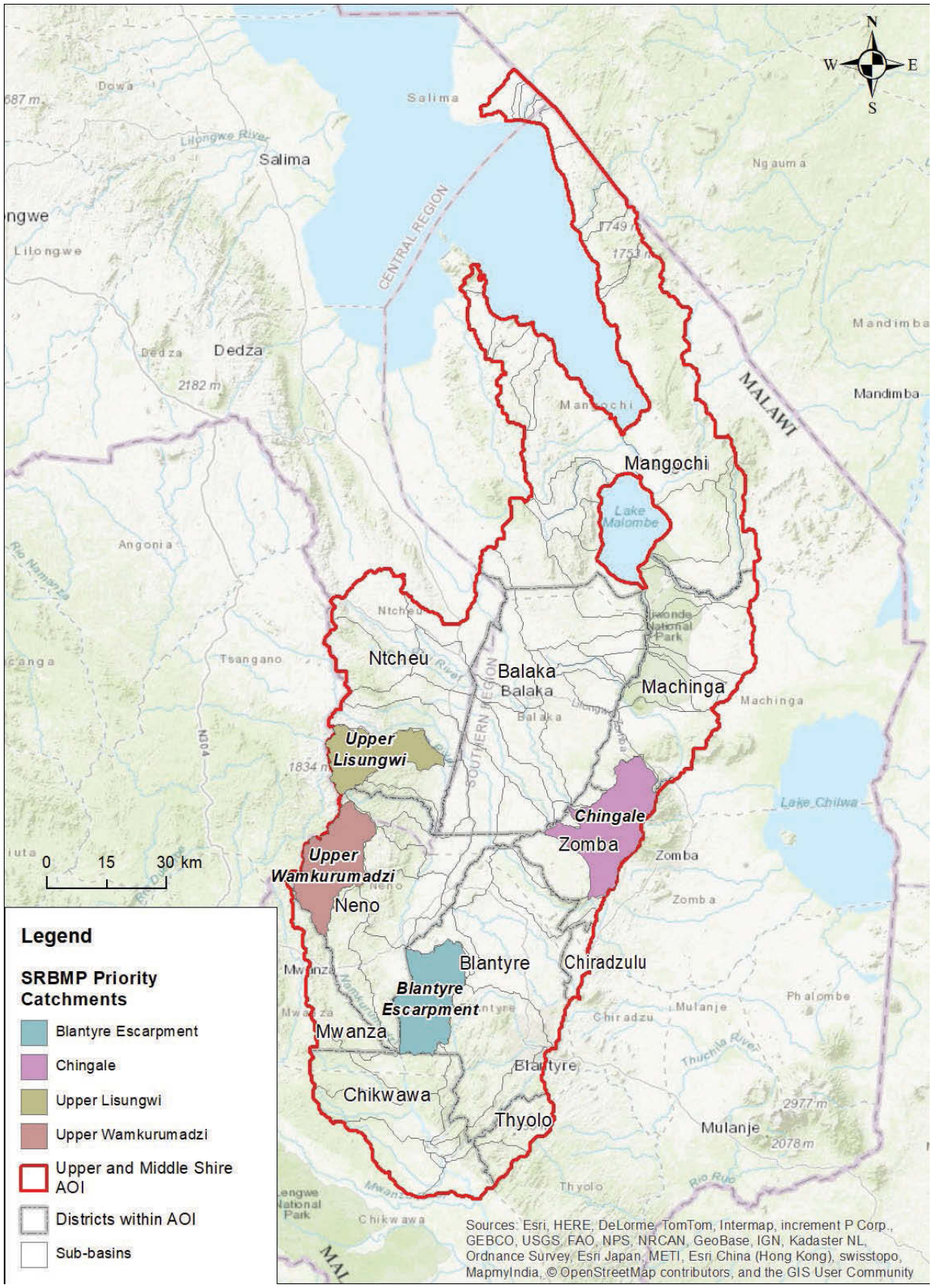
167 Ibid.

168 GoM. 2016(c). *Malawi National Guidelines: Integrated Catchment Management and Rural Infrastructure.*

169 UNIQUE. 2018a. *Landscape Level Analysis of Land and Natural Resources Degradation in Kenya, Malawi and Uganda.*

170 Based on an approach first developed by the IUCN in Uganda.

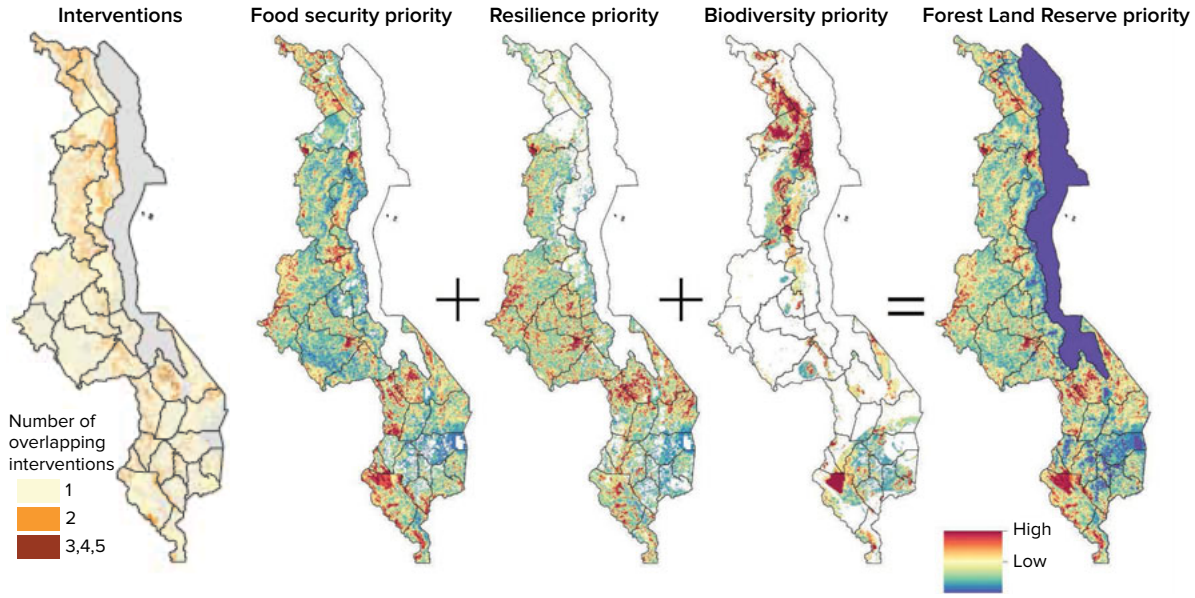
FIGURE 25. Priority sub-catchments targeted under the Shire River Basin Management Program



Institutions and policy

The challenge posed by land degradation has been acknowledged at the government level. GoM has committed to a number of international environmental strategies. Malawi's NDC submission to the UNFCCC points out the importance of improving approaches to SLM at the watershed level. It also stresses the need to encourage climate-resilient agricultural and land husbandry. A National Forest Landscape Restoration (NFLR) Strategy[171] was developed in 2017, which was specifically designed to help address these challenges. One objective of the Malawi National Agriculture Investment Plan[172] is an annual increase in the area under sustainable land and water management of 15,000 ha. GoM also responded to the Bonn Challenge and Africa100 with a commitment to restore 4.5 million ha of degraded land—although it remains unclear where the financing will be found to deliver on this commitment. Figure 26 shows findings from multicriteria analysis used to identify priority landscape restoration areas at the national level. In addition, a new National Charcoal Strategy[173] is being implemented that seeks to reduce forest degradation from unsustainable wood fuel collection by promoting alternative cooking fuels, efficient cookstoves, and sustainable charcoal production (see the **Biomass energy** section for more details on this strategy).

FIGURE 26. Malawi landscape restoration multicriteria analysis



Source: GoM. 2017(e). Forest Landscape Restoration Opportunities Assessment for Malawi.

Renewed efforts are needed for the decentralization of government functions to address degradation drivers and accelerate restoration opportunities. Since the adoption of the 1998 Malawi Decentralization Policy (aimed at bringing decision-making and governance closer to communities), there have been inconsistencies in aligning control over budgets and interventions between the central and district levels. This has been compounded by a need for coherence and coordination between key policies to speed up and enable adoption of restoration activities[174] with delivery through to the most decentralized levels of government.

Advisory services provided by the government's extension services, universities, and NGOs could play a key role in supporting and raising farmer knowledge. Established in 1949, Malawi's extension services are organized at five levels: national, divisional, district, area, and section.[175] Poor access to services is often blamed on staff shortages for the Agricultural Extension

171 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

172 GoM. 2018. *National Agriculture Investment Plan.*

173 GoM. 2017(f). *National Charcoal Strategy 2017–2027.*

174 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.* The conclusion was drawn from a comprehensive review of the policy framework linked to forest and land degradation.

175 UNIQUE. 2018(a). Landscape Level Analysis of Land and Natural Resources Degradation in Kenya, Malawi and Uganda.

Development Officer positions and their level of skills. However, in the absence of access to advisory services, other services are emerging:

- Short-term training by the Lilongwe University of Agriculture and Natural Resources (LUANAR) together with the MoAIWD
- Directed support to Lead Farmers who are considered village leaders and early adopters
- Farmer-to-farmer extension through Farmer Field School approaches

The VNRMCs could be key to achieving and operationalizing land restoration. Instituted through the Forestry Act in 1997, the VNRMCs are mandated with the restoration of degraded land and other key natural resources management such as forest management, protection of catchments and fragile areas, and soil and water conservation. This allows them to solicit external technical and financial support from, for example, private sector and NGOs. Where VNRMCs are operational, they play an advisory role to the Village Development Committee (VDC), whose members are elected at the village level. Ideally, the VNRMC participates in the VDC-managed Village-Level Action Plan (VLAP).[176]

Economic context and impact

Land degradation costs are estimated to be equivalent to about 6.8% of the country's GDP. Using a total economic valuation approach, Nkonya et al. (2016)[177] estimated that the annual costs of land degradation between 2001 and 2009 amounted to USD 244 million per year (in 2007 prices)—about 6.8% of GDP. However, another recent economic analysis of the costs of land degradation[178] suggests that the costs are nearly double this. This later analysis factored in the economic contribution of ecosystem services for soil and water conservation by including costs associated with sediment management for hydropower production. Data show that the power utility ESKOM spent around USD 150,000 per ton in 2017 on sediment management to enable operation of the hydropower facilities at Kapichira. Using 2016 data from FAO,[179] data for maximum soil loss by district, and assuming that 25% of eroded sediment reaches the hydropower scheme raises the annual cost estimate to USD 478.8 million, a figure that would double if it is assumed that 50% of sediment reaches the hydropower facilities.

By contrast, investing in SLM practices would show significant returns, hence reducing the cost of land degradation. Nkonya et al. (2016) estimated that for each dollar spent addressing land degradation, approximately USD 4.3 would be returned over 30 years. In addition, the government's 2017 Forest Landscape Restoration Opportunities Assessment estimated that restoring 2.4 million ha of degraded cropland would increase production. For example, restoration would increase maize production by 1.55 million mt per year, an increase of 40%.[180] However, these figures need to be treated with some caution as they assume very high adoption rates.

Adoption of SLM practices and technologies needs to be financially attractive to smallholder farmers and offer early returns on the investment. Probably the most important prerequisite for substantial uptake of SLM practices is their financial attractiveness from a farmer's perspective. Recent cost-benefit analysis of SLM implementation in the Shire River basin has shown that benefits can accrue fairly rapidly, and small farmers are the main winners from SLM investments. Many activities break even within one or two years.[181] However, some have longer payback periods, which discourages poorer households from adopting some SLM practices. Elsewhere in Southern and East Africa there are high

176 UNIQUE. 2018(a). Landscape Level Analysis of Land and Natural Resources Degradation in Kenya, Malawi and Uganda.

177 Nkonya et al. 2016. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development.*

178 UNIQUE. 2018. *Landscape Level Analysis of Land and Natural Resources Degradation in Kenya, Malawi and Uganda.*

179 Vargus and Omuto. 2016. *Soil Loss Assessment in Malawi.*

180 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

181 LTS. 2013(a). *Land Use Scenario Analysis, Task 3 Report: Integrated Assessment of Land Use Options for Climate Change Mitigation & Adaptation.*

de-adoption rates for SLM techniques such as conservation agriculture and agroforestry—often because labor requirements are high and/or subsidies end.[182]

However, large up-front investment costs and lack of rapid returns constrain farmer adoption, and this has resulted in failed interventions. For example, one study showed that to achieve a positive cash flow, beneficiaries needed to invest USD 100 (at 2013 prices) over the first few years. It is clear that the decisions to invest do not solely rely on high returns.[183, 184] Access to finance is critical among the factors that encourage the uptake of SLM.[185]

At the farm level, enterprise budgets for different SLM techniques show that very promising returns are available if up-front investment and additional initial labor costs can be addressed. For example, conservation agriculture with legume intercropping could generate double the returns compared with 'business as usual' maize with fertilizer use (as supported by FISP)—USD 998 compared with USD 467 per hectare per year.[186] For example, community woodlots generate attractive benefits to smallholder farmers—which are estimated at USD 292 per hectare over 20 years and show an internal rate of return of 28%. Importantly, smallholders can generate short-term benefits by harvesting and selling wood fuel five years after woodlot establishment. However, they also require substantial up-front investments. Conversely, forest management emerges as a costly restoration option for private benefits but becomes attractive when public benefits (such as slope protection, improved resilience, and biodiversity) are considered.

The degradation of land as natural capital directly affects various important economic sectors such as agriculture and forestry. Other sectors such as energy, fisheries, and tourism experience direct or at least indirect effects of a deteriorating land resource base. These sectors contribute in various ways:

- **For supporting economic activity,** the agriculture sector contributes 28% of Malawi's GDP[187] (2016)[188] and 78% of export earnings[189] (2015). The forestry sector contributes 6.2% to the GDP, which does not account for the value of non-wood forest products, processed timber, or the enormous informal trade in wood fuel and charcoal.
- **For supporting livelihoods,** agriculture employs 64% of the workforce, which consists mainly of subsistence farmers. Smallholders account for 80% of agricultural production and 70% of agricultural GDP.[190] Some 33,000 jobs are heavily dependent on the existence of Malawi's forests, 75% of whom are in household businesses.[191, 192] Moreover, household use of wood fuel provides a very significant contribution in kind to incomes. Approximately 2.8 million households depend primarily on wood fuel for cooking, and the average value of their consumption is almost MK 23,000 per year.[193]
- **As a provider of environmental services,** forests provide a range of environmental services, such as GHG mitigation, watershed regulation, climate regulation, soil and water conservation, biodiversity support, and nutrient cycling. The nine protected areas that are part of the Shire River Basin Management Program store an estimated 80 million tons of CO_2e.[194] Of high relevance in the Shire River basin is the role of SLM (in particular of intact forest ecosystems) to avoid siltation of hydropower facilities.

182 There is considerable literature on actual levels uptake of conservation agriculture and related techniques in the region. **For Zambia,** see Baudron et al. 2007. *Conservation Agriculture in Zambia: A Case Study of Southern Province;* Umar et al. 2011. *Options for Improving Small-holder Conservation Agriculture in Zambia.* **For Mozambique,** see Sacramento et al. 2010. *Climate Change Impacts and Coping Strategies in Chicualacuala District, Gaza Province, Mozambique.*

183 Nkonya et al. 2016. *Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development.*

184 CIMMYT. 1988. *From Agronomic Data to Farmer Recommendations: An Economics Workbook.*

185 See Annex 6 for more information about SLM.

186 MoIWD. 2016. *National Guidelines for Implementing Conservation Agriculture in Malawi.*

187 The Global Economy. 2012. *LPG Consumption: Country Rankings.*

188 The agricultural sector is the largest employer of workers in Malawi, with around 59% of men workers and 70% of women workers.

189 WITS. 2015. *Malawi Trade Summary 2015 Data.*

190 World Bank. 2017(b). *Republic of Malawi Poverty Assessment.*

191 Casey and Kafakoma. 2013. *Institutional Assessment of the Forestry Sector and Organisational Review of the Department of Forestry.*

192 Women make up 70% of Malawi's smallholder farmers, provide 70% of work in this sector, and produce 80% of food for home consumption.

193 Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems Malawi Policy Briefing Report.*

194 Bayliss. 2015. *Carbon Storage Analysis of select Protected Areas under the SRBMP.*

Key recommendations

REFORM INCENTIVES FOR FARMER-LEVEL SCALE-UP OF SLM PRACTICES

Better alignment of policy reforms and investments that tackle land degradation with the adjustment of input subsidies could be transformational.

A priority is to invest properly in the implementation of Malawi's recent land tenure reforms. These will increase tenure security and incentives for landholders to invest in SLM measures. This will improve land tenure security and reduce land degradation and increase productivity. However, existing input subsidies work in the opposite direction—by constraining crop diversification, encouraging maize cropping on steep slopes and other marginal areas, and 'crowding out' other spending priorities that could otherwise help increase productivity and build resilience (for example, investments in extension, water storage, and irrigation). Improved targeting of subsidies could reduce the overall fiscal burden that these impose on the national budget. An opportunity exists to reform subsidies in a way that promotes better land stewardship and boosts productivity. This could include directing subsidies to support SLM interventions—including climate-resilient agriculture.

ELEVATE LAND RESTORATION TO A NATIONAL POLICY PRIORITY

Efforts to address forest and land restoration need to be elevated to national priority status and consistently set across policies and laws.

The government's NFLR Strategy,[195] published in July 2017, proposed that land restoration should be elevated to a higher national priority level, backed by financial investment to support the implementation of a range of national programs that would restore 4.5 million ha of land and forests as committed, for example, in the government's pledge to the Bonn Challenge and the AFR100 initiative. GoM acknowledges the challenges of land degradation in the context of climate change and economic development as evidenced by its NDC submission to the UNFCCC. The NDC points out the importance of SLM at the watershed level and the need to encourage climate-resilient agriculture and land husbandry. Appropriate legal provisions, investment funding, incentives, and compliance mechanisms, together with a clear role for traditional authorities, will be needed to deliver this.

INVEST IN SUSTAINABLE LAND MANAGEMENT

Adoption of SLM practices and technologies needs to be financially attractive to smallholder farmers, including early returns.

Probably the most important prerequisite for substantial uptake of SLM practices is their financial attractiveness from a farmer's perspective. Public investments can help address up-front costs in the short term, and benefits can then accrue relatively rapidly to small farmers who become the main winners from SLM investments. Many activities break even within one or two years.[196] However, some have longer payback periods, which discourages poorer households from adopting some SLM practices. As the economic analysis shows, investments that increase uptake of SLM will also deliver major public gains—in particular through reducing costs associated with siltation.

195 GoM. 2017(d). *National Forest Landscape Restoration Strategy.*

196 LTS. 2013(a). *Land Use Scenario Analysis, Task 3 Report: Integrated Assessment of Land Use Options for Climate Change Mitigation & Adaptation.*

DEVELOP A RESULTS-BASED MECHANISM TO DELIVER ENVIRONMENTAL SERVICES

Recent efforts to pilot payments for ecosystem services (PES) schemes in Malawi should be supported and taken to scale.

Recent analysis indicates that the large difference between opportunity costs and avoided costs associated with addressing land degradation creates an opportunity to establish a workable PES mechanism that could generate a continuous flow of revenues for supporting SLM practices in priority areas. These areas are known and could be targeted by PES schemes. Recent piloting in the Shire River basin of the CECF, a village-level revolving fund mechanism, has shown promising results when combined with participatory planning at catchment and village levels and with complementary investments that improve farmer access to markets. This approach could be funded by a PES mechanism and scaled up more widely in Malawi.

6. FORESTS AND WOODLANDS

Malawi's forests and woodlands play a key role in supporting livelihoods and protecting ecosystem services. They supply a wide range of products, including timber and non-timber forest products. Wood fuels (discussed below) dominate Malawi's energy sector and are used by 98% of the population. The industry provides large numbers of jobs and is worth nearly USD 295 million per year—equivalent to 4% of GDP. Forests and woodlands also play a key role in protecting watersheds from erosion, sustain the biodiversity that underpins a large proportion of Malawi's tourism sector, and make an important contribution to mitigating carbon emissions by sequestering carbon (forest loss and degradation are by far the largest contributors to Malawi's national GHG emissions).

Forest degradation and loss are among the biggest environmental challenges facing Malawi. The degradation and loss of forests contribute to land degradation, which leads to sedimentation of rivers and water intakes, and account for Malawi's largest share of GHG emissions. This process has been ongoing for almost half a century. Malawi's forests are lost as land is converted to agriculture, and individual trees in forests and on farms are cut for fuel, construction materials, or other purposes.

Deforestation is a major cause of land degradation in Malawi.

Status of Malawi's forests

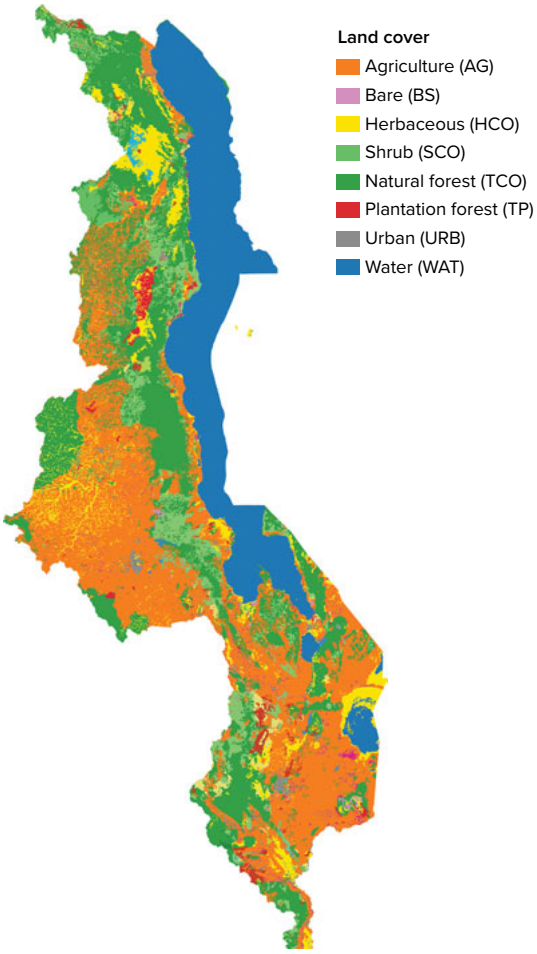
Malawi lacks a consistent set of time series data on land use/land cover (LULC). Several different data sources provide an overall indication of the magnitude of forest loss over time. However, these data are based largely on remote sensing imagery, which unfortunately shows little about forest degradation. The different methodologies used for forest cover mapping introduces discrepancies between different estimates for forest cover loss. Between 1972 and 1992, over half of Malawi's natural forests have been lost. This amounted to an average annual loss of 2.5%.[197] Because the methodology

197 Kainja. 2001. *Forestry Outlook Studies in Africa (FOSA)—Malawi.* Data available in Annex 7.

and data underlying this figure are no longer available, it may not be precise, but it does give a sense of the magnitude of forest loss during this period.[198]

LULC data[199] shows a much slower rate of forest decline between 1990 and 2000—0.85% loss of natural forest per year. Between 2000 and 2010, this figure dropped to just 0.08% annual loss. This could be the result of a reduction in the availability of land available for conversion since most of the former forest land suitable for agriculture had already been converted. Figure 27 shows 2010 LU/LC based on these data (Annex 7).

FIGURE 27. Land cover, 2010



Source: FAO. 2013. *Atlas of Malawi: Land Cover and Land Cover Change 1990–2010.*

Landsat's land cover data used by Global Forest Watch (Figure 28) suggests that the rate of tree cover loss may have risen between 2000–2010 and 2010–2016,[200] although it should be noted that the interpretation of data from 2011 onward changed in a way that would show higher losses.[201]

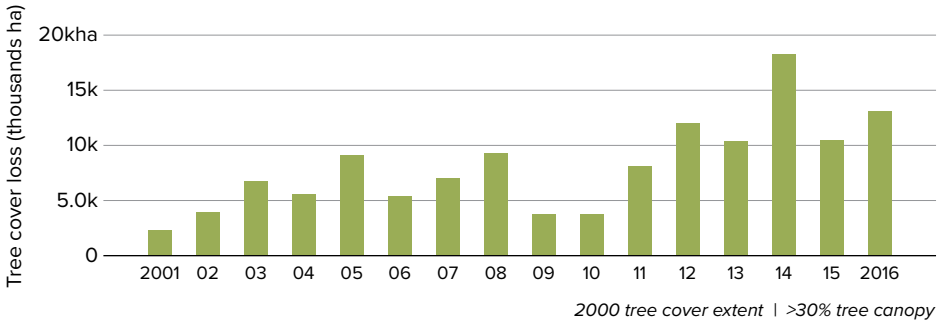
198 Clement Chilima, Director, DoF. 2 May 2018. Comment made at workshop in Malawi.

199 FAO. 2013. *Atlas of Malawi: Land Cover and Land Cover Change 1990–2010.*

200 Hansen et al. 2013. *HIgh-Resolution Global Maps of 21st-Century Forest Cover Change.*

201 Global Forest Watch. 2018. *Malawi Tree Cover Loss.*

FIGURE 28. Change in tree cover, 2000–2016



Source: Global Forest Watch. 2018. *Malawi Tree Cover Loss.*

Spatial data analysis indicates that forest loss has been considerably slower in protected areas in comparison with forests with other types of tenure. Figure 29 shows how forest cover has changed in the Mzimba and Mzuzu districts, where there has been considerable change since 2010.[202] Figure 30 shows the location of all of Malawi's protected areas.

Drivers of forest change

Forest loss and degradation are driven by a complex mix of interrelated forces that are connected to issues of land degradation, agriculture, biomass energy, and biodiversity loss. Identifying and ranking the drivers of forest change has been a focus of the national program for reducing emissions from deforestation and forest degradation programme (REDD+)[203, 204] and the analysis below is consistent with the findings of the REDD+ analysis of drivers (Box 6).

BOX 6. REDD+ readiness and forest monitoring

Since 2014 Malawi has been developing REDD+ readiness, with support from USAID through its Enhancing Capacity for Low Emissions Development and Protecting Ecosystems and Restoring Forests (PERFORM) projects and from the UN-REDD.

A key component of this work is inventorying and monitoring change in carbon sequestration and LULC nationwide to demonstrate additionality required for carbon trading and to provide a baseline against which to monitor changes in forest carbon stocks.

As part of Malawi's REDD+ efforts, Malawi has prepared a road map for developing a national forest management system.[205] This road map has developed a typology of primary and secondary drivers of deforestation and forest degradation, a standardized Malawi LULC classification scheme, and has started work on a forest inventory—the first such inventory since 1992.

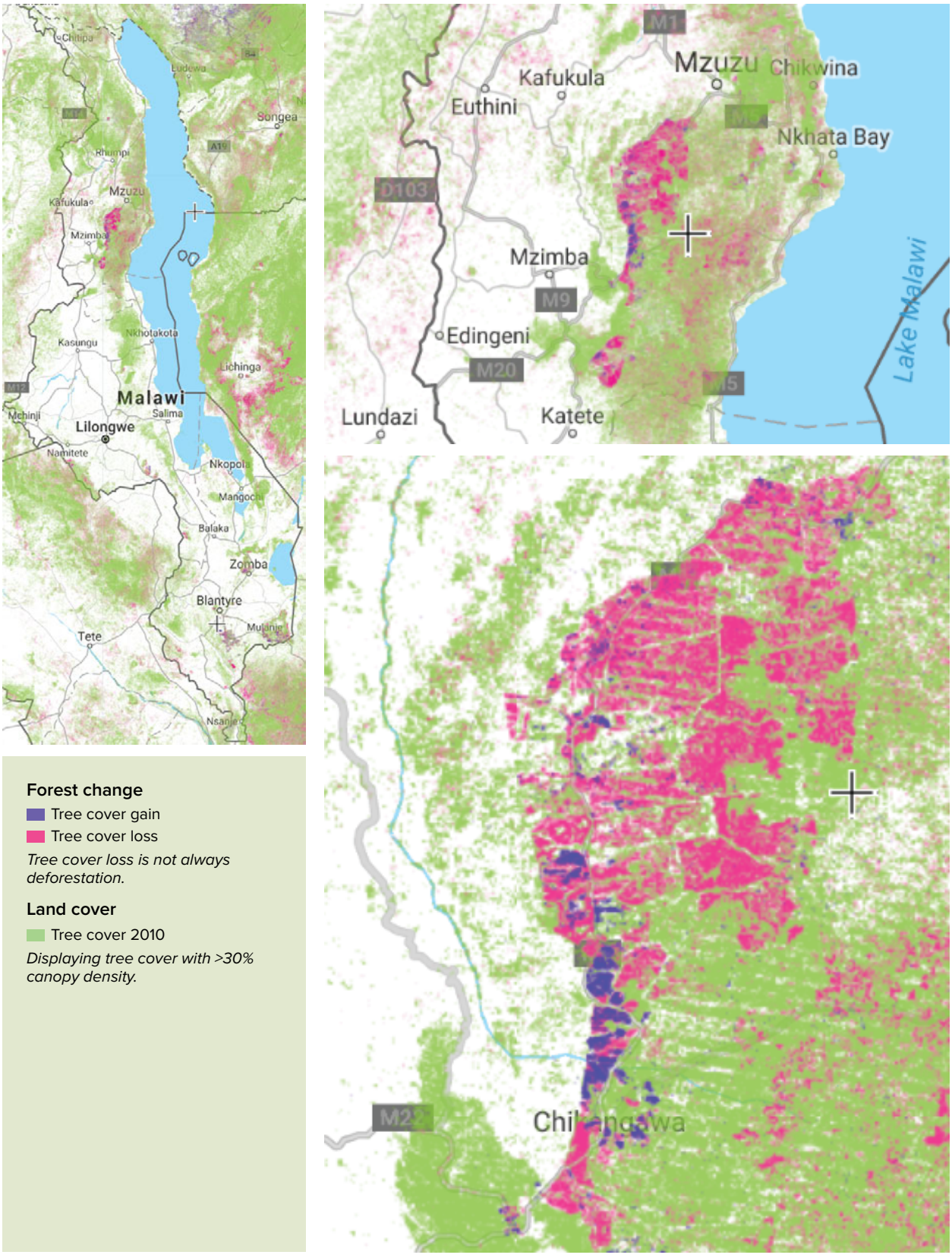
202 This was taken from Global Forest Watch, which used Landsat data on forest cover and loss.

203 LTS. 2015. *Qualitative Analysis of Drivers of Deforestation and Forest Degradation in Malawi.*

204 The REDD+ readiness analysis is based on standard methodology applied across REDD+ participating countries and is based on expert opinion.

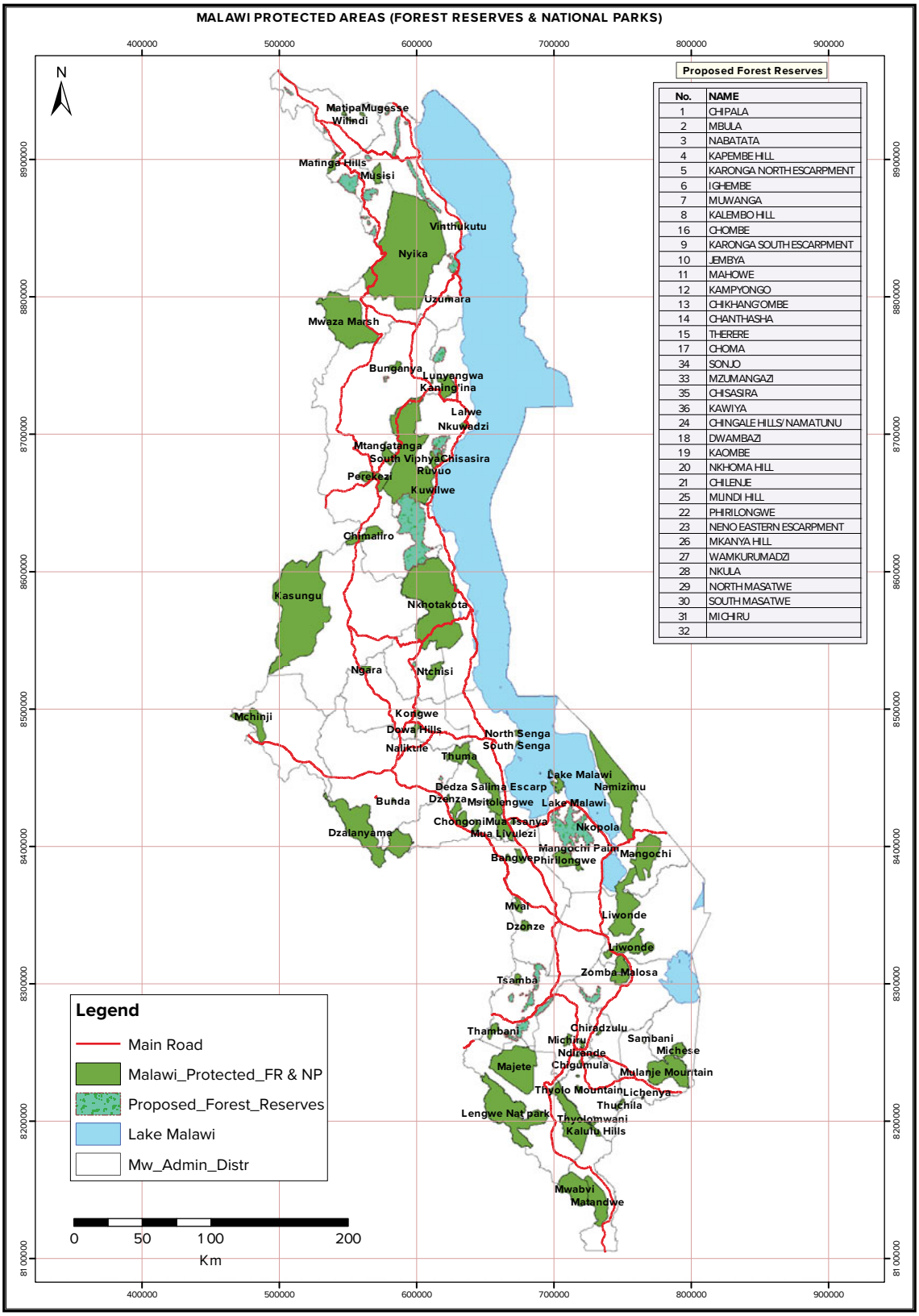
205 GoM. 2015(f). *Roadmap for Developing Malawi's National Forest Monitoring System.*

FIGURE 29. Change in forest cover—national, subnational, and local



Source: Hansen et al. 2013. *High-Resolution Global Maps of 21st-Century Forest Cover Change.*

FIGURE 30. Malawi forest reserves



Source: Map supplied by the Department of Forestry (DoF).

Increasing demand for biomass fuels and agricultural land is the principal driver. Growing demand for construction wood is another driver. Construction wood can be managed sustainably on plantations but is often harvested at unsustainable rates in natural forests. Export industries also drive the use of forest resources. Malawi's largest export is tobacco, which accounted for 55% of export earnings in 2015.[206] Tobacco is dried by burning natural woods, which places even more pressure on forest resources in Malawi and elsewhere.[207] Tobacco was estimated to cause 26% of the country's deforestation in the early 1990s. However, this assumed that all wood used for tobacco is above sustainable yield.[208] Tobacco cultivation has been dropping, and a 2010 estimate found that tobacco accounted for 7.5% of total use of naturally grown wood.[209]

Export-led demand for wood may also be coming from China, as detailed in an analysis of the *mukula* (or rosewood) trade in Zambia.[210] Faced with successive bans on mukula harvesting in Zambia, harvesting and trade to meet Chinese demand is spilling over into neighboring countries, including Malawi (although the impacts have not yet been analyzed outside of Zambia).

Fires also pose a direct threat to Malawi's forests. Miombo woodlands are to some extent resilient to fire. Fires are set to promote growth of new shoots for livestock, to flush out mammals for hunting, and to clear vegetation for planting. Fires are also set in pits for charcoal production. Fires set for these purposes often get out of control. As forests fragment, edge effects increase, which leaves remaining forest stands more vulnerable to fire. Monitoring data are not available on fire frequency, but it is highly likely that the frequency of burning in many woodland areas has increased over time. Frequent burning leads to a gradual thinning of miombo woodlands, loss of forest productivity, and a gradual transition toward savannah.[211]

Climate change is another driver that poses a threat to Malawi's forests. Climate change may slow the growth of miombo woodlands through changes in rainfall and temperature,[212] increase the pressure to convert land from natural vegetation to agriculture, and increase the length and severity of dry periods, all of which are likely to reduce sustainable yield levels and increase fire frequency.

Given the current state of global forest carbon market negotiations, it remains unclear whether results-based payment for forest carbon will eventually provide a substantive source of future revenues or incentives for sustainable forest management and conservation.[213] However, it is anticipated that these activities will in any case strengthen capacity for forest management.

Sustainability of forest use

The decline of the country's forest resources suggests that forest resources are being used at a rate higher than the sustainable yield. Forest accounts constructed for 2010[214] estimated total use of natural forest wood at about 13 million m^3 in 2010, whereas sustainable yield nationwide for miombo woodlands in 2010 was estimated to be 7 million m^3. This suggests that harvests exceed sustainable yield by about 71%. Almost all of the wood in these estimates is for energy, either firewood or converted to charcoal.

206 OEC. 2016. *Malawi.*

207 Jimu et al. 2017. *The Miombo Ecoregion up in Smoke: The Effect of Tobacco Curing.*

208 Geist. 1999. *Global Assessment of Deforestation Related to Tobacco Farming.*

209 Hecht and Kasulo. 2013(c). *Forest Sustainable Balance.*

210 Cerutti et al. 2018. *Informality, Global Capital, Rural Development and the Environment: Mukula (Rosewood) Trade between China and Zambia*.

211 Warren et al. 2001. *Causes and Consequences of Anthropogenic Fire in Mulanje Mountain Forest Reserve, Southern Malawi: Report Following 'Mulanje Fire Research' Expedition, 2001.*

212 Lehmann et al. 2014. *Savanna Vegetation-Fire-Climate Relationships Differ among Continents.*

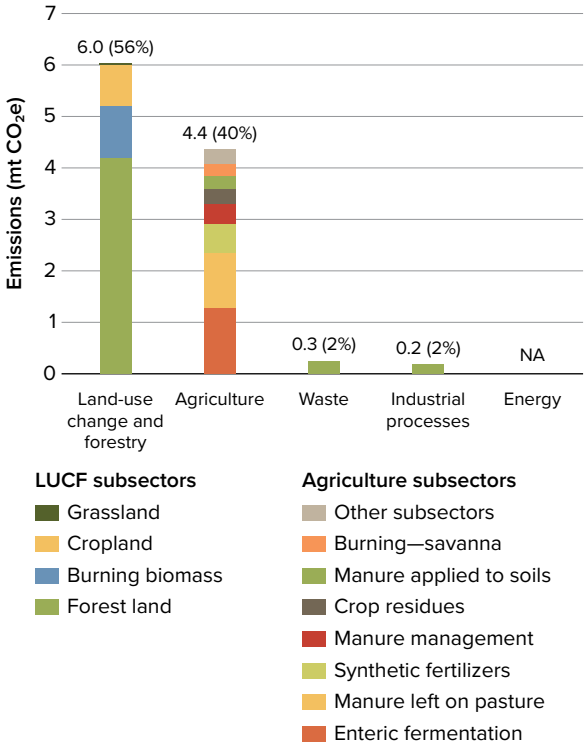
213 Hamrick and Gallant. 2017. *Unlocking Potential: State of the Voluntary Carbon Markets 2017.*

214 Hecht and Kasulo. 2013(c). *Forest Sustainability Balance* and Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems Malawi Policy Briefing Report.*

Forest sector GHG emissions

Forest loss and degradation are also major contributors to Malawi's GHG emissions. Figure 31 shows the composition of GHG emissions in 2011, based on a combination of primary data sources.[215] Land use change and forestry (LUCF) accounted for 56% of the total quantified emissions, and agriculture for 40%. Within LUCF, forestry was responsible for 70% of emissions. Malawi's GHG emissions are small by global standards and are caused mainly by land management and degradation, deforestation, and forest degradation. The cropland portion of forestry emissions may be attributable to the management of on-farm trees, although it is not possible to distinguish this contribution from the available data.

FIGURE 31. Composition of Malawi's GHG emissions, 2011



Source: USAID. 2016. *Greenhouse Gas Emissions in Malawi.* They report that no data were available for energy sector emissions, so their report, and this figure, omit that source altogether.

Economic and other consequences of forest loss

Income and wealth

Forests, forest-based enterprises from both forests and on-farm trees, and protected areas are important contributors to Malawi's economy. They account for 4.3% of the country's total wealth and 8% of its natural capital. Although the country's national income accounts show the forest sector contributing only 1% of value added in 2010, a more comprehensive study estimated its contribution in that year to be 7.9%.[216] The published accounts include only commercial forestry activity, whereas the more comprehensive study also estimates the value of wood fuel and charcoal, on which 98% of the population depends for household energy.[217]

215 USAID. 2016. *Greenhouse Gas Emissions in Malawi*. They report that no data were available for energy sector emissions, so their report, and this figure, omit that source altogether.

216 Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems Malawi Policy Briefing Report*.

217 GoM. 2015(e). *Statistical Yearbook 2015.*

Loss of forest cover contributes to high levels of soil loss, especially on steep slopes.

Forests also contribute to carbon sequestration, as discussed in more detail below, although this only rarely provides an actual monetary benefit. In addition, forests provide ecosystem services that are more difficult to quantify in monetary terms, including watershed protection and biodiversity habitat. The decline of the forests leads to losses of all these contributions.

Forest degradation and soil erosion

Deforestation, forest degradation, and the loss of on-farm trees are significant contributors to the soil erosion and land degradation problems that Malawi faces (discussed in detail in the Land degradation section of this report). Forests and other natural vegetation help buffer the impacts of rainfall, preventing water runoff and soil erosion. As forest cover is lost, increased runoff carries soil both from the previously forested area and from open land downstream. This reduces the productivity of downstream agriculture and erodes streambanks. When soil flows into the hydrological networks, it clogs water intakes for irrigation, drinking water supply, and hydropower generation, imposing a broad array of costs on the economy. In Malawi, this issue has received particular attention in the Shire River basin, in part because all of the country's hydroelectricity generation plants are on the Shire River and the economic consequences of power plant closures are severe.[218]

Biodiversity and threats to revenues

Biodiversity loss, higher fuel costs, loss of government revenue, and tourism are other potential impacts of deforestation and forest degradation. Plantation forests, which have decreased in area since 1990, contribute royalties, concession fees, and license fees to the government. These will decrease with forest loss. Biodiversity is also under threat as forests decline and degrade. The decrease in natural forests could lead to higher prices for wood fuel and charcoal as supply diminishes. Reduced biodiversity may translate in the longer term into reduced numbers of tourists and thus reduced foreign exchange flows.

218 LTS. 2013(a). *Land Use Scenario Analysis, Task 3 Report: Integrated Assessment of Land Use Options for Climate Change Mitigation & Adaptation.*

Gender dimensions of forest management

There are substantial differences between how men and women use forest resources and how changes in forest management affect them. Particular risks are faced by women and these need to be considered for any new strategies for forest management.[219] Men are typically engaged in commercial use of natural forests, cutting wood for poles or other building materials, manufacturing charcoal, or making furniture. Women, in contrast, use trees and forest resources for household purposes, including cooking, food, and traditional medicines. They also put much time and labor into gathering wood fuel for cooking.

However, women's activities often involve illegal extraction of resources from forest reserves, which can expose them to greater vulnerability at the hands of charcoal traders and forestry and other law enforcement officials. Recent changes introduced through the charcoal policy offer prospects for reducing this vulnerability.

Forest institutions and policies

Institutionally, Malawi's forests are divided into four different categories:

1. Natural forests on customary land
2. Forest reserves under the jurisdiction of the DoF or within protected areas under the jurisdiction of Department of National Parks and Wildlife
3. State-owned plantations managed by private companies under concession agreements
4. Private forests owned and managed by tobacco and tea companies[220]

Managing forest resources is the responsibility of the DoF, which operates under the authority of the MoNREM. The DoF's mandate was set out in the Forest Law of 1997.[221] Historically, it has been directly responsible for managing the country's forests reserves and supervising the concessions for privately managed forest plantations. It also provides an institutional home for the Forest Research Institute of Malawi (FRIM) and is responsible for forest policy and data.

In 2016, the country developed a National Forest Policy, which updated the 1996 version that led to the creation of the DoF.[222] The new policy has been designed to align the country with new international agreements[223] on climate change, biodiversity, and other environmental concerns and to address the continued deforestation and forest degradation affecting the country. It sets out ten priority areas: (i) Community-based forest management, (ii) Management of indigenous forests, forest reserves, and ecosystems, (iii) Management of plantations and estates, (iv) Regulation and quality control, (v) Knowledge acquisition and management, (vi) Capacity building, (vii) Biomass energy, (viii) Forest-based industries, (ix) International cooperation, and (x) Financing.

In 2016, Malawi published an ambitious National Forest Landscape Restoration Strategy.[224] The strategy is designed to guide efforts to restore 4.5 million ha of land—a pledge made to the Bonn Challenge.[225] It estimates that meeting this target would cost about USD 380 million at today's prices. The strategy was informed by a national study that used the 'Restoration Opportunities Assessment Methodology' (ROAM)[226] to identify areas where forest and land restoration opportunities exist. The study identified opportunities for over 3.4 million ha of forest restoration and 0.75 million ha of community forests and woodlots.

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219 Fisher. 2004. *Household Welfare and Forest Dependence in Southern Malawi*.

220 Table A.8 shows details on forests by tenure type.

221 GoM. 1997. *Forest Act, 1997, Act Number 11 of 1997*.

222 GoM. 2016(a). *National Forest Policy*.

223 See Annex 2 for a list of international agreements Malawi is a party to.

224 GoM. 2017(d). *National Forest Landscape Restoration Strategy.*

225 The Bonn Challenge is a global effort to bring 150 million ha of the world's deforested and degraded land into restoration by 2020 and 350 million ha by 2030.

226 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

BOX 7. Forest co-management in Malawi

Efforts to advance decentralized management at the forest level in Malawi have resulted in adoption of the forest co-management management model, and this has been applied at a number of pilot sites (mostly forest reserves) to promote sustainable forest management. This approach involves the development of dual responsibility arrangements between local communities and the DoF. The co-management approach has involved participatory planning at forest, forest block, and village level. Participatory forest plans spell out the rights, roles, and responsibilities between state forest institutions and local communities, and these are then agreed by both communities and the DoF.

Participatory forest plans also establish benefit-sharing arrangements between local communities and the State. This helps rebalance management and creates incentives for local communities to manage forests more sustainably. It also transforms the role of state forest agencies into 'extension agents' and allows for more productive forest management arrangements. This approach has tended to be more successful in areas further away from centers of demand for charcoal. Where demand for charcoal production is high, strong enforcement support from district forestry officials is needed to rebuff powerful vested interests in charcoal trade.

Since 2001, the DoF has followed a decentralized approach, in line with the nationwide decentralization policy introduced in 1998.[227] This has gradually shifted some operational functions and responsibilities to the district councils and local authorities while transforming the DoF into an enabling agency supporting the operational work of other stakeholders. Some forest management functions have been at least partially decentralized, including law enforcement, management of customary forest lands, community mobilization and capacity building, and forestry extension. However, a 2013 institutional assessment of the sector found that the decentralization process for forest management had effectively stalled.[228] As part of decentralization efforts, the DoF has also introduced forest co-management in and around several forest reserves, and these have met with some success in improving forest management practices and have proved popular with communities participating in such arrangements (Box 7).

The operations of the DoF are constrained by various issues including staffing, organizational structures, and problems with communication and coordination. There is inadequate staffing at both the national and the decentralized levels. Although the total level of DoF staffing increased from 1,018 to 5,207 between FY2001/02 and FY2011/12,[229] there are still significant shortages, especially of skilled staff at district levels. Furthermore, the organizational structure of the DoF has not changed to reflect its new focus on the facilitation of forest management. The curriculum and research agenda of the Malawi College of Forestry and Wildlife and the FRIM also need to evolve to respond to changing priorities.[230]

Insufficient data also constrain forest work in Malawi. More reliable data are needed in two broad areas:

- **Ground-truthed land and forest data.** Since the 1990s, many different data sets have been developed, but they are not consistent with each other and most are not ground truthed.[231] The DoF is working on a forest inventory, which should be available shortly. It is hoped that this will be the start of the production of reliable ongoing time series data on land cover.
- **Supply and demand data for wood biomass for energy and other purposes.** These data could be collected by the Integrated Household Survey, by surveys of enterprises or the informal sector, and possibly by special surveys of educational institutions, hospitals, and other nonprofit organizations. It should then be possible to estimate both the

227 For example, see: Chiweza. 2010. *A Review of the Malawi Decentralisation Process: Lessons from Selected Districts.*

228 Casey and Kafakoma. 2013. *Institutional Assessment of the Forestry Sector and Organisational Review of the Department of Forestry.*

229 Ibid.

230 Ibid.

231 Ibid.

quantity consumed (and thus the sustainability of use of natural forest products) and the economic value so that the forest sector contributions can be correctly included in the national income accounts. This could be complemented with surveys of local markets to determine the prices of wood fuel, charcoal, building materials, and other forest products.

Funding for government forest activities is also insufficient. Between 2014 and 2017, DoF expenditures have been constant at about MK 20 million per year, while regional office expenditures increased from MK 15 million to just over MK 40 million.[232] The increase in regional expenditures may suggest commitment to decentralization, although revenues are insufficient at all levels of government.

Forests and agroforestry

Agroforestry has the potential for reducing some of the negative impacts of forest loss and degradation. There is some evidence to suggest that forest loss and degradation can be reduced by increasing the number of trees on farms. This has been the objective of farmer-managed natural regeneration (FMNR)—the practice of letting trees grow from seeds already in the soil or compost through natural or assisted-natural regeneration (see Box 8). This practice encourages trees that are native to the area and are therefore more likely to adapt successfully to local conditions. This can be more cost effective and sustainable than using the exotic seedlings often provided by tree planting projects. There is some evidence that a number of different crops produce higher yields when planted in conjunction with FMNR.[233]

BOX 8. Experience of FMNR in Malawi

FMNR approaches offer considerable potential to make cross-cutting contributions to challenges of forest loss, land degradation, and agricultural productivity. One study looked systematically at FMNR in five districts across the country with relatively high rates of on-farm trees (Balaka, Blantyre, Dowa, Salima, and South Mzimba).[234] The study explored why farmers adopted these practices and how it benefited them to do so.

More than half of farmers surveyed reported that they could obtain wood fuel from their own trees, suggesting that this practice could have a strong positive effect on natural forests if widely adopted. Of farmers who already want to grow trees, 40% reported that FMNR was less work and more productive than planting seedlings and 16% reported increases in soil productivity, On-farm trees also provide public benefits, such as sequestering carbon and reducing runoff and erosion that affect downstream communities. The analysis concluded that energy benefits would have to be sufficient to justify the cost (or opportunity cost) of on-farm trees for farmers to allow them the space they take from crops.

232 GoM. 2009–2017. *Annual Economic Reports*. Additional data on budgets and expenditures are available in Annex 7.

233 Total Land Care. 2015. *FMNR In Southern Africa: Factors Motivating Farmers with Actions and Strategies for Scaling Up.*

234 Kundhlande et al. 2017. *Taking to Scale Tree-Based Systems That Enhance Food Security, Improve Resilience to Climate Change, and Sequester Carbon in Malawi.*

Key recommendations

GoM has committed to restoring 4.5 million ha of forest and land by 2030. This is expected to cost nearly USD 400 million (or USD 9.6 per hectare).[235] It is unclear where this financing will come from. Recommendations that might help Malawi address key forest sector challenges are described here.

USE LIMITED PUBLIC FINANCING TO LEVERAGE ADDITIONAL PRIVATE SECTOR INVESTMENT IN FOREST MANAGEMENT

Current levels of public investment in the forest sector for the foreseeable future will be inadequate to support effective management of Malawi's remaining forests.

Current levels of public financing are not likely to increase substantively and yet economic analysis shows that investments in sustainable forest management yield large public benefits to other economic sectors, particularly for hydroelectricity generation. Such investments would also help sustain Malawi's principal source of domestic energy in the face of growing deficits between supply and demand. For this reason, finding ways to increase forest sector financing will be needed if the National Forest Policy (2016) and the NFLR Strategy (2016) are to move from paper policies into implementation.

There are various opportunities for attracting new private sector investment. Examples include:

- **Developing institutional and licensing frameworks for legal and sustainable charcoal value chains.** Recent policy reforms that encourage legal production and supply of charcoal offer new opportunities for attracting private sector investment, including on the supply side. Public investment could help simplify regulatory regimes and encourage the development of biomass enterprises and smallholder producer associations. For value chains other than charcoal, Kambewa and Utila (2018)[236] argue that the SME sector can play an increasing role in value-added processing of forest products with appropriate public support. They found that timber, juice, and wood carvings are vibrant industries.
- **Funding for forest carbon management.**[237] Public financing could be used to complete the process of making Malawi 'ready' to access forest carbon financing (for example, by completing forest inventories and baselines and developing required safeguard frameworks). The DoF is advancing with REDD+ readiness efforts, including the establishment of forest emission baselines, updating forest inventories, and building institutional capacity for REDD+ work. To sustain these efforts will require a long-term commitment of support from the government and development partners alike.
- **Developing PES mechanisms.** Economic analysis on land degradation in Malawi[238] has demonstrated that a market for ecosystem services could be developed in Malawi and could help fund investments in forest management and restoration by local communities. Priority could be placed on paying farmers to restore and protect forest cover along rivers and streambanks, as these offer the highest public returns on investments. This approach could subsequently be scaled to support establishment of woodlots and protection of forests on steeply sloping customary land. In Southern Malawi, the Shire Basin Ecosystem Environmental Support Trust (BEST) has been established to pilot PES that could be funded by an additional tariff on electricity generated by hydropower facilities at Kapichira. This approach could be developed and options for other potential PES schemes explored in other catchments.

235 GoM. 2017(e). *Forest Landscape Restoration Opportunities Assessment for Malawi.*

236 Kambewa and Utila. 2018. *Malawi's Green Gold: Challenges and Opportunities for Small and Medium Forest Enterprises in Reducing Poverty.*

237 Albeit less predictable given current uncertainties over the future of international markets for forest carbon.

238 UNIQUE. 2018(b). *Land and Natural Resources Degradation in the Upper and Middle Shire Valley, Malawi.*

- **Public-private partnership (PPP) for plantation forestry.** Longer-term public investments to restore plantation forest cover in forest reserves might offer longer-term options, as increasing forest cover through plantations would deliver high public goods (thus justifying public investment) while leaving day-to-day operations to private sector concession holders. Previous efforts to attract private sector investments in plantations have not been successful, but there may be lessons to be learned from regional and international experience.

STRENGTHEN FOREST DATA AND BETTER USE IN ECONOMIC PLANNING

Forest data need to be updated and should include data on biomass energy and the related impacts on national accounting.

It is essential to improve forest data, notably with respect to reliable time series data on land cover and routine surveys of the production and use of forest products. A first national forestry inventory since 1992 is expected to be available shortly. Improved inventory and time series data are needed to understand the evolution of the country's forest resources and their contribution to the economy. Once improved forest inventory and use data are in place, it will be possible to build forest 'satellite' accounts that could help quantify the importance of this sector to the economy and ensure that the data are used to inform policy analysis and the preparation of the national accounts.

SCALE UP FOREST CO-MANAGEMENT PRACTICES

Forest co-management pilots have delivered promising results in several forest areas and have often helped reduce conflicts between forest officials and local forest users.

Successful pilots should be consolidated and further scaled up where appropriate as part of longer-term forest sector development.

PROMOTE AGROFORESTRY AND TREE-BASED SYSTEMS

Agroforestry and FMNR can reduce pressure on Malawi's natural forests.

Tree planting projects have been part of the response to forest degradation for decades but were often unsuccessful as the returns did not justify the land or investment effort by farmers. FMNR is seen as an alternative to tree planting, and recent studies[239, 240] have found that this is an effective strategy in Malawi, especially for reducing demand for fuel from natural forests. A regional study on FMNR[241] has developed guidelines for broadening its use, which may be effectively applied to Malawi.

239 Total Land Care. 2015. *FMNR In Southern Africa: Factors Motivating Farmers with Actions and Strategies for Scaling Up.*

240 Kundhlande et al. 2017. *Taking to Scale Tree-Based Systems that Enhance Food Security, Improve Resilience to Climate Change, and Sequester Carbon in Malawi.*

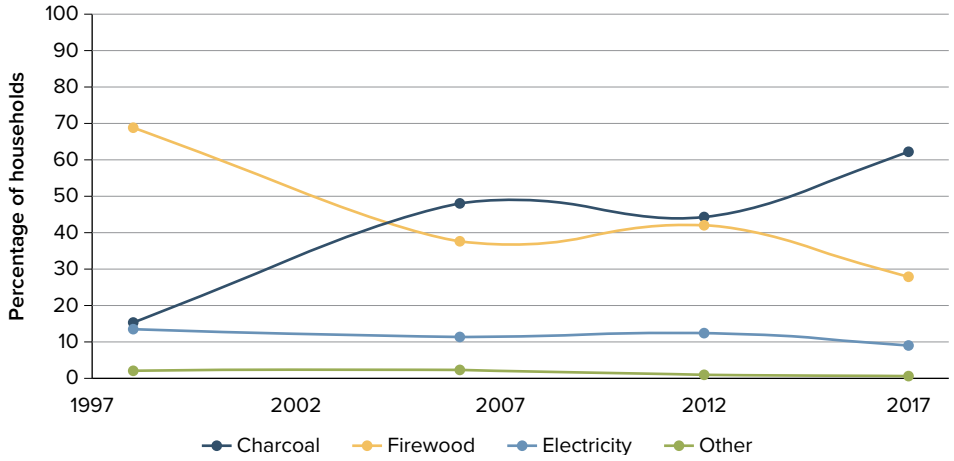
241 Reij and Winterbottom. 2015. *Scaling Up Regreening: Six Steps to Success.*

7. BIOMASS ENERGY

Energy demand and supply

Biomass dominates Malawi's energy sector and is used by 98% of the population, primarily for cooking.[242] About 92% of Malawi's biomass energy is used by households, while a few industries, including tobacco processing and brick burning, use the remaining 8%.[243] Rural households rely almost exclusively on firewood for energy, most of which is self-collected. In contrast, charcoal is the dominant source of fuel among urban consumers, surpassing firewood and other energy sources (see Figure 32).

FIGURE 32. Urban household cooking energy demands 1998–2017



Sources: 1998 Census, 2004/05 IHS2, 2011/12 ISH3, and 2016/17 ISH4.

Malawi faces a charcoal-dominated future linked to population growth and urbanization. The four largest urban centers (Blantyre, Lilongwe, Mzuzu, and Zomba) account for 90% of national charcoal consumption.[244] Charcoal consumption rises in proportion to urbanization rates,[245] and Malawi's urban centers are growing rapidly. Supplies of LPG and electricity are unreliable and appliance costs are high. There is also a cultural preference for cooking with charcoal for certain foods.[246] As a result, up to 90% of households with main electricity connections still cook with charcoal, which is likely to continue for the foreseeable future, regardless of whether electricity expansion is achieved.[247] Charcoal consumption is doubling every 12 to 15 years. For example, the total annual demand for charcoal in Malawi rose from 2.5% in 1998 to 16% in 2017 (see Annex 9 for more information).

There is a north-south split in biomass supply and demand. Almost all charcoal in Malawi comes from indigenous miombo woodlands,[248] an estimated 58% of which are in government-owned Forest Reserves.[249] While the north is characterized by an excess of supply over demand, the reverse is the case in the more densely populated south. In 2010, wood fuel demand from the southern region exceeded sustainable yield of forests by a factor of five, exclusive of supply from trees outside forests (for example, on farms).[250]

242 GoM. 2017(b). *Integrated Household Survey 2016–2017.*

243 GoM. 2009. *Malawi Biomass Energy Strategy.*

244 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal, Consumption, Trade and Production in Malawi.*

245 Mugo and Ong. 2006. *Lessons of Eastern Africa's Unsustainable Charcoal Business.*

246 Holmes. 2015. *Understanding Urban Fuel Choice.*

247 GoM. 2009. *Malawi Biomass Energy Strategy.*

248 Zulu. 2010. *The Forbidden Fuel: Charcoal, Urban Wood Fuel Demand and Supply Dynamics, Community Forest Management and Wood Fuel Policy in Malawi.*

249 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal, Consumption, Trade and Production in Malawi.*

250 Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems in Malawi Policy Briefing Report.*

Rural households rely almost exclusively on firewood for energy, most of which is self-collected.

Socioeconomic significance

The commercial wood fuel industry is worth USD 352 million in 2018 (up from USD 113 million 10 years ago).[251] This represents 4.7% of GDP and provides full-time equivalent employment for 235,000 people (full data provided in Annex 9).[252] However, because of the informal nature of the sector, GoM is losing significant revenue, which could be generated through a formalized market and taxation system. For charcoal alone, an estimated 12–20% (up to USD 38 million) is lost to rent-seeking activities, in the form of bribes.[253]

Demand for charcoal has increased by an estimated 54% between 2008 and 2018. In 2018, demand for charcoal alone is worth an estimated USD 191 million, providing employment opportunities for around 150,000 people (see Annex 9). Charcoal is a fully commercialized commodity produced almost exclusively for urban markets, with highly organized value chains. Yet, around 80% of producers are rural based and operate at a small scale.[254]

The production and transport of wood fuels provides rural households with significant income and flexible livelihood options. Commercial wood fuels can help rural people earn more than the national minimum wage and reduce their vulnerability to poverty, financial insecurity, and seasonal food insecurity.[255, 256] However, corruption within the value chain is rife. An estimated USD 9 million is lost to bribes each year.[257] Enforcement activities (such as confiscations) and rent-seeking (via payments with no receipts and illicitly augmented fines) increase rural households' vulnerability to poverty and food insecurity and have unrecognized impacts on their mental well-being.[258] Importantly, poverty is a key driver behind the rise in charcoal consumption and associated impact on forest and land. Poor households lack access to alternative and affordable materials and sources for energy consumption and construction material (for example, solar or cement).

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251 These figures are projections based on data from GoM. 2009. Malawi Biomass Energy Strategy.

252 GoM. 2009. *Malawi Biomass Energy Strategy.*

253 This figure is derived from the author's projections based on data from: Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal Consumption, Trade and Production in Malawi.*

254 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal Consumption, Trade and Production in Malawi.*

255 Ibid.

256 Hecht and Kasulo. 2013(a). *Development of Forest Valuation Systems in Malawi Policy Briefing Report.*

257 Taulo et al. 2015. *Energy Supply in Malawi: Options and Issues.*

258 Smith et al. 2015. *Criminals by Necessity: The Risky life of Charcoal Transporters in Malawi.*

Climate change

Wood fuels are a contributing factor to climate change, but they also provide opportunities for climate change adaptation and mitigation. Inefficient combustion of wood fuels produces high levels of black carbon, a major contributor to global climate change.[259] Estimates suggest that the burning of firewood and charcoal in Malawi produces 10,166 kt CO_2e, between 17% and 48% of total emissions.[260] Conversely, wood fuels can also be considered as a viable component to reduce fossil fuel emissions, but efforts are required to ensure the sector is carbon neutral.[261] Furthermore, policies promoting afforestation/reforestation programs for sustainable wood fuel options may hinder the adoption of modern fuels and improved technologies.[262] Promotion of alternative energy systems (for example, solar and biogas) is required alongside these programs.

Wood fuels also provide diversification opportunities, helping rural households cope with climate shocks and seasonal drought.[263, 264] Malawi is extremely vulnerable to climate change,[265, 266] with anticipated variations in precipitation, temperature rises, and subsequent impacts on agricultural production and food insecurity.[267] This means the importance of wood fuels as a coping mechanism will likely increase. However, unsustainable harvesting of wood fuels in combination with other land-degrading activities, particularly in river basin catchment areas, contributes to increased soil degradation, exacerbating challenges with water supply, river siltation, and hydroelectric capacities.[268, 269, 270] Limited electricity generation and subsequent power cuts stimulate increased demand for wood fuels (particularly charcoal).[271] A vicious cycle exists, which is further compounded by climate change challenges.

Environmental impacts and drivers

Wood fuel production is rarely a direct cause of deforestation but is frequently a by-product. Land clearance for agricultural expansion is the leading driver of deforestation in Malawi.[272] However, there are localized cases where wood fuel harvesting in urban peripheries (for example, around Blantyre, Lilongwe, and Zomba) has led to severe woodland degradation.[273, 274, 275] Wood fuels tend to result in degradation, as opposed to complete deforestation,[276] but the exact contribution to degradation is unknown and extremely difficult to quantify.[277]

Forest loss and degradation are seldom caused by a single driver. Charcoal production provides a financially viable mechanism to clear land for agriculture, and estimates suggest that around one-third of Malawi's annual forest loss is attributed, in part, to charcoal production.[278] The general picture is that forest loss and degradation in Malawi do not result from wood fuel demands alone but are complicated by larger-scale drivers, including land scarcity associated with population growth, low agricultural productivity, and food insecurity.

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259 Ramanathan and Carmichael. 2008. *Global and Regional Climate Changes Due to Black Carbon.*

260 Bailis et al. 2015. *The Carbon Footprint of Traditional Wood Fuels.*

261 Mwampamba et al. 2013. *Dispelling Common Misconceptions to Improve Attitudes and Policy Outlook on Charcoal in Developing Countries.*

262 Ramanathan and Carmichael. 2008. *Global and Regional Climate Changes Due to Black Carbon.*

263 Brack. 2017. *Woody Biomass for Power and Heat: Impacts on the Global Climate.*

264 Bailis et al. 2015. *The Carbon Footprint of Traditional Wood Fuels.*

265 Fisher et al. 2010. *Do Forests Help Rural Households Adapt to Climate Variability? Evidence from Southern Malawi.*

266 Knox et al. 2012. *Climate Change Impacts on Crop Productivity in Africa and South Asia.*

267 López-Carr et al. 2014. *A Spatial Analysis of Population Dynamics and Climate Change in Africa: Potential Vulnerability Hot Spots Emerge Where Precipitation Declines and Demographic Pressures Coincide.*

268 UMFULA. 2017. *Malawi Country Climate Brief: Future Climate Change Projections for Malawi.*

269 Kaunda and Mtalo. 2013. *Impacts of Environmental Degradation and Climate Change on Electricity Generation in Malawi.*

270 Onishi. 2016. *Poverty, Drought and Felled Trees Imperil Malawi Water Supply.*

271 Holmes. 2015. *Understanding Urban Fuel Choice. The Case of Zomba, Malawi.*

272 Kawandama Hills Plantation. 2016. *Sustainable Charcoal.*

273 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal, Consumption, Trade and Production in Malawi.*

274 Zulu. 2010. *The Forbidden Fuel: Charcoal, Urban Wood Fuel Demand and Supply Dynamics, Community Forest Management and Wood Fuel Policy in Malawi.*

275 Ramanathan and Carmichael. 2008. *Global and Regional Climate Changes Due to Black Carbon.*

276 Specht et al. 2015. *Burning Biodiversity: Fuelwood Harvesting Causes Forest Degradation in Human-dominated Tropical Landscapes.*

277 Mwampamba et al. 2013. *Dispelling Common Misconceptions to Improve Attitudes and Policy Outlook on Charcoal in Developing Countries.*

278 Openshaw. 2011. *Supply of Woody Biomass, Especially in the Tropics: Is Demand Outstripping Sustainable Supply?*

Institutions and policies

Malawi has historically adopted a punitive approach to wood fuel sector governance, which has impeded the development of sustainable systems of production and supply.[279] Negative perceptions of wood fuels among policymakers and enforcement agencies have led to a 'crisis mentality', making it unfeasible to enact policies that support formalization and modernization of the sector. The informal and clandestine nature of the commercial wood fuels industry also stigmatizes producers, transporters, and sellers, creating a disabling environment for investment and for the implementation of new policy approaches.

Chronic underfunding and lack of capacity in the DoF have made it challenging to successfully execute strategies, reform sector regulation, or fund the development of a sustainable commercial wood fuel sector. An emphasis on the pursuit of alternative energy options has taken resources away from wood fuels but has had little impact on fuel switching (for example, moving from using charcoal to LPG), and wood fuel demand continues to rise. The DoF lacks the necessary finance and personnel to successfully execute strategies with which it is entrusted. In 2007, the annual budget for one District Forest Office with multiple staff and vehicles was MK 75,000 (equivalent at the time to USD 500).[280]

Since the enactment of the Forestry Act (1997), no indigenous forest resources have been certified for production, and applicants find it challenging to meet the qualifying criteria. In February 2015, GoM rejected 50 applications for charcoal licenses because they failed to meet the required criteria for production on private land, access to tree seedlings, and extension support from the DoF.[281] Most applications for charcoal production are in gazetted forest reserves, as these contain greater amounts of indigenous trees (sometimes as old as 120 years) and make the best quality charcoal. Privately planted blue gum (*Eucalyptus* spp.) trees do not produce the same level of quality. However, as per the National Charcoal Strategy,[282] the government is encouraging people to apply for licenses to grow and manage their own forest areas. Only one charcoal production permit currently exists. It was issued in September 2015 to an essential oils company operating near Mzuzu, where charcoal is produced as a by-product from a plantation of *Corymbia citriodora*, a tree native to Australia.[283]

Enforcement

Enforcement of laws designed to protect forests is weak and ineffective. Critics argue that prevailing regulations and procedures are complicated and not widely understood at community levels. This is partly because regulations and procedures are written in English, and few extension workers understand the legal and policy language used. Inadequate communication of the law generates uncertainty about which regulations apply to the production and transportation of wood fuels. Such uncertainty over regulations and responsibilities creates space for corruption, and this undermines the ability of formal mechanisms to effectively govern the sector and protect forest resources. It also reduces the capacity to raise revenue via official channels.

Unbalanced power relations between forest officers and local communities contribute to nonenforcement of forestry law, as they frequently live within the communities they are meant to enforce.[284] As a result, informal activities continue to occur at producer levels, while enforcement targets the transporters of wood fuel, who tend not to be village members. Due to their visibility, transport routes are more frequently targeted than production areas,[285, 286, 287] an approach that ultimately fails to protect forest resources.[288]

279 GoM. 2009. *Malawi Biomass Energy Strategy.*

280 FGLG. 2008. *Malawi Policy Brief No. 3. Making Community-based Forest Management Work.*

281 The Nation. 2016. *Government Rejects 50 Charcoal License Applications.*

282 GoM. 2017(f). *National Charcoal Strategy, 2017–2027.*

283 Kawandama Hills Plantation. 2016. *Sustainable Charcoal.*

284 Sibale and Banda. 2004. *A Study on Livelihoods, Governance and Illegality: Law Enforcement, Illegality and the Forest Dependent Poor in Malawi.*

285 Kambewa et al. 2007. *Charcoal: The Reality—A Study of Charcoal, Consumption, Trade and Production in Malawi*.

286 Sibale and Banda. 2004. *A Study on Livelihoods, Governance and Illegality: Law Enforcement, Illegality and the Forest Dependent Poor in Malawi.*

287 Zulu and Richardson. 2013. *Charcoal, Livelihoods, and Poverty Reduction: Evidence from Sub-Saharan Africa*.

288 Smith et al. 2015. *Criminals by Necessity: The Risky Life of Charcoal Transporters in Malawi*.

Illegal logging and transboundary timber trade is becoming an increasing problem that contributes to land degradation.

There is a severe lack of reliable data on the wood fuels sector. Due to the illicit and informal nature of the trade in wood fuels and punitive approaches to regulate the market, there is a scarcity of information on supply and demand and significance for the economy, environment, and livelihoods.[289, 290, 291, 292] GoM will inevitably struggle to regulate a sector that it knows little about.

Responsibility for wood fuel policy is split between the forestry and energy sectors, which hinders integrated planning and implementation. Energy policy has generally sought to promote alternative sources, while forestry policy has emphasized the need to ensure sustainable supply of wood-based fuel. This ambiguity discourages investment, as the government's position is unclear and support for industry actors is not assured. The National Energy Policy (2003) is now 15 years old but its envisaged transition away from biomass-based fuels has not yet materialized. The fundamental fuel-switching objective of energy policy remains unchanged.

Recent policy reforms

Recent reforms offer the promise of a formal, sustainable, and commercial wood fuel sector and a more holistic approach to wood fuel sector governance. Malawi's revised National Forest Policy (2016)[293] promotes "*sustainable production and utilization of firewood and charcoal*" (p. 23) and acknowledges the underestimation of traded wood fuels to national GDP. MGDS III (2017–2020) also endorses the sustainable management of wood fuels. The NFLR Strategy (2017) outlines support for the sustainable production of charcoal through improved incentives, the development of forest management plans, and community-based approaches, and specifies national goals for increased supplies of locally managed and sustainably sourced wood fuels.

The National Charcoal Strategy (2017–2027)[294] represents an ambitious and progress reform which sets out a 10-year plan for a climate-resilient and sustainable energy sector. The strategy was developed through a consultative process co-chaired by the Departments of Forestry and Energy Affairs using an 'evidence-based strategy' (p. 5). There are seven pillars supporting the plan (see Box 9).

289 Smith et al. 2015. *Criminals by Necessity: The Risky Life of Charcoal Transporters in Malawi*.

290 Mwampamba et al. 2013. *Dispelling Common Misconceptions to Improve Attitudes and Policy Outlook on Charcoal in Developing Countries*.

291 Zulu and Richardson. 2013. *Charcoal, Livelihoods, and Poverty Reduction: Evidence from Sub-Saharan Africa*.

292 Neufeldt et al. 2015. *From Transition Fuel to Viable Energy Source: Improving Sustainability in the Sub-Saharan Charcoal Sector.*

293 GoM. 2016(a). *National Forest Policy.*

294 GoM. 2017(f). *National Charcoal Strategy, 2017–2027*.

BOX 9. Seven pillars supporting the National Charcoal Strategy (2017–2027)

- Promote adoption of alternative cooking and heating fuels
- Stimulate wide-scale adoption of fuel-efficient charcoal and firewood cook stoves
- Significantly increase sustainable wood production, specifically for biomass energy production
- Effectively enforce laws and regulations to limit, and eventually stop illegal charcoal production
- Promote and regulate legal (licensed) charcoal production, transport, and sale
- Enhance the livelihoods of Malawians in ways that can be sustained over time
- Ensure that the information, awareness, and communications required to change behavior and increase adoption are available

Key recommendations

Newly published policy documents support the formalization of a sustainable and commercial wood fuel sector, though (aside from the one license) all charcoal in Malawi remains technically illegal. There will be many challenges in transforming wood fuels from the informal to the formal economy and implementing the government's vision of a modern and sustainable biomass energy sector. Some risks and constraints are highlighted here, with suggestions for future opportunities.

FORMALIZING AN INFORMAL SMALL-SCALE DOMINATED SECTOR

Interventions are needed to make it easier for informal producers, working at multiple scales, to operate within a formal setting.

Malawi's wood fuel sector is dominated by rural households working at a small scale. Formalization of wood fuel sectors elsewhere in Sub-Saharan Africa has typically favored large-scale production models and benefited urban-based elites. A one-size-fits-all approach to wood fuel governance marginalizes small-scale rural actors, offers limited scope for rural development and poverty alleviation objectives, and will struggle to protect forest resources. However, appropriately scaled and context-specific approaches may provide more equitable options for all stakeholders. This could include incentivizing sustainable production for larger scale specialized producers while simultaneously maintaining flexibility for small-scale producers to avoid potential marginalization. Examples include simplifying or removing regulations, reducing barriers to the procurement of licenses, and promoting sustainable practices through tax incentives.

It is vital to consider how to better engage informal wood fuel production.

Many small-scale producers will struggle to engage with a formalized wood fuel sector. Initiatives that encourage sustainable practices, while maintaining scope to include informal, flexible production may provide complementary alternatives. Incorporating informal and existing wood fuel management schemes (for example, woodlot management, agroforestry) into incentive schemes and support interventions may also provide better outcomes, especially if enacted alongside efforts to strengthen tenure rights and explore participatory forest management options.

Training and business development can help promote a financially and environmentally sustainable wood fuels sector.

Clear guidance on what constitutes a sustainable management plan and how to obtain one could help reduce informality in the sector. Disseminating knowledge and promoting available technologies to produce charcoal more efficiently (for example, optimized woodland management practices, improved kilns) could develop producers' capacity to deliver more sustainable yields.[295]

EMPOWERING VALUE CHAIN ACTORS

Small-scale producers need more access and greater involvement in the sector, to help shape regulation and improve the bargaining power of stakeholder networks.

Collective action, such as the formation of associations, could improve small-scale producers' access to formal markets and increase their participation in decision-making structures. Developing mechanisms to enable secure, long-term commercial rights to communities to sustainably harvest forest resources would also increase access. This could include devolving the issuance of licenses to local levels and removing some licenses altogether, given their overlap and the lack of capacity to enforce compliance.

INSTITUTIONAL CAPACITY FOR IMPLEMENTATION

Review and reform the policy, legal, and regulatory provisions for wood fuels in Malawi.

A functioning, legal charcoal industry could deliver significant fiscal returns to the state through formal taxation systems, which are not currently being captured, and encourage investment in modernization and efficiency improvement. Opportunities to support this transition include:

- A cross-sectoral review of current laws and regulations to identify areas for simplification to encourage compliance. A simpler and more implementable system could lead to less evasion, reduce the space for rent seeking, and allow value chain actors to be recognized and potentially gain access to technical and financial support.
- Training and awareness raising for all sector actors on any new regulatory provisions, with a structured rollout to ensure that stakeholders understand the new opportunities and their roles and responsibilities.
- Assessment of capacity within the DoF and district authorities for the enforcement roles for which they are responsible, with support for capacity building as required.

DATA COLLECTION

There is a need for more information on the wood fuel industry.

The lack of information on the nature, significance, and potential of the industry is a major constraint to rational policy that would lead to formalization and modernization.

Data requirements (in priority order) include:

- Up-to-date demand and supply statistics, nationally and by region and district, with an institutionalized system for periodic monitoring and updating
- More reliable data on pricing (including seasonality) and revenue distribution through the value chain, with an evaluation of the potential for a transition to official revenue collection under a restructured and simplified set of laws and regulations
- Assessment of the social, economic, and environmental impacts of punitive enforcements, with proposals for how those currently benefiting from the informal nature of the trade can be compensated or otherwise provided for

295 Neufeldt et al. 2015. *From Transition Fuel to Viable Energy Source: Improving Sustainability in the Sub-Saharan Charcoal Sector.*

- Contextually relevant market information, including a better understanding of energy transitions in growing urban markets in other developing countries, to offer reliable projections of future demand
- Assessment of the capacity of multiple supply systems (for example, participatory forestry, agroforestry, and plantations) to meet growing energy demands and opportunities to integrate them into the wood fuels supply chain
- Quantification of wood fuel's contribution to deforestation and forest degradation, relative to other drivers (for example, agricultural expansion), distinguishing between wood fuel types and land uses
- Insights into the organization of the informal sector and how these structures and local knowledge can be integrated with formal systems, for example, through formation of stakeholder associations
- Assessment of the poverty alleviation potential of the biomass energy sector, including disaggregated participation (for example, gender, age, poverty, well-being) and distribution of benefits to address power imbalances along the value chain
- Appraisal of the impacts of climate change on energy provision and transitions and the potential mitigation role of wood fuels (for example, integration with carbon market mechanisms such as REDD+)[296]

PERCEPTIONS AND EXPECTATIONS

There is a need to raise awareness of the role of wood fuels as a conditionally renewable, secure, and economically vital source of energy for Malawi.

Based on the latest data on the significant value, employment, and contribution to livelihoods and climate change, there is a need to raise awareness of the role of wood fuels as a conditionally renewable, secure, and economically vital source of energy for Malawi. Support should be provided to educate and raise awareness of the role and value of the wood fuel economy at national, district, and community levels. The aim should be to reduce stigma and promote wood fuels as a sustainable and secure source of energy and income, supporting energy security, creating employment, generating revenue flow to rural areas, and complementing other energy systems. This, in turn, should complement efforts to deregulate, recognize, and formalize those involved in wood fuel production, transport, and sale.

MODERNIZATION OF THE ENERGY SECTOR

Promoting fuel efficiency and fuel switching, where feasible, will encourage a more modern, formal, and efficient energy sector.

Alongside measures to formalize, modernize, and streamline the regulation of the commercial wood fuels sector, there are opportunities to promote greater efficiency in consumption and to encourage a switch to alternative clean fuels where affordable and appropriate. These opportunities align with and could be supported by the government's recently launched Renewable Energy Strategy. According to the National Cookstove Steering Committee (a coordinating body for government agencies, NGOs, and private sector organizations working on clean cookstoves in Malawi), 500,000 clean and efficient cookstoves are already in use. By 2020, they aim for 2 million Malawian homes to adopt such devices. Emphasis should be placed on supporting and upscaling these types of interventions. There are a number of commercial players and social enterprises in East and Southern Africa that offer high-quality, modern cooking appliances for both firewood and charcoal. There is potential for them to be encouraged to invest in Malawi's clean cooking sector, for example, by using tax breaks.

LPG is another clean burning and convenient fuel alternative.

Wealthier charcoal consumers could be encouraged to switch to LPG, which is a clean burning and convenient fuel alternative. The entry cost of the cooking appliance and gas cylinder is a known barrier for poorer households, as is the cost of refills and the reliability of stock. However, there are a number of start-ups in East Africa piloting pay-as-you-go systems to encourage greater uptake of LPG. These models could be explored for relevance and transferability to the Malawian LPG market.

296 Schure et al. 2014. *An Approach to Promote REDD+ Compatible Wood-fuel Value Chains.*

8. HOUSEHOLD AIR POLLUTION

HAP is the source of air pollution that poses the greatest threat to Malawians. It is a significant health burden, especially to women and children and the rural population.

HAP is the world's number one environmental cause of death[297] and affects two-thirds of the world's population.[298] In Malawi, almost the entire population (98%) uses solid fuels from biomass to meet household demand for cooking, heating, and lighting.[299] Solid fuels, or simply firewood, is used in open fires or rudimentary cookstoves where combustion is incomplete. This causes significant amount of exposure to smoke and toxins in the household's air.[300]

Using firewood for cooking, heating and lighting, causes significant exposure to smoke and toxins.

In Malawi, the level of HAP is extremely high. The levels of fine particulate matter (PM) in households are far above guidelines for even outdoor air toxicity levels. The World Health Organization (WHO) air quality guidelines levels of outdoor air should not exceed a 25 µg/m^3 mean PM level in 24 hours.[301] In 2017, monitoring in Malawian households detected that the average mean PM was 59.4 µg/m^3—more than double the WHO maximum level for air toxicity. The increased air toxicity is equal to a 2.5–5.0% increased risk of short-term mortality.[302] This pollution of household air comes from the use of firewood and charcoal in households (91.4% and 7.2%, respectively).[303] Conditions are worse in rural households where solid fuels are the predominant source of energy. Urban homes use charcoal that causes higher carbon monoxide concentrations[304] (see Figure 32 in **Biomass energy** section for distribution of energy demands).

The health burden of HAP for Malawians is significant, particularly for women and children. After HIV/AIDS, infections of the lower respiratory tracts (that is, lungs, bronchi, and trachea) are the second-highest cause of death and premature

297 According to the WHO, household air pollution from cooking with solid fuels prematurely kills 4 million people globally per year, half of which are young children suffering acute lower respiratory infections.

298 Gordon et al. 2014. *Respiratory Risks from Household Air Pollution in Low and Middle Income Countries.*

299 Global Alliance for Clean Cookstoves. 2018. *Malawi Country Profile.*

300 Importantly, the notion of household air pollution includes the exposure to smoke and pollution in the home area from burning solid fuels inside or near the house (for example, the 'khondi' veranda). Either location of the burning affects the air that enters the house or remains in the house due to ventilation constraints.

301 Fullerton et al. 2017. *Biomass Fuel Use and Indoor Air Pollution in Homes in Malawi.*

302 Jary et al. 2017. *Household Air Pollution, Chronic Respiratory Disease and Pneumonia in Malawian Adults: A Case-control Study [version 1; referees: 2 approved].*

303 Global Alliance for Clean Cookstoves. 2018. *Malawi Country Profile.*

304 Fullerton et al. 2017. *Biomass Fuel Use and Indoor Air Pollution in Homes in Malawi.*

death in Malawi.[305] In Malawi, air pollution is considered the second-highest risk factor that drives death and disability (after poor water and sanitation) and is ranked the fourth-highest risk factor overall (after malnutrition, unsafe sex, and poor water and sanitation).[306]

Medical research has identified a strong correlation between HAP and the occurrence of pneumonia among children across the developing world.[307] In Malawi, the risk of contracting pneumonia in children is increased by a factor of 1.8 because of exposure to HAP.[308] Other diseases and complications resulting from exposure to HAP include "acute lower respiratory tract infections and low birth weight in children, lung cancer, chronic obstructive pulmonary disease, interstitial lung disease, tuberculosis, cardiovascular disease and cataracts in adults"[309] as well as neurological disorders and cardiopulmonary problems (shortness of breath).[310]

Pregnant women are particularly vulnerable to HAP due to the deposits of pollutants in their fat issues, which result in adverse pregnancy outcomes such as stillbirth, miscarriage, and retarded fetal growth. Exposure to HAP varies between women and men, generations, locations, and time of day. However, generally women and children are exposed to the highest concentrations of airborne toxins because they are the ones who cook, tend the fires, and care for children and elders.[311] As such, women and children are particularly susceptible to suffering from the effects of HAP. Importantly, the effects start in utero and follow through to early life and adulthood.

Poverty and health challenges, such as malnutrition and HIV/AIDS, make this situation worse and contribute to unacceptably high maternal death rates. Pregnant women already face vitamin deficiencies, poor sanitation, and other health conditions among groups at risk.[312] The risk of obstetric complications at birth are also high. Bleeding alone accounts for 40% of all maternal deaths, and the prevalence of HIV/AIDS is one in five people (for example, 18.5% in Blantyre).[313] HAP is another factor that simply complicates an already challenging situation.

Currently, for the vast majority of the population, there are no affordable fuel options to replace biomass/charcoal for cooking and heating. And this limits practice options for reducing HAP. There is a strong body of evidence showing that 'improved' biomass/charcoal cookers do little to reduce the overall level of HAP.[314, 315]

Institutions and policy

GoM has undertaken a series of initiatives to manage the use of firewood in households, promoting stove types that minimize emissions of toxins and smoke:

- Program for Biomass Energy Conservation
- Promotion of Alternative Energy Sources Project
- National Sustainable and Renewable Energy Program and Strategy.

The success of these programs has had varied results, pointing to the complexity and need of a multipronged approach that encompasses people's domestic preferences as well as introduction of appropriate technologies. In addition, guidelines on stoves, buildings, and ventilation are not standardized.

305 IHME. 2018. *Malawi.*

306 Ibid.

307 Interview with Professor Gordon at the Liverpool School of Tropical Medicine, *The Lancet,* October 2014.

308 Fullerton et al. 2017. *Biomass Fuel Use and Indoor Air Pollution in Homes in Malawi*.

309 Ibid.

310 Das et al. 2017. *Biomass Cooking Fuels and Health Outcomes for Women in Malawi.*

311 Gordon et al. 2014. *Respiratory Risks from Household Air Pollution in Low- and Middle-income countries.*

312 The research on attributing environmental and household conditions to specific diseases is difficult and sparse in Malawi.

313 Jary et al. 2017. *Household Air Pollution, Chronic Respiratory Disease and Pneumonia in Malawian Adults: A Case-control Study [version 1; referees: 2 approved].*

314 Mortimer et al. 2017. *A Cleaner Burning Biomass-fuelled Cookstove Intervention to Prevent Pneumonia in Children under 5 Years Old in Rural Malawi (the Cooking and Pneumonia Study): A Cluster Randomised Controlled Trial.*

315 Ezzati and Baumgartner. 2017. *Household Energy and Health: Where Next for Research and Practice?*

Key recommendations

PROMOTE FUEL SWITCHING TO LPG AND CLEAN ENERGIES

The long-term goal should be to make cooking energy 'clean'.

A continued emphasis is needed for urban and rural electrification and for fuel switching to cleaner fuels, such as LPG. However, affordability issues hamper uptake of both these technologies for many households. In many areas where grid connections are not likely to be available in the foreseeable future, the introduction of mini- and micro-electricity grids using solar panels alongside bulk investments are options that can be considered. Unfortunately, these are usually expensive and, in most cases, would require external financing.

EDUCATION AND PUBLIC AWARENESS

In the short term, immediate interventions should include education and public awareness-raising strategies that make the severe health risks apparent.

Chronic and acute respiratory diseases resulting from HAP are preventable. Evidence-based and targeted interventions that improve household air quality are needed to reach young adults and children as they predominantly carry the high burden of respiratory diseases and death caused by pneumonia.[316]

SUBSIDIES FOR MORE EFFICIENT STOVES AND IMPROVED VENTILATION

Alterations to household ventilation should be supported.

In some countries, such as Peru, the government responded to the significant deaths of women who suffered respiratory diseases by providing subsidies for households to reconstruct stoves and chimneys that improve indoor air quality. Making alterations to household ventilation should be prioritized and supported at a greater scale.

316 Jary et al. 2017. *Household Air Pollution, Chronic Respiratory Disease and Pneumonia in Malawian Adults: A Case-control Study [version 1; referees: 2 approved].*

9. FISHERIES

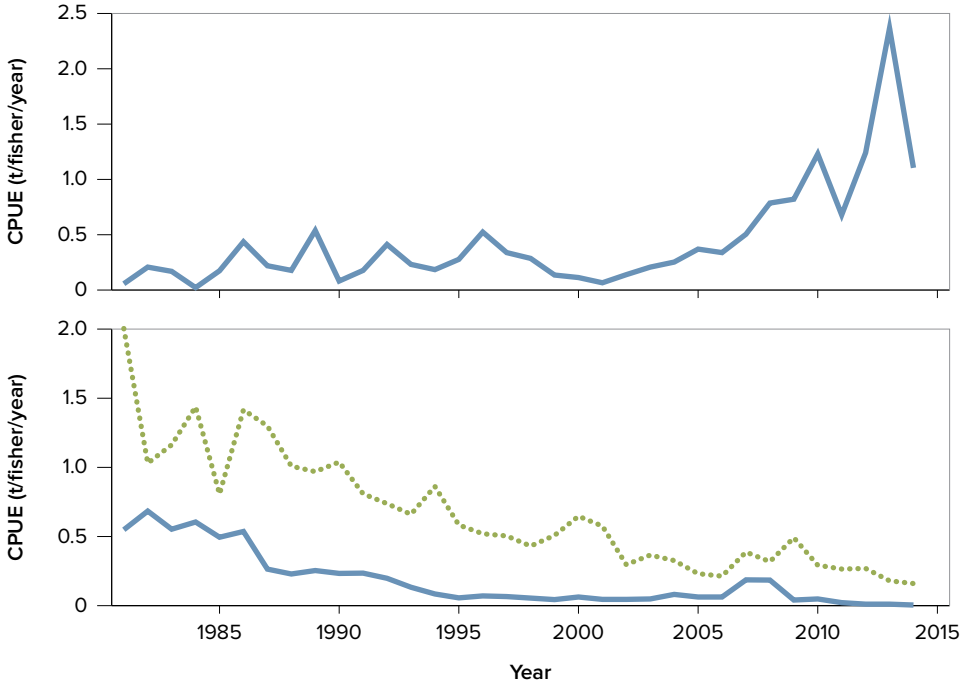
Status of fisheries stocks

Malawi's fisheries sector provides an important livelihood for many Malawians, and protein consumed through fish is particularly important for a lot of poor households. Figures for total landed catches are increasing and now stand at around 199,454 tons per year (2017), with a rapid increase since 2014. The reasons for this apparent increase are complex, reflecting changes in species composition of harvests, increasing fishing effort, and changes in the way in which fish stocks have been monitored.

Malawi's fisheries sector provides an important livelihood for many Malawians.

One reason for the apparent rise in fish catches is large increases in the Usipa catch. Usipa *(Engraulicypris sardella)* is a small pelagic fish that forms large shoals. It feeds on zooplankton and is highly reproductive when zooplankton stocks are in good supply. Usipa stocks can then crash when zooplankton stocks become exhausted. When caught, Usipa is commonly dried[317] and now makes up about 60% of the total fish yield.[318] In the past, Usipa catches were under-recorded as they are fished at night using lights and actual catch monitoring was largely overlooked. It is a species that is preyed upon by other fish and its increasing population might be because of a reduction in the population of its natural predators (Figure 33). It may also reflect changes in fish catch monitoring and recording techniques.

FIGURE 33. Comparison of CPUE between Usipa (above) and Cichlids (below) over 30 years, showing rise of Usipa and decline of Cichlid species



Source: Weyl et al. 2010. *Lake Malawi: Fishes, Fisheries, Biodiversity, Health and Habitat.*

Note: CPUE = catch per unit effort.

In contrast to Usipa catches, most other fish stocks in Malawi have been declining, and overall fish consumption has reduced. There has been a considerable decline in the availability of commercially important fish species. For example, from the 1970s to the early 1990s, the Chambo (*Oreochromis spp.*) catch from Lake Malawi was usually around 30,000 metric tons (mt) per year. Now the catch is sometimes as low as 2,000 mt per year.[319] While overall catch levels between 2006 and 2016 in Lake Malawi have been static, fish catches from Lake Chilwa and the Shire River have declined dramatically (see Annex 10 for more information).

Volatility in catches affects fish consumption. Fish and fish products account for a high proportion of the protein intake by Malawi's population and a lower consumption is a potential nutrition problem for poor households who, in the past, relied on fish as a cheap source of protein. In the 1970s, fish consumption was at 14 kg per person per year and fish contributed 70% of the animal protein consumed by Malawians. In 2013, fish consumption was around 7.6 kg per person per year[320]—a fall of nearly 50%.

317 Hara and Njaya. 2016. *Between a Rock and a Hard Place: The Need for and Challenges to Implementation of Rights Based Fisheries Management in Small-scale Fisheries of Southern Lake Malawi.*

318 DoF. 2013(b). *Estimated Annual Catch Report for 1974 to 2012.*

319 Weyl et al. 2010. *Lake Malawi: Fishes, Fisheries, Biodiversity, Health and Habitat. Aquatic Ecosystem Health & Management.*

320 FAO. 1992(a). *Fish and Fishery Products; and FAO, 2015, Yearbook of Fishery Statistics Summary Tables: Food Balance Sheets.*

Recent rapid increases in landing of small fish, especially Usipia (*Engraulicypris sardella*), suggest that the current fish supply per person is rising again and may now be over 12 kg per person. However, these figures are derived by simply dividing total landed catch by total population. In addition, there is insufficient research on fish stocks to know if this very rapid rise in the landed catch can be sustained in the long run or what the likely impacts are on longer term protein availability for Malawians.

The figures also do not take account of the high level of post-harvest losses, which considerably reduce actual protein *per capita* availability. Post-harvest fish losses cause a loss of revenue for fishing communities, fish processors, and traders (most of whom are women). These losses are estimated to be at around 30–40%.[321] Post-harvest losses are at their highest during the peak fish production period between January and April when there are more rains and high humidity. This makes the traditional open sun drying almost impossible.[322] Losses are exacerbated due to a lack of appropriate infrastructure such as feeder roads, ice plants, cold rooms, and poor fish-processing facilities, which reduce the quality of the fish harvest, especially during the rainy season.

Expenditures on fisheries do not match the importance of the sector in Malawi's economy. The share of fisheries expenditures across the ministry's total budget is extremely low at only 1.45% (or USD 369,027) and yet the fisheries sector contributes around 4% of Malawi's GDP. In addition, the livelihoods of 1.6 million people in lakeshore communities are based on the fishing industry[323] and the industry directly employs about 60,000 fishermen and indirectly over 500,000 people through fish processing, transportation, and marketing, as well as boat building and repairs.[324]

Drivers of fishery decline

A range of factors are driving the decline in fish catches.[325] First, there is an overcapacity in the capture fisheries and subsequent overfishing. Second, inappropriate fishing gears such as seine nets with small mesh sizes and mosquito nets are widely used. Third, local fisheries governance structures are weak and struggle to enforce fishing laws and regulations. Fishing communities have limited alternative income options, which also helps drive overharvesting.

Malawi's lake ecosystems are also subjected to a range of threats, most of which are linked to human activity—increased nutrient inputs, changes to phytoplankton composition, sediment loading, nearshore water quality impacts, and changing water levels.[326] These are caused by factors such as deforestation and agricultural practices that cause soil erosion, which lead to the sedimentation of water courses. Effectively addressing these threats needs improved management practices of both the fisheries and the surrounding catchments.

The decline in the Chambo populations in Lake Malawi has been driven by overfishing.[327] This is a problem when fishing occurs during the Chambo breeding season, which destroys the Chambo breeding nests. The widespread use of large shore seine nets with extremely small meshes also contributes to the declining population. These nets decimate the populations of the juvenile Chambo ('Kasawala') that gather in the shallow water.

Climate change

At present, there is insufficient evidence to make a clear link between climate change and a decline in Malawi's fish stocks. This is because the ways that climate change affects Malawi's fisheries are not well understood, and very little

321 These figures are estimates from a variety of sources and there is no definitive source to confirm.

322 Chiwaula et al. 2017. *Improved Processing and Marketing of Healthy Fish Products in Inland Fisheries in Malawi.*

323 GoM. 2012. *Annual Economic Reports.*

324 DoF. 2013(a). *Frame Survey Report for 2003 to 2013.*

325 There is a lack of robust data on post-harvest fish losses and there are no recent studies. Most sources still refer to the FAO analysis from 1992, which puts the loss at around 30%. See: FAO. 1992(b). *Case for Improving Marketing of Fish in Malawi.*

326 Bootsma and Jorgensen. 2005. *Lake Malawi/Nyasa: Experience and Lessons Learned Brief.*

327 Weyl et al. 2010. *Lake Malawi: Fishes, Fisheries, Biodiversity, Health and Habitat.*

TABLE 6. Potential effects of climate on fish stocks

Environmental Element	Effect of Weather Patterns and Climate Trends	Impacts
Ecosystem/breeding habitats	● Rising temperatures may cause some species of fish to migrate to deeper, colder waters. ● Winds can change upwelling patterns in the lake and may indirectly foster migration of fish to other areas further from the shoreline.	● Changing distribution ● Declines in some species and stocks
Fertilization and nest protection	● Heavier rainfall and high rates of runoff and soil erosion cause heavy siltation. This reduces visibility and can also affect breeding and early-stage development.	● Reduced population

Source: Adapted from Wood and Moriniere. 2013. *Malawi Climate Change Vulnerability Assessment.*

monitoring or research has been done.[328] Some fish species' reproduction and habitats are potentially affected by changing rain patterns, temperatures, runoff, and shifting wind patterns, but it is not known which has the greater impact—climate change or human-driven stressors. It is possible that changes in water temperature and weather patterns linked to climate change are contributing to the decline in fish catches, even though the effects and impacts are not yet well understood[329] (see Table 6).

Economic context and impact

Economic analysis of the costs of fisheries declines is out of date. The most recent economic analysis of fisheries degradation used data up to 2007,[330] which indicated that by 2007 the annual cost of unsustainable fishery use was USD 27 million, equivalent to 0.8% of GDP. As there has not been significant progress in reversing degradation since, these losses could be significantly higher. An up-to-date assessment of the fish stocks and fisheries within Malawi is needed, expanding and building on the DoFi's ongoing data collection and establishing FAO monitoring methodologies.

The role of gender also has an economic impact on fisheries as men and women fulfill distinct roles in the fisheries value chain. In general, men tend to dominate fishing activities while women are involved in the post-harvesting activities such as fish processing (sun drying, parboiling, smoking, and brining) and trading. Due to cultural and traditional perceptions that the lake is not a safe place, women lack fish-catching skills. In addition, women are often excluded in representation in fisheries governance and resource management due to cultural beliefs, norms, and unfavorable regulatory structures of the government.[331]

Institutions and policy

The government has tried to introduce more effective fisheries co-management practices, with responsibilities shared between government and fishing communities, and decentralized authority given to district councils. However, governance capacity to enforce fisheries regulations and control illegal fishing and destruction of habitats is weak.[332] A particular focus has been on joint patrolling of illegal large trawlers. These efforts have not been widely effective[333] with

328 Wood and Moriniere. 2013. *Malawi Climate Change Vulnerability Assessment.*

329 Hara and Njaya. 2016. *Between a Rock and a Hard Place: The Need for and Challenges to Implementation of Rights Based Fisheries Management in Small-scale Fisheries of Southern Lake Malawi.*

330 GoM. 2011. *Economic Analysis of Sustainable Natural Resource Use in Malawi.*

331 Hara et al. 2017 *Women's Participation in Fish Value Chains and Value Chain Governance in Malawi: A Case of Msaka (Lake Malawi) and Kavhulu (Lake Chilwa).*

332 Hara and Njaya. 2016. *Between a Rock and a Hard Place: The Need for and Challenges to Implementation of Rights Based Fisheries Management in Small-scale Fisheries of Southern Lake Malawi*; Wilson. n.d.. *The History of Participatory Fisheries Management in Malawi*.

333 See, for example, Hara and Njaya. 2016. *Between a Rock and a Hard Place: The Need for and Challenges to Implementation of Rights Based Fisheries Management in Small-scale Fisheries of Southern Lake Malawi*; Weyl et al. 2010. *Lake Malawi: Fishes, Fisheries, Biodiversity, Health and Habitat*.

limited buy-in from fishing communities who did not feel their interests were being represented.[334] With decentralization, the DoFi is elevating the need for building capacity of local officials (despite scarcity of resources).

Access to fish and fishing intensity has not been controlled in the past, which makes it difficult to implement effective controls in the future. Until now there has been a reluctance to explore restrictive measures, particularly those that would limit access, effort, or output or introduce zonal-based fishing rights. This lack of control continues to be business as usual, making it harder for the government and fisherfolk to make the difficult choices that are necessary to move Malawi's fisheries toward sustainable utilization. In addition, fisherfolk and farmers lack the necessary skills and knowledge to adapt their behavior without additional support and do not have the financial resources to change what they do.

Sustainable management is also inhibited by constraints in the legal framework.[335] While local beach village committees organize the fishery, the ultimate sanction of withdrawal of a fishing license and adjudication of local conflicts are reserved by the state through the DoFi and the courts. There is a disparity between the inflexible national legal and policy provisions and the bylaws or customary rules at the fishing villages. The DoFi, with support from the chiefs, has the right to seize illegal gear, but the mandate to destroy seized items is vested in the criminal law courts.

Policy and regulatory overlaps and contradictions also work against effective management of the lake and river catchments. In practice the management of catchment areas fall under a number of departments, sectoral policies, and legislations that include fisheries/aquaculture, marine, local government, environment, agriculture and livestock, tourism, forestry, national parks and wildlife, water, and land. These each have sectoral policies and legislations that overlap in jurisdiction.[336]

Subsidiary regulations are not comprehensive enough to implement the Fisheries Conservation and Management Act of 1997. For example, regulations pertaining to gillnet fishing periods and times have been omitted, resulting in increased conflicts between the small-scale and commercial fishers. The closed season is discriminatory to small-scale fishers, there is no provision regarding the introduction of new fishing gears and techniques, and punitive measures are not prohibitive enough as to be a deterrent.

The revised National Fisheries and Aquaculture Policy[337] provides opportunities to address some of the key drivers that affect the decline in fish stocks. The policy seeks to marry increasing fish production with initiatives that will control inappropriate fishing technologies, monitor the impact of pollution and environmental changes, and develop capacity of the government and local institutions to manage fisheries resources better.

334 Wilson. n.d.. *The History of Participatory Fisheries Management in Malawi*.

335 Kosamu. 2017. *Revisiting the 'Three-pillared Design' of a Management System for the Elephant Marsh Wetland Fishery in Malawi*.

336 Donda et al. 2014. *Fragmentation of Resource Management on the Southeast Arm of Lake Malawi: Dynamics around Fisheries*; Weyl et al. 2010. *Lake Malawi: Fishes, Fisheries, Biodiversity, Health and Habitat*.

337 GoM. 2016(d). *National Fisheries and Aquaculture Policy.*

Key recommendations

LEGISLATION AND POLICY

Strengthen fisheries co-management arrangements in tandem with stronger enforcement against illegal fishing technologies and overfishing.

Effective fisheries governance is prioritized in the revised fisheries policy, along with the recognition that improved institutional arrangements must be based on co-management with fishing communities. Successfully implemented, co-management interventions will empower primary stakeholders (mostly local fisherfolk) to manage the fishery on which their livelihood depends. These arrangements will enable the development of participatory Fisheries Management Plans, including regulations and penalties, and enforcement of these regulations to control access.

Participatory aspects of co-management will need to be complemented by strict enforcement (by the state) of the Fisheries Conservation and Management Regulations (2000).

Specifically, this states that no trawl net or ring net shall be used

- Within one international nautical mile (1,852 m) of every shoreline
- In waters of a depth of less than 18 m
- Between 1700 and 0700 hours

Currently these regulations are not being enforced. It is particularly important to monitor trawlers. Tracking devices should be fitted and the use of inappropriate net mesh sizes should be stopped. Seine nets with illegal mesh sizes must be destroyed and the owners prosecuted, or the nets will be used again.

DATA COLLECTION

Up-to-date information is needed on the status of fish stocks and fishing practices.

There is a definite need to undertake an up-to-date assessment of the remaining fish stocks, current fishing practices, and the impact of climate and other environmental changes. This is required to define the correct prescriptions and levels to stabilize the decline of fish stocks and return them to a more natural state.

10. BIODIVERSITY

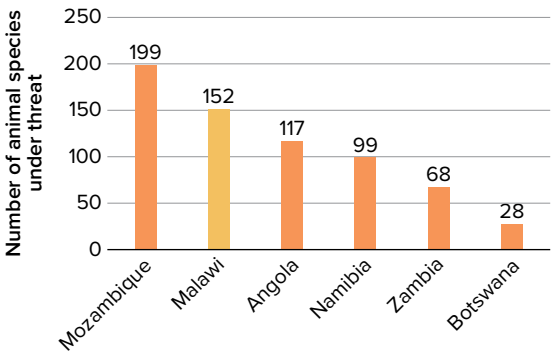
The status of Malawi's biodiversity

Much of Malawi's biodiversity key taxa are in decline, and most species of national and international conservation significance are increasingly restricted to protected areas. According to the Malawi's National Biodiversity Strategy and Action Plan (NBSAP II) published in 2015, forestry, fisheries, and wildlife sectors contributed 12.8% to its GDP in 2010.[338] However, Malawi has one of the highest numbers of threatened species in the region, and the expanding population and increased demand for agricultural land and sources of protein are causing a steady decline in Malawi's biodiversity assets. In recent years, GoM has introduced a range of concession models to attract private sector investment in protected areas, which have been extremely successful in terms of both conservation outcomes and revenue generation. GoM has also made substantial recent progress in tackling wildlife crime and illegal logging.

Terrestrial biodiversity

According to the IUCN Red List of Threatened Species,[339] Malawi has 150 critically endangered, endangered, or vulnerable species (animals). A summary of country totals benchmarked against selected other countries is shown in Figure 34.

FIGURE 34. Number of threatened animal species in Malawi and neighboring countries



Source: IUCN. 2017. *The IUCN Red List of Threatened Species.*

Over 50% of Malawi's elephant population has been lost in the last 25 years, including the African elephant *Loxodonta africana* and other important keystone species. According to the NEAPW,[340] elephant populations have been increasing only in Liwonde National Park and Majete Wildlife Reserve. Other elephant populations are gradually declining in numbers and in range due to habitat loss. For example, Kasungu National Park currently supports approximately 50 elephants, compared to about 2,000 in the late 1980s. Current estimates put the national elephant population close to 2,000 individuals.[341]

Other species of international conservation concern have also declined or are now extinct in Malawi. For example, African Wild Dogs *Lycaon pictus* are known to still exist in Kasungu (KNP) and Nyika National Park (NNP), but they are subject to high levels of human encroachment and poaching.[342] Cheetah *Acinonyx jubatus* was reported as almost extinct in Malawi in 1996 and, with the exception of small numbers that have recently been reintroduced into Liwonde National Park, the species is now gone from Malawi.

Expanding demand for agricultural land and bush meat is the main cause of the decline in Malawi's wildlife. However, weak judicial systems, law enforcement, and natural resources governance have also undermined efforts to halt the

338 GoM. 2015(c). *National Biodiversity Strategy and Action Plan II (2015–2025).*

339 IUCN. 2017. *The IUCN Red List of Threatened Species.*

340 GoM. 2015(d). *National Elephant Action Plan for Malawi 2015–2025.*

341 Ibid.

342 Wild Dog Conservation Malawi. 2018. *Endangered Dogs*.

Lake Malawi supports over 800 species of fish—the highest freshwater fish diversity in the world.

declines of many species. Until recently, wildlife crime was not considered a serious offense, and Malawi has been used as an important transit hub for illegal wildlife products, which are imported and exported through its borders.[343]

Aquatic ecosystems

Aquatic ecosystems cover about 20% of the total surface area of Malawi and are habitats to an astonishing diversity of fish and other aquatic fauna and flora.[344] Lake Malawi is probably the most famous natural ecosystem in Malawi. It is the ninth-largest lake in the world and the third-largest in Africa. It is over 2 million years old and a center of endemism for Cichlid fish. There are at least 800 species of Cichlids in Lake Malawi, of which 117 are classified as threatened by the IUCN. The lake contains the largest number of freshwater fish species in the world, 30% of all known cichlid species,[345] and 4% of the world's fish species.[346]

Fish stocks in Lake Malawi are declining. Of particular significance is the decline of the endemic *Chambo,* of which there are three species*:* (i) *Oreochromis lidole,* (ii) *Oreochromis karongae;* and (iii) *Oreochromis squamipinnis.* The former is endemic to Lake Malawi, Lake Malombe, and the Shire River and is harvested extensively in Lake Malawi for food, sale, and trade. It is now listed in the IUCN Red List as an endangered species on account of its precipitous decline.

Between 1980 and 1996, the total *Chambo* catch (for Lake Malawi, Upper Shire, and Lake Malombe combined) reduced by more than 70%.[347] In 1980, the catch was 10,711 tons, by 1990 it had declined to 6,483, and by 1996 it was down to 2,774 tons. In Lake Malombe, *Chambo* stocks are considered to have been in a state of collapse or near collapse since the early 1990s. Assessments suggest that overfishing is the main cause for this decline. The use of inappropriate nets and harvesting within breeding zones may also contribute. Since the 1990s, surveys indicate that the collapse of the *Chambo* fish stocks continues unabated.[348, 349]

Wetlands

Wetlands, such as Lake Chilwa and the Elephant Marsh, are important for resilient livelihoods and for their ecological functions. These wetlands are important for livelihoods and climate resilience. They support important fisheries, livestock grazing, and agriculture, especially during dry periods where water elsewhere in the landscape is scarce.[350]

343 GoM. 2017(g). *The National Ivory Action Plan.*

344 GoM. 2014(a). *Fifth National Report to the Convention on Biological Diversity.*

345 UNESCO. 2018. *Lake Malawi National Park.*

346 GoM. 2010. *Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth.*

347 IUCN. 2017. *The IUCN Red List of Threatened Species.*

348 Weyl. 2001. *Hard Choices for Chambo Management in Area A of the Southeast Arm of Lake Malawi.*

349 Banda et al. 2005. *The Chambo Restoration Strategic Plan.*

350 Arthur and Hara. 2017. *Climate Resilient Livelihoods and Sustainable Natural Resources Management in the Elephant Marshes—Livelihoods Report.*

Malawi's wetlands support internationally-significant populations of water bird species, including the African Skimmer *Rynchops flavirostris.*

Malawi's wetlands support populations of internationally significant water bird populations, including both resident and migratory populations. The Elephant Marsh also plays an important role in flood storage and attenuation and for purifying sediment-rich water flowing through the Shire system. The annual value of the regulating services provided by the Elephant Marsh was estimated between USD 3 million and 255 million.[351] Most of this value is from harvesting fish and thatching grass. The total tourism/recreation value is currently quite low at approximately USD 17,500 per year, but there is significant potential for growth in this sector.

BOX 10. The Elephant Marsh wetland of international importance

Malawi recently created a new Ramsar reserve to conserve the Elephant Marsh. This newly designated protected area covers 600 km^2 and is considered to be a wetland of international importance. It is the second wetland in Malawi designated under the Ramsar Convention—the first was Lake Chilwa—designated in 1996. The Elephant Marsh supports an important freshwater open water fishery and provides critical dry season grazing for the large cattle herds of the lower Shire valley. The marsh also provides a habitat for over 110 water bird species and supports over 20,000 water birds and more than 1% of a delineated population of three water bird species.[352]

The Department of National Parks and Wildlife (DNPW) and the DoFi are now working to support sustainable management of the marsh through improved fisheries management, integrated agriculture, aquaculture systems, and introduction of community-based tourism and improved zoning. The DNPW is also proposing to designate this area as Malawi's first Community Conservation Area as part of a strategy to support sustainable use of this wetland.

Protected areas

Malawi has 96 protected areas, comprising forest reserves, national parks, and wildlife reserves. These cover a total of 10,585 km^2—or 11.2% of Malawi's total land area.[353] Forest reserves are managed by the DoF and national parks and wildlife reserves by the DNPW. Many of these protected areas are also categorized as important bird areas.[354] These

351 Forsythe and Turpie. 2016. *Ecosystem Services of the Elephant Marsh.*

352 Turpie et al. 2016. *Climate Resilient Livelihoods and Sustainable Natural Resources Management in the Elephant Marshes, Malawi. Sub-study 4: Biodiversity of the Elephant Marshes*. MoAIWD. August 2016.

353 GRID-Arendal. 2013. *Zambezi River Basin—Atlas of the Changing Environment.*

354 Birdlife International. 2018. *Malawi.*

BOX 11. Mulanje Cedar: The national tree of Malawi

The Mulanje Cedar, *Widdringtonia whytei*, is endemic to the Mulanje Mountain, the second-highest mountain in Southern Africa, rising to over 3,000 m. The Mulanje Mountain is a forest reserve of 473 km^2 that contains over 70 endemic plant species. The wood of the Mulanje Cedar is fragrant and is resistant to insects and fungi—properties that have made this species much sought after for illegal trade. Over recent years, virtually all remaining Mulanje Cedars have been logged from the Mulanje Mountain. The rate of decline of the Mulanje Cedar has probably been the most dramatic of all species within Malawi. The tree is highly threatened and close to extinction.[355]

areas face considerable challenges with illegal logging and encroachment. This is contributing to significant declines of native species of tree, especially the Mulanje Cedar, the national tree of Malawi.

Drivers

A growing demand for agricultural land and for wood biomass, fish, and bush meat is driving the decline of Malawi's remaining biodiversity even from within protected areas (as the resources available outside the protected areas diminish). In addition, poor land management practices such as the conversion of forests and the elimination of fallow periods affect biodiversity.

Institutions and policy

The responsibility for the management of Malawi's biodiversity, wetlands, and protected areas is with several government departments:

- The EAD is responsible for the production of the NEAPW, the NBSAP II, access and benefit sharing of genetics resources, and the production of the IUCN Red List for Malawi.
- The DNPW oversees the management of all National Parks, Wildlife Reserves, and Games Parks.
- The DoF oversees the management of all forest reserves including plantation, production, and conservation forestry.
- The DoFi manages and develops the fisheries sector in Malawi, including the protection and conservation of fish stocks.

Most government departments face very low levels of finance. However, the DNPW has started to address this issue by encouraging investment in protected areas by the private sector and other non-state actors, such as the nonprofit African Parks, to which full management control has now been delegated in three protected areas.

This has proved to be extremely effective by improving the management of these protected areas and increasing tourism revenues. However, the considerable success of the introduction of delegated concessions has also led to large disparities in financing between protected areas where concession arrangements are in place and those that lack such arrangements (see Table 7). The mean actual spend per unit area per year is about USD 100 per km^2 for District Forest Reserves and USD 200 per km^2 for State Reserves and Nature Reserves. This compares with an average spend of USD 600 per km^2 for National Parks in Tanzania.[356]

355 IUCN. 2017. *The IUCN Red List of Threatened Species.*

356 Green et al. 2013. *Modelling Tree Growth to Determine the Sustainability of Current Off-take from Miombo Woodland: A Case Study from Rural Villages in Malawi.*

TABLE 7. Current annual funding per unit area of protected areas in the Shire Valley, Malawi[357]

Site	Size (km^2)	Annual Allocation (USD)	USD per km^2	Management Authority
Mwabvi Wildlife Reserve	135	2,783	21	GoM
Matandwe Forest Reserve	264	50,000	192	GoM
Mangochi Forest Reserve	326	12,774	40	GoM
Liwonde National Park	548	3,000,000	5,475	APN (CapEx)
Majete Wildlife Reserve	700	1,000,000	1,429	APN
Lengwe National Park	887	6,122	7	GoM

Source: Munthali. 2016. *Situational Report on Financial Sustainability of Protected Areas in the Shire Basin.*

Note: APN = African Parks Network; CapEx = Capital expenditure.

BOX 12. The transformative impact of protected areas management concessions

In 2003, GoM introduced its first fully delegated concession model for Majete Wildlife Reserve. The concession was awarded to Africa Parks—a nonprofit conservation organization that takes on direct responsibility for the rehabilitation and long-term management of protected areas in partnership with governments and local communities. In that year, Majete Wildlife Reserve received just 10 visitors and generated close to zero revenues. By 2017, the reserve attracted over 9,000 visitors, half of whom were Malawian nationals, bringing in over USD 550,000 to the reserve and communities.

There has also been a dramatic improvement in conservation outcomes, with the reserve now fully restocked with wildlife. Based on the overwhelming success of this arrangement, additional fully delegated concessions were awarded to Africa Parks for Nkhotakota Wildlife Reserve and Liwonde National Park, both in 2015. At all three protected areas, there have been substantial investments in staff training, community development, and restocking of wildlife populations, in tandem with investments to improve conservation enforcement. At these sites, there have also been dramatic turnarounds in conservation outcomes and substantial increases in tourism revenues that help subsidize park management.

Enforcement—Positive signs

Recently, GoM has taken a stronger stance on combating wildlife crime and strengthening law enforcement. There have been notable policy reforms and some high-profile wildlife crime court cases. Malawi signed the London Declaration on Illegal Wildlife Trade and the Arusha Declaration on Wildlife Crime. In January 2015, Malawi joined the Elephant Protection Initiative and agreed to implement the NEAPW. It also undertook a major review of illegal wildlife trade[358] that proposed specific actions to strengthen enforcement of wildlife crime, many of which are now being implemented. In 2017, Malawi adopted the SADC Law Enforcement and Anti-Poaching Strategy (LEAP), a regional convention that aims to reduce poaching and wildlife trade and improve law enforcement in Southern Africa.

Malawi's law enforcement and legal system are now more effective for protecting wildlife. Since their establishment in 2016, Wildlife Crime Investigation Units (WCIUs) have increased enforcement efforts against wildlife traffickers and traders, with dramatic increases in prosecution rates and custodial sentencing. Malawi now has some of the toughest penalties in the SADC region. Following the wildlife trade review published in 2015, the government passed an amendment to strengthen the National Parks and Wildlife Act[359] including the introduction of automatic custodial sentences for some offenses.

357 Munthali. 2016. *Situational Report on Financial Sustainability of Protected Areas in the Shire Basin.*

358 Waterland et al. 2015. *Illegal Wildlife Trade Review Malawi, May 2015.*

359 GoM. 2017(h). *National Parks and Wildlife (Amendment) Act, 2017 (No. 11 of 2017).*

Key recommendations

CONTINUE TO ENGAGE WITH THE PRIVATE SECTOR

The private sector can play an important role in improving the management of protected areas and raise tourism revenues at the same time.

In some cases, engaging with the private sector has already transformed park management. It is helping Malawi attract greater numbers of tourists to these protected areas and contributing to economic development for local communities around these parks. This approach needs to continue to attract other concessionaires. Since not all parks will be suitable for the fully delegated concession model applied at Majete Wildlife Reserve, Liwonde National Park, and Nkhotakota Wildlife Reserve, the DNPW will need to develop different concession management arrangements tailored to the specific context of particular protected areas.

EXPAND NATURE–BASED TOURISM REVENUES

Nature–based tourism revenues can help finance biodiversity conservation.

A considerable proportion of tourism to Malawi is nature-based attractions such as Lake Malawi, Liwonde National Park, and Mulanje Mountain. Tourism in Malawi has been gradually increasing with approximately 900,000 visitors in 2014.[360] If this growth is to be sustained, Malawi will need to create incentives for the private sector to invest in better tourism services and infrastructure, complemented by improved brand development at the national level.

MONITOR AND COMBAT WILDLIFE CRIME

GoM should continue to implement the recommendations of the illegal wildlife trade review and improve awareness and the handling of wildlife crime.

GoM has made good progress in recent years in strengthening wildlife crime management efforts, including through the use of courtroom monitoring and private prosecutions. However, further action is needed. For example, there needs to be an increased judicial awareness of wildlife crime and improved capacity for handling wildlife cases and forensics.

Improve surveillance and monitoring of protected areas and natural resources to ensure better targeting of limited field–level resources.

The conservation of many key sites for biodiversity conservation, such as protected areas, forest reserves, and wetlands, are understaffed or not staffed at all, which makes it extremely difficult to detect and suppress illegal resources use. Greater use of geospatial technologies that could include aerial surveys, satellite monitoring, and drone surveys could help better target limited human resources at field levels.

360 Solimar. 2017. *Technical Study to Enhance the Potential for Nature-Based Tourism in the Shire River Basin—Tourism Strategy*.

11. WATER RESOURCES

The quality and availability of Malawi's water is under threat. Human activity, population growth, agricultural expansion, urban waste and pollution, and soil erosion are all contributing factors—and changes in Malawi's climate will only exacerbate the situation.

Malawi's water resources

Malawi's system of lakes, wetlands, aquifers, and rivers are the country's most important natural resource. About 94% of Malawi's landmass falls in the Zambezi River basin (constituting 8% of the basin with Africa's fourth longest river). The remaining 6% is in the Congo and Rovuma River basins along with an internal drainage basin of Lake Chilwa. See Figure 35 for a map of Malawi's lakes and rivers.

Lake Malawi is the world's fourth-deepest and Africa's third-largest freshwater lake. It is fed by over 200 rivers (mostly ephemeral) from Malawi, Tanzania, and Mozambique and has a surface area of 28,760 km^2 [361] and an abundance of biodiversity.[362] The only outlet of this vast lake is into the Shire River as it flows south. The Shire River discharges an average of 18,000 km^3 per year of runoff into the Zambezi River and onwards to Mozambique. This equates to 20% of the Zambezi River basin's total runoff,[363] which is a significant portion of the Zambezi River, the third-largest river in Africa by discharge.

Malawi's groundwater is situated in the extensive Precambrian weathered basement complex and the lakeshore and Lower Shire River valley quaternary alluvial aquifers. They yield 2 liters per second and 20 liters per second, respectively.[364] Malawi's other lakes (Malombe, Chilwa, Chiuta, Kazuni, and Chiwondo); large wetlands (the Elephant, Ndindi, and Vwaza Marshes); rivers; and aquifers are collectively of national economic, social, and environmental significance.

Malawi's water availability is decreasing rapidly and it has the lowest water availability *per capita* of its neighboring countries. Soon, despite having satisfactory quantities of renewable water (estimated at 17.3 km^3 per year in 2011), the country is likely to experience water scarcity. This is when demand for water exceeds the available and accessible amounts of sufficient quality water. Across Southern Africa, the rate of population growth and the subsequent increased demand for water far outpace water availability. Climate variability and change, and insufficient water infrastructures and management systems such as dams, wells, municipal extension services, and so on, make this problem even worse. However, Malawi's situation is serious. Figure 36 shows how Malawi faces water scarcity with less than 1,000 m^3 of water *per capita* per year.

In Malawi, 79% of water allocations are given to irrigated agriculture (1.17 km^3 per year) and the remaining 21% to municipal water supply (0.15 km^3 per year) and industries (0.05 km^3).[365] Together, these abstractions represent 7.9% of total renewable water resources (see Figure 37).

Failure to adequately respond to Malawi's water resource management challenges will likely lead to more water pollution, uncertain water availability, and greater competition for water use. The three main areas of critical water use (agriculture, hydropower investments, and urban water management) not only need improved water resource management, but they also face the added challenges of population growth, urbanization, and unregulated and unmonitored expansion of water abstraction for industry and agriculture.

361 GoM. 2010. *Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth*.

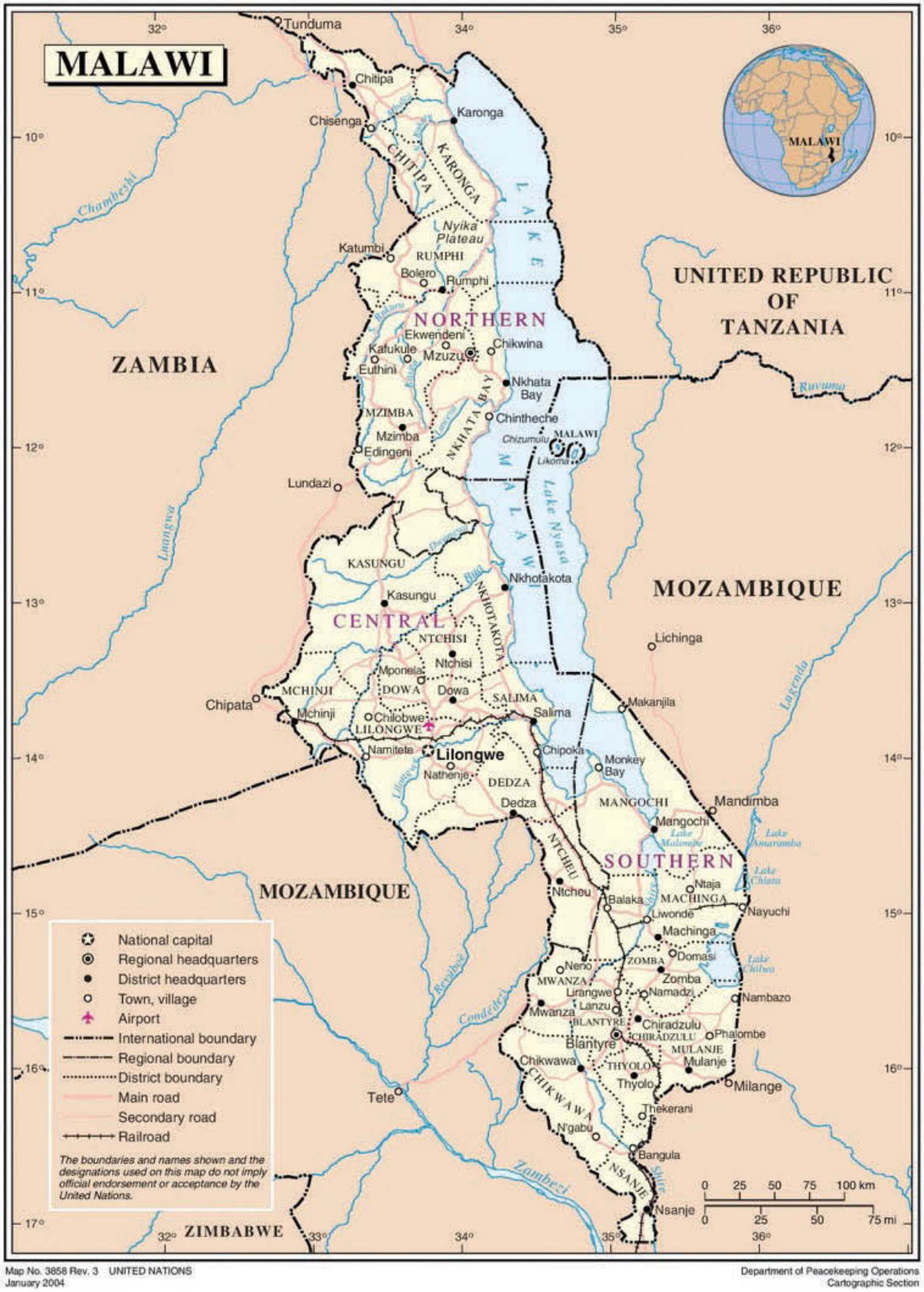
362 World Bank. 2010. *The Zambezi River Basin: A Multi-sector Investment Opportunities Analysis (Vol. 3): State of the Basin (English)*. About 99% of the more than 800 cichlid fish species and more than 70% of the 17 clariids are endemic to the Lake Malawi region, which is also thought to hold more than 3,000 fish species, 200 mammals, 650 birds, and over 5,500 plant species.

363 World Bank. 2010. *The Zambezi River Basin: A Multi-sector Investment Opportunities Analysis (Vol. 3): State of the Basin (English)*.

364 Kumwenda et al. 2015. *Trends and Outlook: Agricultural Water Management in Southern Africa—Country Report Malawi.*

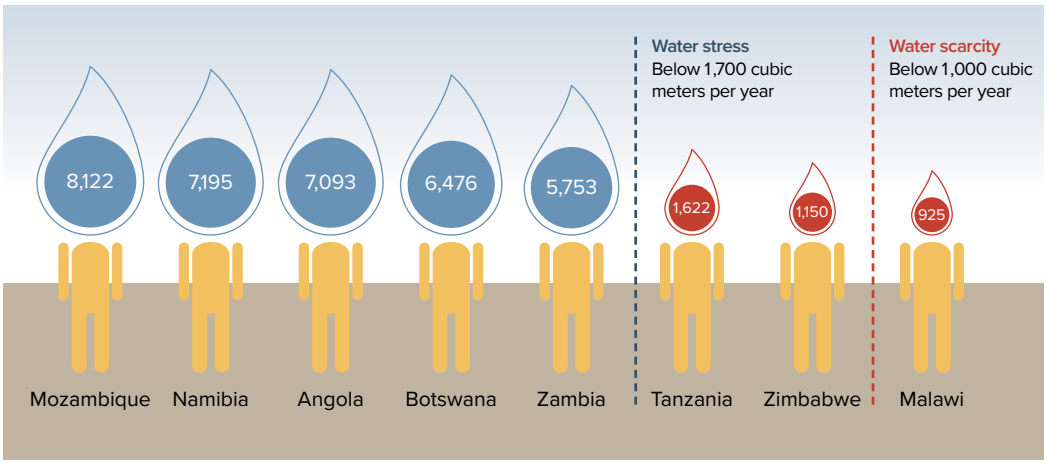
365 Ibid.

FIGURE 35. Map of Malawi showing extent of lakes and rivers



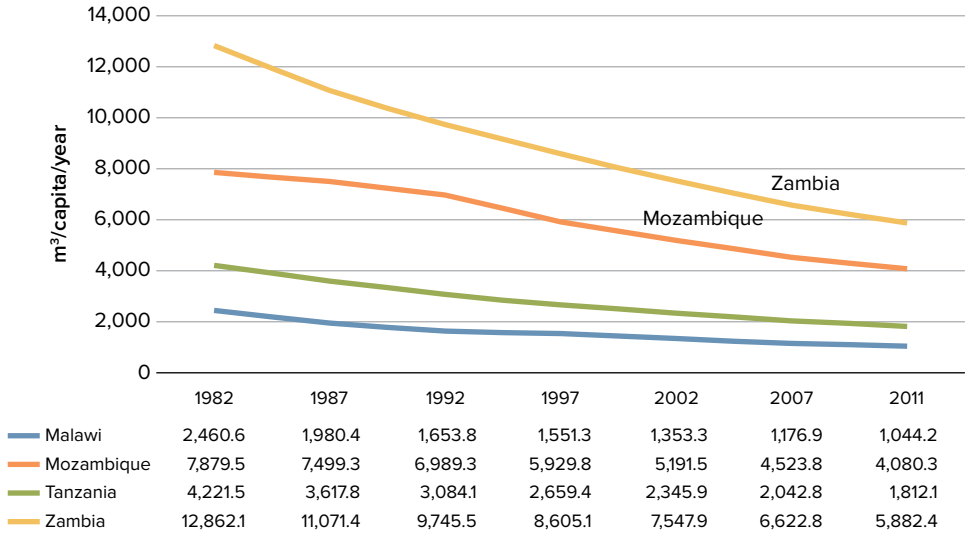
Source: United Nations. 2004. *Malawi.*

FIGURE 36. Malawi's availability of water *per capita* compared to other Zambezi River Basin countries



Source: Grid Arendal. 2013. *Zambezi River Basin—Atlas of the Changing Environment.*

FIGURE 37. Graph of total renewable water resources



	1982	1987	1992	1997	2002	2007	2011
Malawi	2,460.6	1,980.4	1,653.8	1,551.3	1,353.3	1,176.9	1,044.2
Mozambique	7,879.5	7,499.3	6,989.3	5,929.8	5,191.5	4,523.8	4,080.3
Tanzania	4,221.5	3,617.8	3,084.1	2,659.4	2,345.9	2,042.8	1,812.1
Zambia	12,862.1	11,071.4	9,745.5	8,605.1	7,547.9	6,622.8	5,882.4

Source: Adapted from data on renewable water from SADC. 2013. *SADC Statistics Yearbook 2013.*

Environment

All of Malawi's water resources are being rapidly degraded and exploited by unregulated and intensifying human activity. These activities include deforestation which is causing high rates of erosion and sedimentation, which, in turn, has an impact on aquatic life. There is increasing biological and chemical pollution from urban areas and industrial waste, all made worse by an absence of adequate wastewater treatments. In addition, there is chemical leakage from the overuse of fertilizers and pesticides (particularly during wet seasons).

In rural areas, freshwater resources are being undermined by food insecurity and population growth caused by increased loss of vegetation and the extension of farming into wetlands and river channel beds.[366] These same rural communities are often negatively affected by the deteriorated ecosystem services and are then at greater risk of extreme water conditions such as floods and droughts.

366 Phalira. 2016. *Community Environment Conservation Fund Presentation.*

In cities and towns, water resources are being increasingly polluted by waste generated through increasing urbanization and the growth of informal settlements and industries. In Lilongwe, farming, housing, and informal markets (such as Tsoka and Lizulu) encroach on the buffer zones of the Lilongwe River.[367] This results in direct and indirect transmission of pollutants into the water, including oils from workshops, effluent disposal, animal and solid waste, sulphates, nitrates, and lead from used batteries. Similar pollution patterns have emerged in the Mudi, Naperi, and Nasolo Rivers of Blantyre; the Lunyangwa River of Mzuzu and Likangala; and Domasi Rivers in Zomba.

Urban water pollution also has a knock-on effect on aquatic life, downstream users, and the river's ecosystem services. For example, large amounts of plastics are damaging to birds and wildlife.[368] In addition, chemical and solid waste pollution affects people's health,[369] spreads waterborne diseases, and increases treatment costs for municipal water utilities.

Malawi's rivers and lakes are experiencing rapidly deteriorating water quality. This is happening due to an increased loading of chemicals and nutrients from agriculture, industries and mining, soil erosion, and sedimentation. Eutrophication in Southern and Central Lake Malawi, and the other larger lakes, is now evident with changes to the phytoplankton assemblages, riverine vegetation growth, and its impact on hypoxia (oxygen depletion) and fish stocks.[370] Conditions are now more favorable for aquatic weeds, such as the water hyacinth (locally known as *Namasupuni*) and the Kariba Weed, allowing the creation of large mats of vegetation negatively affecting water flows, fisheries, navigation, and water quality.

Climate change

Future extreme and uncertain hydrological conditions could undermine the environmental and socioeconomic functions of Malawi's lakes, wetlands, aquifers, and rivers. Lake Malawi, the Shire River, and wetlands such as the Elephant Marshes sustain vital ecosystem functions and wildlife. When the level of Lake Malawi and rainfall patterns across the Shire River basin fluctuate, the ecosystem and economic services of the Shire River follow suit. The following potential floods and drought conditions then affect a number of important resources including:

- Hydropower production;
- Water supply to urban areas in Blantyre, Limbe, Liwonde, and Mangochi, as well as thousands of rural communities in catchment areas; and
- Irrigation systems that are critical for production of commodities such as raw sugar, tea, and tobacco.

Water resources and the economy

The impacts of degraded water resources in Malawi can be seen by the effects they have on critical water use, which has a knock-on effect on the economy. The compounded economic impact of degraded water resources in Malawi is hard to collectively estimate, but poor sanitation alone is estimated to cost the country USD 57 million per year (or 1.1% of GDP). For example, a cost-benefit analysis of increased investments in water supply and sanitation infrastructures estimates 1.4 times return for water supply and 1.2 times return for sanitation.[371] Flooding in recent years has cost the country the equivalent of 5% of GDP—a financial burden exacerbated by the absence of water-regulating infrastructures and encroachment in high-risk flood zones.

367 ICLEI-CBC. 2017. *River Revitalisation in Lilongwe, Malawi.*

368 GoM. 2010. *Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth*.

369 About 90% of mortality attributed to diarrhea is caused by poor water and sanitation in Malawi, numbering 8,000 mortalities (4,500 of which are children under five) per year (Water and Sanitation Program 2012).

370 Otu et al. 2011. *Paleolimnological Evidence of the Effects of Recent Cultural Eutrophication during the Last 200 Years in Lake Malawi, East Africa.*

371 WSP. 2012. *Malawi—Economic Impacts of Poor Sanitation in Africa.*

Malawi's water availability is decreasing rapidly and it has the lowest water availability *per capita* of its neighboring countries.

Water is an essential economic input for Malawi's predominantly rainfed agricultural productivity and for commodity crops, all of which rely directly on water access and availability. In all, agriculture contributes 90% of export earnings and its water use makes up 79% of all water withdrawals.[372] Estimates from 2010 suggest that only 9–22% of the potential 4 million ha of irrigable land was put under irrigation.[373] As such, expanding irrigation and its water withdrawals is a top economic priority for the government and is addressed by the Cabinet's 2011 Green Belt Initiative[374] and the National Irrigation Policy.[375]

In addition, water resources are critical for Malawi's economy as hydropower creates over 95% of Malawi's electricity.[376] Malawi needs hydropower for existing energy production and is a big part of future plans for energy production. However, natural processes such as siltation and erosion are a threat to hydropower production. Climate variability also exacerbates this potential problem. In 2015, erratic rainfall and low levels in Lake Malawi resulted in a 66% drop in hydropower production at the three downstream Nkula, Tedzani, and Kapichira turbines.[377] One of many economic and environmental consequences of this subsequent loss of electricity supply was an increased pressure on forests for firewood.

Institutions and policy

Legislative commitments

Malawi has a range of policies and institutional structures designed to manage water and sanitation, both at strategic and local levels. At a strategic level, the 2007 National Water Policy[378] (2nd edition) outlines the vision of 'water and sanitation for all, always' with objectives, guiding principles, and sector-specific strategies (ranging from agriculture through to ecotourism). Similarly, the 2008 National Sanitation Policy[379] sets out national objectives and provides guidance on implementation mechanisms to promote integrated multisectoral coordination and monitoring of sanitation. At a

372 Kumwenda et al. 2015. *Trends and Outlook: Agricultural Water Management in Southern Africa—Country Report Malawi.*

373 Ibid.

374 http://www.malawivoice.com/green-belt-initiative-gbi-the-game-changer-in-malawis-economy/

375 GoM. 2016(e). *National Irrigation Policy.*

376 ESCOM. 2015. *Water Levels and the Energy Situation.*

377 Sanje. 2015. *Malawi's Hydropower Dries Up as River Runs Low, Menacing Forests.*

378 GoM. 2007. *National Water Policy (2nd Edition).*

379 GoM. 2008. *National Sanitation Policy*.

decentralized level, the Catchment Management Committees (CMCs) play a critical role in convening government, private sector, and traditional authority representatives for shared water challenges and opportunities.

The Water Resources Act (1969) is the principle law that covers the water sector. In 2013, the act was updated to create the following institutional structures:

- National Water Resources Authority (NWRA)
- CMCs
- Water Tribunal
- Water User Associations
- Water Trust Fund

The Waterworks Act of 1995,[380] on the other hand, covers water supply and sanitation and the establishment of Water Boards for providing piped water and sewerage services.

In the transboundary context, Malawi is a signatory of the 2000 Revised SADC Protocol on Shared Watercourse System and the 2004 Zambezi Watercourse Commission Agreement (ZAMCOM), which both carry obligations on the equitable use of water among riparian states. However, Malawi has not, in contrast to the other seven riparian states in the region, finalized the accession processes of the ZAMCOM agreement.

What happens in practice

Unfortunately, functions across the various regulatory and institutional structures responsible for water and sanitation regularly overlap, which can hinder efficient management—a situation made worse by inadequate staffing levels. The MoAIWD was formed in 2014, and its Water Resources Department (WRD) mandate covers multiple uses and functions of water resources. The Water Resources Board was initially intended as a regulatory authority, but it also fulfils an advisory function to the minister on issues ranging from water abstraction permits to incidents of pollution, as well as approval of water infrastructures and collaboration with stakeholders. The ministry also suffers from staff shortages, with only 60% of positions filled. As of 2018, an office was acquired for the NWRA in Lilongwe and recruitment is still pending. However, the recently updated 2013 Act now gives the NWRA further mandates than those of regulatory bodies.[381]

380 GoM. 1995. *Waterworks Act 1995 (No. 17 of 1995).*

381 GoM. 2016(b). *Shire River Basin Plan. Volume 1: Basis for Planning*.

Key recommendations

Reducing the main challenges facing Malawi's water resources requires a multisectoral, cross-ministerial approach that ranges from national through to local interventions. At the same time, the potential for productive use of water for food production and hydropower is high and current abstractions are low.[382] Just as water challenges and potential vary across sectors, from hydropower through to water supply, so do remedial investments and policy frameworks. The critical issues around Malawi's environment and water resources and the key approaches to support these are detailed below.[383]

382 Unused water resources were estimated to be 92%. See Kumwenda et al. 2015. *Trends and Outlook: Agricultural Water Management in Southern Africa—Country Report Malawi.*

383 GoM. 2016(b). *Shire River Basin Plan. Volume 1: Basis for Planning*.

EXPAND CATCHMENT MANAGEMENT AND ADOPT MORE EFFICIENT TECHNOLOGIES

The application of targeted and proven approaches needs to extend beyond piloting.

This involves supporting sustainable catchment management with the implementation of National Catchment Management and Rural Infrastructure Development Guidelines. It also should involve close cooperation with district partners and establish a monitoring program for sediment loads in waterways of major importance. Measures to improve water use efficiencies can have a substantial impact. For example, supplemental irrigation (that is, irrigating only during critical crop growth and development periods)[384] for greater crop and water productivity can, when coupled with rainwater harvesting, increase yields two to three times more than conventional rainfed agriculture.[385]

STRENGTHEN INSTITUTIONAL REFORMS IN THE WATER SECTOR

Make sure that institutional reforms in the water sector are implemented and enforced to realize the benefits of these reforms.

It is recommended that institutional mandates are enforced through the operationalization of the NWRA in accordance with the 2013 Water Resources Act, with its delineation of mandates with existing departments and subnational institutions, such as River Basin Agencies.

PRIORITIZE LICENSING, ALLOCATION, AND MONITORING OF WATER USE

Improving water management requires strengthened systems and capacities for licensing, allocating, and monitoring water use.

Water usage needs to be managed and allocated appropriately during normal operations and extreme low-flow events. This can be achieved by identifying and agreeing on water priorities and when and how to allocate water usage appropriately. Building robust water use licensing systems can be done through capacity building, targeting both field and licensing staff, and developing detailed procedures and protocols alongside improved flow and abstraction measurement technology.

CONTINUE TO BUILD WATER-MONITORING CAPABILITIES

The continuous collection of water data is critical for managing priority water challenges.

In particular, building the government's capacity and systems is needed in the areas of:

- Water quality and pollution monitoring.
- Regulation and compliance for urban wastewater discharge (for example, through compliance monitoring and effluent license conditions).
- Sewerage facilities in major urban areas.

In addition, the management of groundwater relies on improved data availability (centralized online database, basin geology analysis, groundwater levels, quality and abstraction data collection) and focusing on hot spot challenges and the declaration of groundwater management areas.

384 Fox et al. 2005. *Risk Analysis and Economic Viability of Water Harvesting for Supplemental Irrigation in Semi-arid Burkina Faso and Kenya*; World Bank. 2006. *Sustainable Land Management: Challenges, Opportunities and Trade-offs*; Rockström and Barron. 2007. *Water Productivity in Rainfed Systems: Overview of Challenges and Analysis of Opportunities in Water Scarcity Prone Savannahs*.

385 USAID. 2015(a). *Agricultural Water Management Water and Development Strategy—Implementation Brief.*

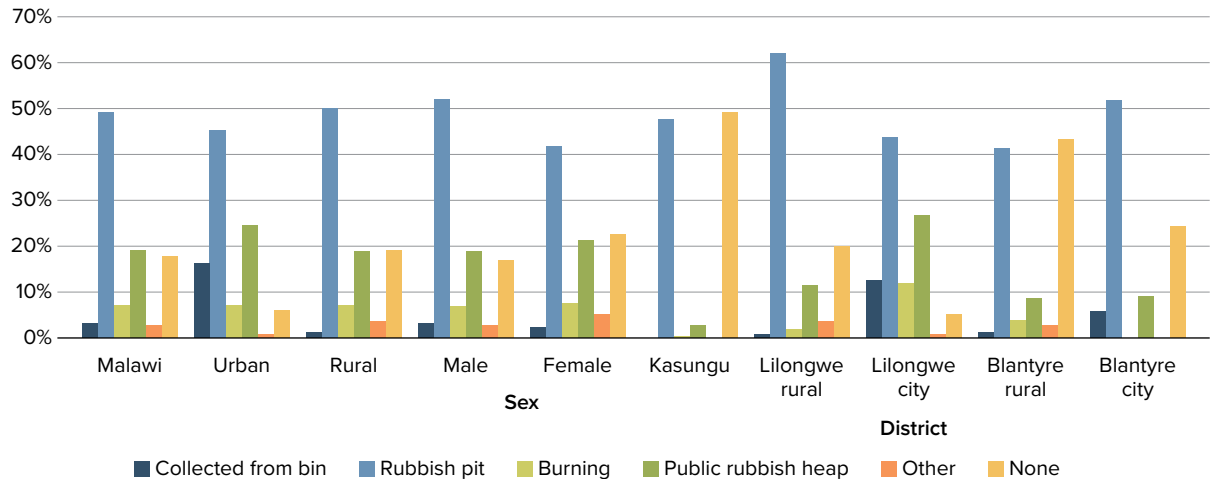
12. WASTE MANAGEMENT (SOLID AND LIQUID)

Waste management requirements are growing rapidly, yet the necessary infrastructure and policy implementation lags. The gap between requirements and the resources available is extremely large. This is particularly serious in urban areas, where population growth increases the need for waste management and population density leaves many people (usually the poorest) living in close proximity to both rubbish and sewerage. Current urban planning is not keeping pace with waste management needs.

Status of waste management

Only 10%–15% of urban wastewater is collected through sewerage[386] and an estimated 70% of MSW is not officially disposed of.[387] This is a significant challenge for Malawi. Much of this waste ends up in open spaces, in rivers, and on the street.[388] Even the 30% of solid waste that is collected for disposal is not disposed of effectively. Data are limited but the 2010 State of the Environment Report[389] provides information from 2005. This shows that less than 5% of households have trash picked up from their bin, and almost 70% of households deposit their waste in a rubbish pit or public trash pile[390] (see Figure 38). On average, the solid waste generation rate is estimated at 0.5 kg *per capita* per day.[391]

FIGURE 38. Trash disposal practices, 2005



Source: GoM. 2010. *Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth.*

GoM has drafted policy documents that provide clear guidance on solid waste management, but implementation remains inadequate. Lack of implementation is due to a long-term failure to allocate adequate finance, implying a lack of political prioritization. There are some local initiatives supported by donors and NGOs, but these alone will not address the issue or provide the necessary finance at the required scale.

The country has only two municipal landfills, no publicly managed trash incinerators,[392] and just a few waste transfer stations. Only the major cities of Blantyre, Lilongwe, and Zomba have wastewater treatment plants. Hazardous waste is often mixed with nonhazardous waste, household waste, and commercial and industrial waste. Sources of growing

386 Chipofya et al. 2018. *Comparison of Pollutant Levels in Effluent from Wastewater Treatment Plants in Blantyre, Malawi.*

387 Nyirenda. 2016. *Status of Waste Management in Malawi.*

388 Barré. 2014. *Waste Market in Urban Malawi: A Way Out of Poverty?*

389 GoM. 2010. *Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth.*

390 Ibid.

391 Nyirenda. 2016. *Status of Waste Management in Malawi.*

392 Privately owned incinerators do exist but are not formally monitored, for example, at St. Gabriel.

The country has only two municipal landfills, no publicly managed trash incinerators and just a few waste transfer stations.

concern to the government include post-construction, livestock, and medical waste. Official dumps are just that, dumps. They have no fencing; have large-scale rodent infestations; and are an active source of human poisoning, pollution, and water contamination.[393]

Most district and municipal councils have no sewerage networks, and often sludge ponds or old quarry sites are used to dispose of sludge pumped from septic tanks. Most of the sewage plants that exist are dysfunctional due to age and because they were not designed for the capacity now required of them. As a result, they now need major maintenance. Liquid waste pollutes both ground and surface water and contaminates land used for urban agriculture. Studies have shown that heavy metals in industrial liquid waste exceed standard limits,[394] and river water in many urban areas is not fit for human consumption.[395] These factors together bring severe risks to human health.

There are no large-scale formal recycling schemes. In large urban centers such as Lilongwe and Blantyre, plastics are collected from the disposal sites and sold on to recyclers. To a very limited extent, composting waste is managed by NGOs, a few small firms, and some poor waste pickers.[396] There are some examples of small-scale PPPs and job creation in composting, recycling, and trash management, but these are limited. In addition, funding is not yet sufficient to address this growing problem,[397] However, the government is proactive on electronic waste (e-waste). For example, Malawi Communications Regulatory Authority (MACRA) is developing regulations on e-waste management.

In the context of an already limited service provision for solid and liquid waste, Malawi also faces a future challenge regarding pressures caused by urbanization. Rapid urbanization is often a key factor that overwhelms service provision in developing countries, when investment in services such as waste management and sanitation cannot keep up

393 Nyirenda. 2016. *Status of Waste Management in Malawi.*

394 Schütz. 2013. *Water Quality in Malawi—Effluent Water from a Matchstick Factory in Blantyre.*

395 See for example: Maloudi. 2012. *Water and Sanitation Needs Assessment for Blantyre City, Malawi*; Phiri et al. 2005. *Assessment of the Impact of Industrial Effluents on Water Quality of Receiving Rivers in Urban Areas of Malawi.*

396 Nyirenda. 2016. *Status of Waste Management in Malawi.*

397 Barré. 2014. *Waste Market in Urban Malawi: A Way Out of Poverty?*

with population increases. Currently, the growth rate of Malawi's urban centers remains relatively slow compared with comparator countries. However, even at a 15% growth rate,[398] urban populations can double in as little as seven or eight years. Investments in sustainable urban planning including solid waste management and sewerage need to be considered to deal with this urbanization challenge, which will more than likely intensify.

Climate change

Solid waste only contributes about 2% of Malawi's total GHG emissions. However, while still small, these emissions are growing at a faster rate than Malawi's total GHG emissions. Between 1999 and 2011, GHG emissions from solid waste grew by 2.3% per year. Malawi's total GHG emissions grew at a slower rate of 0.7% per year during the same period.[399]

However, climate change will affect the way solid waste should be managed in the future. Shifts in temperature and rainfall patterns will increase the risks to Malawi's environment and health from poor waste management. It is important to be aware of these risks so that plans can be made to:

- Improve the operation of existing solid waste sites.
- Make sure the design of new sites takes climate change into account.
- Make sure policy decisions on waste management incorporate climate change.

Table 8 shows examples of how potential changes to the climate can affect the environment and put people at risk.

TABLE 8. How climate change affects solid waste management practices

Climate Variable	Potential Climate Change	Examples of Impact of Waste Management
Temperature	Annual warming between 1°C and 5°C by the 2080s	Increased water demand for both site operation and workers
	More hot days, especially in dry seasons	
	Fewer cold days (especially in rainy seasons)	Impacts on biological processes such as composting and anaerobic digestion
	Longer hot spells in summer	Increased risk of changes in distribution of vermin and pests
Precipitation[a]	Generally wetter days for Malawi	Increased risk of flooding from groundwater and surface water
	Precipitation increases in rainy seasons	Disruption to infrastructure, for example, road and rail
		Increased precipitation intensity can affect slope stability on waste management sites
		Impacts on biological processes such as composting and anaerobic digestion
Cloud cover	Reduction in cloud cover	Risk to workers of skin conditions due to increased exposure to sunshine, when working outside
Humidity	Humidity increases (especially during rainy seasons)	Impacts on outdoor biological processes

Source: Based on Christian. 2010. *Potential Impacts of Climate Change on Solid Waste Management in Nigeria.*

Note: a. Global and downscaled climate change models and scenarios do not provide a consistent projection of changes in Malawi's average rainfall. Some indicate an increase in annual rainfall, others a decrease. There is more confidence that there will be an increase in the frequency and intensity of storms.

398 World Bank. 2017(a). *Malawi Economic Monitor: Harnessing the Urban Economy*.

399 USAID. 2016. *Greenhouse Gas Emissions in Malawi*.

Institutional issues

Malawi has the necessary legislation for effective waste management, but there is a chronic lack of finance to manage waste effectively, combined with limited capacity to enforce existing regulations.[400] The new EMA (2017) provides clear guidance and authority for waste management, the National Water Policy aims to ensure water of acceptable quality for all needs in Malawi, the Integrated and Sustainable Waste Management Framework calls for multi-stakeholder engagement, and formalized national effluent standards exist.[401] Governance mandates for leading national-level regulation and budget allocations lie with the EAD, while municipal and district councils are responsible for local-level waste management and the enforcement of regulations. Limited budget allocation relative to the scale of the problem forces government staff into a reactive rather than proactive approach to tackling waste.

Conflicting and confused mandates within government complicate effective waste management. The EAD is only meant to lead on regulation, but in practice it also undertakes some initiatives such as taking GHG measurements. Both the Water Affairs Department and the MoH have sanitation departments, but policies and priorities are not harmonized.

Economic context and impact

Solid waste management is associated with a range of economic, environmental, and social costs. There has been no detailed analysis of the costs of Malawi's current solid waste management status. However, the lack of effective waste management systems does mean the cost of upgrading and improving Malawi's solid waste management will be imposed onto future generations.

In addition to the direct costs of managing solid and liquid waste efficiently on a day-to-day basis, costings must also consider other external factors. These include methane and other air emissions from open dumps, landfill and transport, contamination, resource depletion, and the cost of future site remediation.

The major environmental cost of poor waste management is the pollution of surface and groundwater and resulting health hazards. Often household refuse is mixed with medical and industrial waste, unregulated dumping in unsuitable locations creates dust and litter, and untreated sewage pollutes accessible water sources. There is a lack of adequate data to provide accurate estimates of environmental costs. These should ideally include life-cycle assessments (LCAs)[402] to provide analysis of all environmental impacts of products rather than just immediate ones associated with final use and disposal.

The most obvious social cost of poor solid waste management is human health. Other social costs include the education of the public and industry on waste management, at both household and enterprise levels. It also includes the cost of encouraging and managing recycling schemes and the opportunity costs of clean-up campaigns.

400 For example, the Water Policy, Sanitation Policy, Waste Management Bylaws, and the Public Health Act.

401 GoM. 2017(i). *Environment Management Act, Act 19 of 2017*; GoM. 2005. *National Water Policy*; MBS. 2005. *Malawi Standard; Drinking Water Specification.*

402 For example, see DEAT. 2004. *Life Cycle Assessment.*

Key recommendations

Tackling waste management challenges in Malawi will require a comprehensive approach. The approach must include building the regulatory and policy capacity of the government so that standards are enforced and coherence and integration are achieved, from local through to national levels.

PRIVATE SECTOR AND MULTI–STAKEHOLDER PARTNERSHIPS

Leveraging private sector resources for solid waste management could improve the current situation at local levels.

The financial resources required at a national scale are so large that, without engagement with the private sector, GoM does not have the fiscal or political space to reallocate the substantial sums required. PPPs have the potential to go some way toward providing the level of resource required for the scale of solid waste management.

Local-level and private sector initiatives could include:

- Actively supporting private initiatives for waste management and marketing, including regularizing informal sector waste pickers.
- Adjusting regulations if necessary to support these private initiatives.
- Actively supporting the separation, processing, and sale of recyclable and compostable waste.
- Implementing and enforcing 'polluter pays' principles for larger enterprises.
- Raising public awareness of waste management by providing practical guidelines through municipalities, NGOs, and schools.
- Working with large and medium enterprises in trades and professions with significant waste management issues—with the aim of reducing and self-managing waste and creating less dependence on regulation.

WASTE MANAGEMENT AND URBAN PLANNING

Develop and implement sustainable urban plans that include investments in practical waste management.

The current relatively slow pace of urbanization in Malawi provides a window of opportunity to close the gap between the urgent need to manage waste more effectively and efficiently and the current shortfalls in infrastructure, finance, and management capacity. Prioritizing investments now will be far more cost effective than postponing them for, as the rate of urbanization increases, 'catching up' will become more and more difficult and expensive.

LIFE–CYCLE ASSESSMENTS

LCAs can be used as a tool to manage waste more efficiently and reduce waste volumes.

LCAs have the added value of encouraging better information gathering on sustainability issues of the economy and economic activity. Specific areas where LCAs can be used by government are to inform policies on eco-labelling, deposit-refund schemes, and subsidies and taxation that encourage recycling.

An Agenda for Change

This section identifies priority actions for different environmental sectors to address environmental challenges. These include policy and institutional reform measures as well as specific actions at sector levels. Ten strategic recommendations are presented below, and more detailed sectoral and thematic recommendations are summarized in Annex 1.

Productive land, forest, and fisheries resources

RECOMMENDATION 1: ADDRESS LAND DEGRADATION

Reform incentives for farmer-level scale-up of SLM practices by strengthening land tenure security and reforming input subsidies.

The priorities are to reform incentives for farmer-level scale-up of SLM practices by implementing land tenure reforms at scale in tandem with reforms to subsidy regimes. If land tenure reforms are implemented effectively, and at scale, this will increase tenure security and incentives for landholders to invest in SLM measures. Improved land tenure security will reduce land degradation and increase productivity. Unfortunately, poorly targeted input subsidies currently work in the opposite direction and contribute to land degradation, directly (for example, by constraining crop diversification) and indirectly (for example, by crowding out fiscal space for investments in extension services). Therefore, reforms to subsidy regimes are also needed that better target limited public resources and create incentives for better land stewardship.

RECOMMENDATION 2: OVERHAUL FISHERIES MANAGEMENT SYSTEMS

Strengthen fisheries co-management arrangements in tandem with stronger enforcement against illegal fishing technologies and overfishing.

Effective fisheries governance is prioritized in the revised fisheries policy, along with the recognition that improved institutional arrangements must be based on co-management with fishing communities. Successfully implemented, co-management interventions will empower primary stakeholders (mostly local fisherfolk) to manage the fishery on which their livelihood depends. However, this will need to be complemented by much more effective enforcement of fisheries management regulations and bylaws.

RECOMMENDATION 3: SUPPORT IMPLEMENTATION OF THE NATIONAL CHARCOAL STRATEGY

Support this ambitious and progressive reform, including its proposals to promote fuel switching to cleaner and alternative fuels (such as LPG) to develop legal and sustainable charcoal value chains.

There are opportunities, which align with the government's recently launched Renewable Energy Strategy, to promote greater efficiency in consumption and encourage a switch to alternative clean fuels where affordable and appropriate. A number of commercial players and social enterprises in East and Southern Africa offer high-quality, modern cooking appliances for both firewood and charcoal. There is potential for them to be encouraged to invest in Malawi's clean cooking sector, for example, by using tax breaks.

Simplify or remove regulations to allow the wood fuel industry to transform from the informal to the formal economy.

A functioning and legal charcoal industry could deliver significant fiscal returns to the state through the formal taxation system, which are not currently being captured, and encourage investment in modernization and efficiency improvement. Initial steps for transforming wood fuels from the informal to the formal economy would involve simplifying or removing regulations and reducing barriers to securing licenses for charcoal production and trade. This could include promoting sustainable practices through incentives, for example, by providing planting and tree stewardship grants and supporting co-management efforts.

Environmental management

RECOMMENDATION 4: IMPLEMENT THE NEW LEGAL AND INSTITUTIONAL FRAMEWORK FOR THE ENVIRONMENT

Provide sufficient public financing to support effective implementation of the new EMA (2017) and the creation of a semiautonomous EPA.

These linked reforms provide an important window of opportunity for strengthening environmental management in Malawi. The aim of the new EMA is to align Malawi's management of ENR with modern global standards. It also allows for the creation of a semiautonomous EPA with broad and substantial powers. Successful implementation of the new legal framework will depend in large part on whether the new agency is provided with sufficient resources to operate efficiently.

To enable effective implementation of the EMA, the EPA will need a robust program of capacity building and operational support. This support should come from both the government and development partners. This will need to include support for the development of internal institutional structures, appropriate staffing and capacity building, preparation of regulations for the SEA and EIA, and the certification of EIA practitioners, as well as the development of operational procedures, for example, to guide and define relationships with other government agencies, to establish registries of EIAs, and so on.

RECOMMENDATION 5: ACCELERATE AND SUPPORT THE DECENTRALIZATION OF ENVIRONMENTAL MANAGEMENT FUNCTIONS

Support and promote GoM's renewed commitment toward decentralization.

Decentralization was launched in 1998 as part of the transition to democracy, with the aim of diffusing overly centralized power and bringing services closer to citizens. However, the decentralization process has been undermined by a slow and fragmented assignment of functions and resources to local authorities. Since the local government elections in 2014, GoM has renewed its commitment to the process by increasing intergovernmental transfers and initiating the devolution of human resources. In addition, the new EMA and the forthcoming establishment of the EPA provide a further opportunity to accelerate the decentralization of environmental management functions, as does the integration of the LDF and National Local Governance Finance Committee. The EMA provides for the appointment of environment officers at the district level as members of the District Development Committees. These developments could also provide an opportunity to strengthen compliance monitoring of EIAs and improve coordination with other officers and bodies at the district level and below, such as with District Forestry Officers and VNRMCs. The LDF also offers the possibility of increasing investments in interventions that tackle environmental degradation, for example, for SLM and forest regeneration.

RECOMMENDATION 6: ADDRESS HOUSEHOLD AIR POLLUTION THROUGH EDUCATION AND SUBSIDIES

Support and encourage markets and incentives for fuel switching for cooking to affordable clean fuels, including LPG and electricity, to help reduce chronic and acute respiratory caused by HAP.

A continued emphasis is needed for urban and rural electrification and for fuel switching to cleaner fuels, such as LPG. However, affordability issues hamper uptake of both these technologies for many households. Subsidies for more efficient stoves and improved ventilation should be prioritized and supported at a greater scale, making sure analysis is done to cost this carefully as there may be little budgetary space for Malawi to fund such subsidies.

Education interventions are needed to build public awareness of the severe health risks of HAP.

It is young adults and children who mainly carry the high burdens of death and disease caused by HAP-induced pneumonia. In the short term, immediate interventions are needed to build awareness of the severe health risks resulting from HAP using education and public awareness raising strategies.

Environmental accounting and expenditure

RECOMMENDATION 7: VALUE NATURAL CAPITAL IN ECONOMIC PLANNING

Develop natural capital accounts to mainstream the values of key natural resources in national economic policy and planning.

The National Statistical Office needs support to enable it to produce national capital accounts to build national economic accounting and statistics and enhance policy analysis. Natural capital accounts provide an analysis of the economic benefits of enhanced environmental protection and the costs of environmental degradation. Natural capital accounting is the process of measuring natural capital, recognizing their value, and incorporating that information directly into national economic accounts and statistics. For Malawi, this would require sufficient capacity in the National Statistical Office to produce these accounts.

A good starting point would be the preparation of accounts that could best inform policy on priority environmental challenges, for example, land, forest, and water accounts. The accounts could then be used to generate analysis by the MoFEPD on key policy issues and questions—for example, to quantify the real contribution of natural assets and the ecosystem services they provide to the national economy, to quantify and track economic losses associated with land degradation, or to quantify the impact of the informal economy (for example, wood fuel extraction or fish harvesting) on the underlying resource base (for example, forests or fish stocks).

Natural capital accounts can also be used for policy analysis. Natural capital accounts can guide decisions on water resources allocation and help target investments in productive natural resources sectors such as forests and fisheries. Addressing existing data gaps will allow a more informed and nuanced understanding of the returns to environmental spending and support decision-making on policy development and implementation.

RECOMMENDATION 8: INCREASE PRIVATE SECTOR INVESTMENT TO ADDRESS ENVIRONMENTAL CHALLENGES

Use scarce public financing efficiently to leverage additional private sector investment to address natural resources management and environmental challenges.

The financial requirements to improve environmental management in Malawi are substantial, but the government's ability to redirect public finance to address this is constrained. GoM has neither the fiscal nor political space to adequately address the many environmental challenges the country faces, and the continued support of development partners will be required in the near and medium term. This includes support for environmental interventions through programs and projects that prioritize themes, and sectors that combine economic growth (or a reduction in economic costs), poverty reduction, and environmental benefits. The sectoral priorities identified in this report (see Annex 1) are drawn from the analysis that has combined these and provide the basis for prioritizing external support for GoM's environmental and economic objectives.

Build on GoM's commitment to increasing private sector involvement to boost environmental investment.

All recent environment policies refer to the importance of mobilizing private sector investment. GoM's limited resources need to be used in a targeted way to leverage private sector interments. The successes of PPPs in managing wildlife and protected areas provides a model that can be extended. Opportunities already exist for increased private sector investments in managing protected areas, marketing agricultural commodities, developing and managing forest plantations, and recycling plastics and other solid waste.

Secure, support, and invest in the productive activities of small farmers and other rural producers.

Small farmers already provide major inputs to Malawi's economy, with smallholders accounting for 80% of agricultural production and 70% of agricultural GDP.[403] In addition, economic multiplier effects and nonmarket values can add to the wider economic value of smallholder production. Greater efforts to secure, support, and invest in their productive activities could increase their economic contribution significantly.[404]

403 World Bank. 2017(b). *Republic of Malawi Poverty Assessment.*

404 Verdone. 2018. *The World's Largest Private Sector? Recognizing the Cumulative Economic Value of Small-scale Forest and Farm Producers.*

Knowledge, information and awareness

RECOMMENDATION 9: STRENGTHEN CLIMATE INFORMATION SERVICES

Implement a national, integrated program for improved climate information services.

Climate information services are an important contributor to building climate resilience. More robust and timely data are required to support climate services' decision-making and planning for resilience.[405] Several studies confirm that the returns on investing in climate services are high, on average 1:3, and for warning services the cost-benefit ratio is much higher.[406] In Malawi, improving the uptake of climate information is essential considering the country's exposure to climate change and extreme events. Climate information is vital for short-term decision-making (for example, responding to extreme events) as well as in the longer term for planning across sectors, especially in agriculture, disaster risk reduction, land and water use, and energy.

Improved climate services could be achieved through the concerted integration of ongoing investments in climate services, alongside financing the emerging gaps across meteorology and hydrology information management (estimated at USD 17 million).[407, 408]

Strengthening Malawi's climate services should focus on three key priorities: (i) improving institutional cooperation both between the core climate service agencies, and also between these agencies and the private and public sectors, (ii) operationalizing ICT tools and collaborative platforms for data processing to produce sector/user-relevant information, and (iii) mobilizing additional funding to expand the infrastructures for collecting and processing weather and water data.

RECOMMENDATION 10: BOOST ENVIRONMENTAL AWARENESS

Support GoM's environmental communication and education strategies.

A focused environmental communications strategy with consolidated and proactive messaging is needed. Policies and institutional changes will not, on their own, bring about the major changes required to address key challenges. Quality information sharing and the encouragement of behavior change are needed to help citizens understand the environmental challenges they and their country face and be aware of the positive and negative roles they can play.

Incorporate the Internet and social media into traditional communication channels to accommodate their ever–increasing global communication role.

At least 85% of Malawians use a mobile phone, over 30% have access to the Internet, and these numbers are rising every day. While it is acknowledged that newspapers, radio, and television remain important communication channels, it is recommended that the importance of effective communication and the role of the Internet, social media, and communication technologies are taken into account when designing environmental interventions.

405 IPCC Special Report, 2018. *Global Warming of 1.5oC. Summary for Policymakers*. Intergovernmental Panel on Climate Change.

406 World Meteorological Organization. 2015. *Valuing Weather and Climate: Economic Assessment of Hydrological and Meteorological Services*; World Bank. 2018(b). *Assessment of the State of Hydrological Services in Developing Countries*.

407 GoM. 2017(c). *Strategic Program for Climate Resilience.*

408 Increased investments will also lead to increased maintenance and upkeep costs, so this figure would increase.

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ANNEX 1

Summary of Priority Recommendations

These sectoral and thematic recommendations have been prioritized using a multicriteria approach, factoring in the level of impact, the time frame to see initial positive results, technical and institutional capacity, and GoM's political priorities.

In Table A.1, the highest ranking is given to actions/investments that are likely to have the **highest impact** and **shortest time** to attain initial results.

TABLE A.1. Priority sectoral and thematic recommendations

Priority Recommendations	Challenges	Lead Agencies
Cross-Cutting Issues		
Institutions, policies, and public finance		
1. Support the implementation the EMA (2017) and the new EPA.	The new EMA (2017) and the supporting EPA have not yet completed their legislative journey, without which it will be difficult to institutionally champion the environmental changes.	MoFEPD
2. Utilize the unique opportunity provided by the new EMA and the establishment of the EPA to decentralize environmental management functions.	The move toward decentralization of environmental management functions implemented in 2014 needs to be strengthened.	MoNREM
3. Develop natural capital accounts to mainstream the values of key natural resources in national economic policy and planning.	Malawi's growth is based on an unbalanced portfolio of assets and gains in natural capital, and thus total wealth. In addition, land value statistics do not capture declining soil fertility. The values of key natural resources need to be understood by mainstreaming natural capital accounts into national economic policy and planning.	MoNREM
4. Support GOM's environmental communication and education strategies and incorporate the Internet and social media into traditional communication channels.	Current communication methods are traditional and need to incorporate new methods of communication such as social media. There is also a need to shift public mind-sets to build awareness of key environmental challenges and appropriate positive responses.	
5. Support Malawian institutions review public environmental and climate change expenditures.	Valuation data and data on public environmental expenditures are outdated and need to be reviewed. Insufficient data on costs of environmental degradation, particularly on ecosystem services.	MoNREM/MoFEPD
6. Use environmental valuation data better to frame policies, identify investments, and set budgets.		

Priority Recommendations	Challenges	Lead Agencies
7. Strengthen Malawi's EIA and SEA capabilities, associated regulations, and the certification of EIA practitioners.	Malawi's EIA and SEA capacity levels and regulation and certification of practitioners are weak.	MoFEPD
Climate change and resilience		
1. Invest in strengthening Malawi's weather and climate services capacity to improve flood and weather forecasting and more effective early warning systems and disaster management.	Decisions on climate change risks, opportunities, and responses are currently taken with little or low-quality climate information.	MoNREM, MoAIWD, DoF, DoCCMS
2. Scale up the implementation of improved land management practices as part of integrated landscape approaches to land, forest, and water resources management, to reduce the rate of land degradation and deforestation, build resilience to climate change impacts, and slow the drawdown on natural capital. *(See also the similar recommendation in Land Degradation below)*	Changes to climate and weather patterns exacerbate existing vulnerabilities of Malawi's natural resource base. Environment-related issues are often key factors that increase adverse impacts and costs of disasters.	MoAIWD, MoNREM
3. Build capacity of both government and community institutions at local levels to strengthen their ability to support and implement actions that build resilience to climate change impacts.	Effective policies and actions must be tailored for specific, varied, and localized impacts and needs.	MoAIWD, MoNREM
4. Improve planning of the built environment to include design that takes account of climate impacts and can protect against the damage caused by extreme weather events.	Adequate 'climate proofing' is not yet part of building and design regulations for public buildings and economically important infrastructure.	Ministry of Transport and Public Works (MoTPW)
Key Environment and Natural Resources Management Themes		
Land degradation		
1. Reform incentives for farmer-level scale-up of SLM practices by • **Introducing sustainable incentives for good/improved land management, such as directing subsidies to support SLM interventions and climate-resilient agriculture;** • **Removing disincentives to sound land management, most notably those generated by the current FISP;** • **Reforming FISP from an input subsidy program focused only on inputs (fertilizer and mostly maize seed) to a sustainable land stewardship program that promotes agroforestry, forest restoration, and SLM practices; and** • **Addressing key evidence gaps on SLM impacts and adoption rates.**	Current legal provisions, incentives, and compliance mechanisms are not adequate to address the challenges of reversing land degradation.	MoAIWD, MoNREM

Priority Recommendations	Challenges	Lead Agencies
2. Elevate land restoration to a national policy priority (NFLR Strategy, 2017, provides framework).	The serious environmental and economic impacts of land degradation are not adequately reflected in national policy.	
3. Invest in SLM (See also the similar recommendation under Climate change and resilience above) • **Public investments can address short-term, up-front costs**	At present, the high cost of FISP crowds out finance available to the Ministry of Agriculture and hence limits opportunities to support land regeneration efforts. Some SLM practices have longer payback periods, which discourages poor households from adopting them.	
4. Develop a results-based mechanism to deliver environmental services • **PES schemes in Malawi should be supported and taken to scale.** • **Build on existing positive experience with 'Community Environment Conservation Fund' in the Shire River basin.**	Insufficient understanding of why SLM practices are adopted or not adopted.	
Forest and woodlands		
1. Use limited public financing to leverage additional private sector investment in forest management and restoration. • **Developing institutional and licensing frameworks for legal and sustainable charcoal value chains** *(See also the similar recommendation under Biomass energy below)* • **Provide funding for forest carbon management** • **Finance the implementation of the National Forest Policy (2016) and the NFLR Strategy (2016).** • **Supplement scarce public finance through PES mechanisms.** *(See also the similar recommendation under Land degradation above)*	Forest and woodland restoration is an urgent but massive task, with formidable financial and implementation challenges.	MoNREM, DoF
2. Explore opportunities to increase private sector investment in forestry • **Explore potential for SMEs to become more active in forest management, including in the wood fuel subsector** *(see also section on Biomass energy)*	SMEs have potential roles in both plantation forestry and value addition to forest products but face regulatory hurdles and barriers to new revenue streams such as PES.	
3. Strengthen forest data and use them more effectively in economic planning • **Support the implementation of the 'Roadmap for Developing Malawi's National Forest Monitoring System 2015** • **Build on the recent donor initiatives to address forest data gaps**	Forest management decision-making is hampered by data gaps.	

Priority Recommendations	Challenges	Lead Agencies
4. Scale up forest co-management approach to balance responsibility and authority between communities and the government	Current centralized forest management does not provide incentives for local communities to manage forests more sustainably.	
5. Promote agroforestry and tree-based systems to reduce pressure on Malawi's natural forests. *(See also proposed change at point 4 above)*	Tree-planting projects are often unsuccessful as the returns do not justify the land or other resources that farmers must invest.	
6. Update forest data to include data on biomass energy, other informal sector forest activities, and the related impacts on national accounting (the key data need is to better understand the scale of forest degradation linked to GHG emissions)	Lack of data on land cover and the production and use of forest products limits understanding of the country's forest resources and their contribution to the economy.	DoF
7. Promote agroforestry and FMNR to reduce pressure on Malawi's natural forests. *(See also proposed change at point 3 above).*	Tree-planting projects are often unsuccessful as the returns do not justify the land or other resources that farmers had to invest regulatory them.	DoF
8. Undertake further analysis of the potential for SMEs to become more active in plantation forestry.	SMEs have potential roles in both plantation forestry and value addition to forest products but face regulatory hurdles and barriers to new revenue streams such as PES.	DoF
Biomass energy		
1. Support GoM's new policy approach that seeks the formalization of a sustainable and commercial wood fuel sector.	Malawi's wood fuel sector is dominated by rural households working at a small scale. But many small-scale producers struggle to engage with a formalized wood fuel sector.	MoNREM, DoF
2. Review and reform the policy, legal, and regulatory provisions for wood fuels in Malawi, to make it easier for informal producers, working at multiple scales, to operate within a formal setting.	98% of the population uses biomass fuels and over 60% uses charcoal, yet all charcoal in Malawi remains technically illegal.	
3. Additional analysis needed on the nature, significance and potential of the wood fuel industry.	Wood fuel industry currently carries a stigma that works against developing it into a sustainable and secure source of energy, employment, and revenues that complements other energy systems.	
4. Raise awareness of the role of wood fuels as a conditionally renewable, secure, and economically vital source of energy for Malawi.	Policy reform is constrained by the lack of information on the nature, significance, and potential of the wood fuels industry.	
5. Modernize the energy sector by promoting fuel efficiency and, where feasible, encourage fuel switching to LPG.	Currently, only small numbers of people use clean fuels and/or fuel-efficient appliances.	

Priority Recommendations	Challenges	Lead Agencies
HAP		
1. Immediate interventions should include education and public awareness raising strategies that make the severe health risks apparent.	The level of HAP is extremely high and is a significant health burden, particularly for women and children.	MoH
2. Provide subsidies for more efficient stoves and improved ventilation.	Inefficient cookstove technology and inadequate ventilation magnify HAP risks.	MoNREM
Fisheries		
1. Support new fisheries co-management programs that learn lessons from previous co-management attempts. *(Revised National Fisheries Policy, 2016, provides framework)*	Previous efforts to initiate co-management of fisheries resources failed to achieve buy-in from fishing communities who did not feel their interests were being represented.	DoFi, Department of Tourism (DoT)
2. Strictly enforce the Fisheries Conservation and Management Regulations and increase surveillance and monitoring of fish populations and catch volumes. *(Revised National Fisheries Policy, 2016, provides framework)*	Key drivers of the decline in fish stocks are inappropriate fishing technologies, pollution and other environmental changes, and the weak capacity of the government and local institutions to work together to better manage fisheries resources.	
3. Update information on the current status of fish stocks and the impacts of fishing practices and environmental changes (including climate change).	Inadequate and outdated data on fish stocks, fishing practices, and environmental changes hinder effective fisheries management.	
Biodiversity and protected areas		
1. Expand opportunities for the private sector to improve the management of protected areas and raise tourism revenues at the same time.	Many key sites for biodiversity conservation, such as protected areas, forest reserves, and wetlands, are understaffed or not staffed at all.	DNPW, DoT
2. Expand nature-based tourism revenues to help finance biodiversity conservation.	Protected areas, especially forest reserves, face considerable illegal logging and encroachment, while government funding is limited.	
3. GoM should continue to implement the recommendations of the illegal wildlife trade review and improve awareness and the handling of wildlife crime.	Malawi was weak at prosecuting wildlife crime in the past but is now strengthening wildlife crime management efforts.	
4. Improve surveillance and monitoring of protected areas and natural resources to ensure better targeting of limited field-level resources.	Government funding for conservation is inadequate, and there are currently limited incentives for the private sector to invest.	
Water resources		
1. Expand sustainable catchment management practices and adopt more efficient technologies.	Water resource management does not use a catchment-level approach (except as pilots) and efficient technologies are often absent.	MoAIWD, MoNREM
2. Ensure that institutional mandates in the water sector are implemented and enforced to realize the benefits of these reforms.	Overlapping functions across the various regulatory and institutional structures responsible for water and sanitation lead to weak policy implementation.	MoAIWD

Priority Recommendations	Challenges	Lead Agencies
3. Strengthen systems and capacities for licensing, allocation, and monitoring of water use.	A lack of detailed procedures and protocols, combined with weak capacity of key staff, results in ineffective water management.	NWRA
4. Strengthen water monitoring capabilities.	A lack of data and regular monitoring hinders effective management of ground and surface water resources.	
Waste management		
1. Private sector and multi-stakeholder partnerships for solid waste management could improve the current situation at local levels.	Managing Malawi's liquid and solid waste is a significant challenge, and the government does not have either the financial resources or implementation capacity to address this effectively.	MoNREM
2. Invest in sustainable urban planning and development in expanding small towns that includes effective systems for sanitation and solid waste collection.	Long-term sustainability issues are not currently factored into waste management decisions. The current relatively slow pace of urbanization provides a window to ensure waste management is embedded in sustainable urban planning and development.	
3. LCAs can be used as a tool to manage waste more efficiently and reduce waste volumes.		

ANNEX 2

International and Regional Agreements to Which Malawi Is a Party

Malawi is a party to a number of international and regional environmental conventions, treaties, and protocols. Many of them are the focal points of the EAD. See Table A.2.

TABLE A.2. Focal points of the EAD

Name	Web Page
The Convention on Biological Diversity (including the Cartagena Protocol on Biosafety Cartagena Protocol on Biosafety)	https://www.cbd.int/
Stockholm Convention on Persistent Organic Pollutants	http://chm.pops.int/
United Nations Framework Convention of Climate Change	https://unfccc.int/
Montreal Protocol on Ozone Depleting Substances	https://www.epa.gov/ozone-layer-protection/international-actions-montreal-protocol-substances-deplete-ozone-layer
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	http://www.pic.int/
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx
The Global Environment Facility	https://www.thegef.org/

Table A.3 presents a list of other international and regional environmental conventions, treaties, and protocols to which Malawi is also party, along with the relevant responsible departments and webpage links.

TABLE A.3. Other agreements and their focal points

Name	Focal Point	Web Page
Ramsar Convention on Wetlands of International Importance	Director of National Parks and Wildlife	https://www.ramsar.org/
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	DNPW	https://www.cites.org/
Convention on the World Heritage Sites	*No focal point*	https://www.unccd.int/
The United Nations Convention to Combat Desertification and Drought	DoF	https://www.unccd.int/
International Treaty on Plant Genetic Resources for Food and Agriculture	Malawi Plant Genetic Resource Centre	http://www.fao.org/plant-treaty/en
Convention on International Plant Protection	Department of Agricultural Research Services	https://www.unccd.int/
UN Convention on the Law of the Sea	*No focal point*	
Protocol on Shared Watercourse Systems and Revised Protocol on Shared Watercourses	Ministry of Foreign Affairs and International Cooperation	https://www.sadc.int/documents-publications/show/1975
Protocol on Wildlife Conservation and Law Enforcement	*No focal point*	https://www.sadc.int/documents-publications/protocols/
SADC Policy and Strategy for Environment and Sustainable Development	Ministry of Foreign Affairs and International Cooperation	https://www.sadc.int/issues/environment-sustainable-development/

ANNEX 3

A Summary of the Shared EIA Roles and Responsibilities

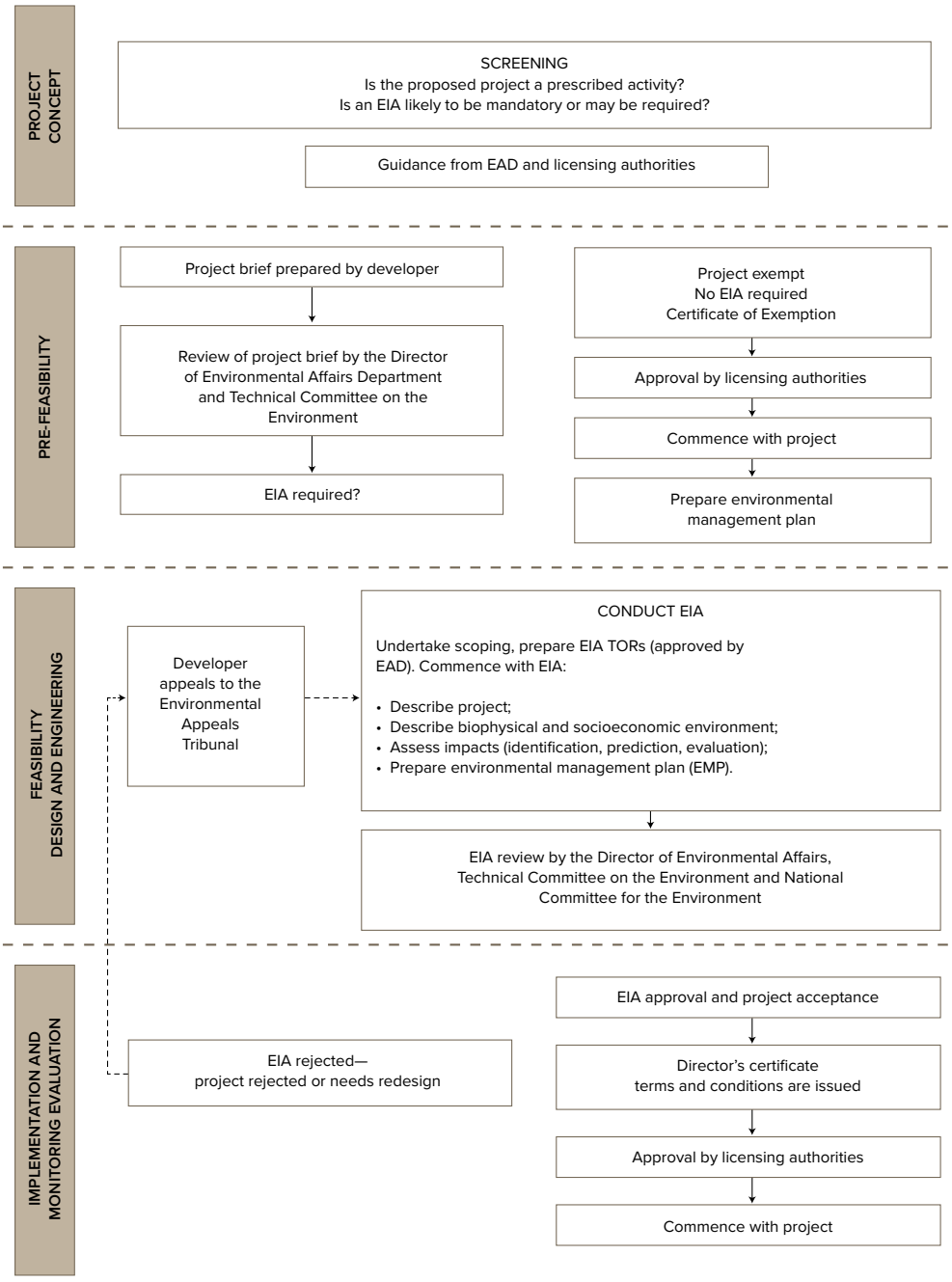
TABLE A.4. Shared EIA roles and responsibilities

Institution	Responsibilities
Environmental Affairs Department	● Facilitating the EIA process ● Ensuring compliance with EIA provisions in the EMA ● Production and updating of guidelines on EIA practice and procedures ● Preparing sector-specific guidelines on EIA practice and procedures ● Updating the list of prescribed projects ● Secretariat to the TCE and the National Council for the Environment ● Maintaining a register of projects being appraised under the EIA process ● Maintaining a central library of EIA reports ● Maintaining a directory of EIA consultants
Technical Committee on the Environment	● Evaluating project briefs, EIA terms of reference, and EIA reports ● Developing terms and conditions for project approval ● Reviewing and monitoring project auditing programs ● Recommending courses of action to the Director ● Reporting to the National Council for the Environment
National Council for the Environment	● Advising the minister regarding environmental protection and management and the conservation and sustainable utilization of natural resources ● Recommending measures for the integration of environmental considerations in all aspects of economic planning and development ● Recommending measures for the harmonization of the activities, plans, and policies of lead agencies and NGOs concerned with the protection and management of the environment and the conservation and sustainable utilization of natural resources
Ministry of Economic Planning and Cooperation	● Determining if public sector projects are prescribed under the EMA and referring Project Submission Documents to the Director of Environmental Affairs ● Participating in the TCE

Institution	Responsibilities
Sectoral or line ministries	● Ensuring that their own projects adhere to EIA requirements ● Ensuring that private sector projects within their jurisdiction adhere to the EMA ● Participating in the TCE ● Providing information and advice to project developers ● Incorporating EAD-approved terms and conditions in EIA certificates ● Ensuring that the terms and conditions contained in the EIA certificate are met, including those specified by the Director of Environmental Affairs
District Environmental Officers	● Undertaking environmental inspections and monitoring in the district ● Supervising the preparation of a District Environmental Action Plan every five years ● Advising the District Development Committee on all matters relating to the environment and on the performance of its environmental functions ● Reporting to the Director on all matters relating to the protection and management of the environment and the conservation and sustainable utilization of natural resources ● Submitting reports to the Director as required ● Promoting environmental awareness in the district regarding the protection and management of the environment and the conservation of natural resources ● Gathering and managing information on the environment and the utilization of natural resources in the district ● Performing other functions as the Director may, from time to time, assign

ANNEX 4

EIA Process Flowchart



Source: Walmsley and Patel. 2011. *Handbook on Environmental Assessment Legislation in the SADC Region*.

Note: TORs = Terms of references.

ANNEX 5

An Overview of Natural Disasters Since 1990

TABLE A.5. Malawi's natural disasters 1990–2017

Year	Natural Disaster	Location	Estimated People Affected	Estimated Economic Loss and Damage	Estimated Recovery Cost
2017	**Floods**	Malawi	55,920 affected		
2015–2016	**Drought**	Malawi	6.7 million affected needing food aid	USD 365.9 million	USD 500.2 million
2015	**Floods**	Malawi—15 districts declared state of emergency	1,101,360 affected 230,000 displaced 106 killed 172 reported missing	USD 335 million (equivalent to 5% GDP)	USD 494 million
2013	**Floods**	Malawi—74% in Southern Malawi	33,000 affected		
2012	**Drought**	Malawi	1,900,000 affected		
2012	**Floods**	Malawi—Nsanje District	90,740 affected		USD 7.3 million
2011	**Floods**	Malawi	83,590 affected		
2010	**Floods**	Malawi	21,290 affected		
December 2009 to January 2010	**Earthquake**	Malawi—Karonga	145,000 affected 4 killed	USD 5.2 million/20% drop in rice production in Karonga	
2008	**Floods**	Malawi	16,380 affected		
2007	**Drought**	Malawi	520,000 affected		
2007	**Floods**	Malawi	180,000 affected		
2006	**Floods**	Malawi	16,000 affected		
2005	**Drought**	Malawi	5,100,000 affected		
2005	**Floods**	Malawi	44,500 affected		
2003	**Floods**	Malawi	81,000 affected		
2002	**Drought**	Malawi	2,830,000 affected		
2002	**Floods**	Malawi	396,340 affected		
2001	**Floods**	Malawi	508,750 affected		
2000	**Floods**	Malawi	20,000 affected		

Year	Natural Disaster	Location	Estimated People Affected	Estimated Economic Loss and Damage	Estimated Recovery Cost
1997	**Floods**	Malawi	400,000 affected		
1995	**Floods**	Malawi	1,300 affected		
1991/92	**Droughts**	Malawi	7,000,000 affected	USD 1 billion in cereal losses/maize production fell by 60% GDP contracts by as much as 10.4%	USD 500 million in cereal imports
1991	**Floods**	Malawi	268,000 affected		

Sources: GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report*; GoM. 2014(b). *Joint Public Expenditure Review of Malawi's Environment and Disaster Risk Management Sectors, 2006–2012*; Benson and Clay. 2003. *Economic and Financial Impacts of Natural Disasters: An Assessment of Their Effects and Options for Mitigation*; EM-DAT. 2018. *The International Disaster Database*; Pauw et al. 2010. *IFPRI Discussion Paper. Drought and Floods in Malawi—Assessing the Economy-wide Effects*; GoM. 2015(g). *National Disaster Risk Management Policy;* GoM. 2015(a). *Malawi 2015 Floods Post Disaster Needs Assessment Report*.

ANNEX 6

Sustainable Land Management

Sustainable Land Management (SLM) brings major environmental benefits, but these are not without costs. While some practices, such as intercropping maize and legumes, are cheap and easy to adopt, others, such as contour bunding, require considerable amounts of labor to construct and maintain. Many SLM enterprises, based on renewable use of natural resources, require up-front finance. This limits uptake by poor households and leads to dropout. Dropout rates are reduced when direct support for SLM investments is paired with other interventions such as rural roads and support for small enterprise development.

Cost-benefit analysis of SLM implementation in the Shire River basin has shown that benefits can accrue fairly rapidly. It also shows that small farmers are the main winners from SLM investments. Many activities break even within one or two years. However, some have longer payback periods, which discourages poorer households from adopting some SLM practices. In addition, SLM practices have to appear to be financially beneficial to farmers or they will not adopt them.

The poorest households need to be supported to adopt SLM practices. Extremely cash-poor households find it difficult to make the investments required to adopt SLM activities and enterprises. This applies even when these investments are small or when payback periods are short. For this reason, interventions need to support this group to enable them to participate in, and benefit from, SLM interventions.

Subsiding SLM activities can substantially increase participation and uptake rates. This issue emerged during the early implementation of catchment management support in the Shire River basin, where uptake of SLM practices, despite project support, remained limited—a situation made worse by two years of El Nino–induced drought, which severely affected agricultural yields and livelihoods. A revolving fund—called the CECF—was introduced to support and incentivize participation in participatory SLM activities on customary land. This substantially increased participation and uptake rates.

Substantial and long-lasting public investments and policy reforms are needed to overcome multiple SLM adoption barriers. SLM adoption barriers include limited market access and access to finance, lack of tenure security, limited access to information and knowledge, and a weak policy environment. Some of these constraints are being addressed by the government (including land tenure) but need to be followed through systematically and sustainably. Reforming the currently weak public extension

system seems to be a key factor, since global experience shows that access to knowledge and experience is a prerequisite for the adoption of new technologies and practices.

The private sector can play a significant role in climate-smart and sustainable land use investments—its potential needs to be unleashed. The justification for public sector investment in SLM is mainly based on market failures, such as externalities and non-excludability of users, and the public good argument. While public investments are key, the private sector has to play a key role in significant scale-up of productivity-enhancing technologies. One reason is that value chains need to be fully developed to make on-farm investments profitable. Currently, a weak investment, business, and regulatory climate inhibits development of agricultural and forestry enterprises and value addition.

Scaling up SLM needs to include the provision of sound advisory services to land users, provision of financial incentives for SLM adoption, and leveraging private sector investments. The approaches for advisory service provision need to be revised. Promising models are based on the extension service delivery that goes beyond public organizations but includes multiple service providers. Modernization of the extension system would also include capacity development of extension agents to ensure excellency and relevance of their service. Financial attractiveness of SLM practices can be further increased by implementing innovative but cost-efficient PES schemes (including carbon schemes at landscape levels).

The private sector should be incentivized to undertake productivity-enhancing, sustainable, and even climate-smart land use investments. As an example, a Catalytic Project Development Facility can facilitate and incentivize the collaboration of the different actors needed to plan, finance, and implement this type of investment. The actors would include supply chain companies, private investors, financial institutions, and development agencies.

Valuable lessons can be learned from previous and existing SLM interventions from inside and outside Malawi. Previous implementation experiences provide a good understanding of the constraints and challenges that hamper the widespread uptake of SLM practices and how these can be addressed. There are lessons to draw on from outside Malawi too. For example, in Ethiopia work-based social protection programs have played a key role in supporting SLM interventions. However, important evidence gaps remain:

- The role of land tenure and how reforms to customary land tenure arrangements influence the uptake of SLM practices
- The institutional challenge of delivering extension support in a cost-effective manner to scale up SLM interventions
- Practical and financially viable ways to support and incentivize farmers to use SLM techniques and enterprises in the longer term

ANNEX 7

Forest and Land Data

TABLE A.6. Change in Malawi forest cover 1972–1992

Region	1972 Forest Extent (ha)	1992 Forest Extent (ha)	Total Forest Lost (ha)	Rate of Deforestation (ha/year)	Rate of Deforestation (%/year)
North	1,507,266	470,238	1,037,028	51,851.40	3.44
Central	1,488,110	777,217	710,893	35,544.65	2.39
South	1,404,510	650,860	753,650	37,682.50	2.68
Total	4,399,886	1,898,315	2,501,571	125,078.55	2.84

Source: Kainja. 2001. *Forestry Outlook Studies in Africa (FOSA)—Malawi*, p. 9.

TABLE A.7. Land cover 1990–2010

	Area in Each Category, in km^2			Change in Area, as Share of Total Country	
	1990	2000	2010	1990 to 2000	2000 to 2010
Agriculture	47,053	48,094	48,277	0.883%	0.155%
Bare	233	232	233	−0.001%	0.001%
Herbaceous	10,130	10,344	10,477	0.182%	0.113%
Shrub	1,250	1,215	1,252	−0.030%	0.032%
Natural forest	32,740	31,729	31,635	−0.857%	−0.080%
Plantation	1,239	1,162	899	−0.065%	−0.223%
Urban	1,362	1,387	1,390	0.022%	0.002%
Water	23,853	23,695	23,695	−0.134%	0.000%
Total	117,858	117,858	117,858		

Source: FAO. 2013. Atlas of Malawi: Land Cover and Land Cover Change 1990–2010.

TABLE A.8. Forest land by tenure type, 2002 (or earlier)

Forest Resource	Area (ha)
Forests on customary land/village forest areas	1,000,000
Forest reserves (indigenous woodland)	980,000
State-owned plantations:	
● Industrial plantations	73,000
● Wood fuel and pole plantations	23,000
● Woodlots	15,000
Private sector:	
● Fuelwood plantations	13,000
● Industrial plantations	2,000
Total	2,106,000

Source: Casey and Kafakoma. 2013. *Institutional Assessment of the Forestry Sector and Organisational Review of the Department of Forestry*.

Note: This table is based on the data available in 2013, which dates back at least as far as 2002 and possibly further. The authors report that no more recent data were available, and these are not accurate. They are confident that the area on customary land is lower than 1 million ha at present. However, this does give some sense of the scale of different forest ownership types—and of the need for improved monitoring systems. In the source document the total was given as 1,906,000.

TABLE A.9. Load losses and cost imposed on hydropower system by soil erosion

Load Losses Due to Weeds and Sediment	Energy Lost (kWh)	Revenue Lost (MK, millions)	Revenue Lost (USD)
Insufficient generation capacity	11,575,684	68.47	46,000
Maintenance, faults, outage, nonavailability	11,760,392	69.56	46,000
Removal of trash, low headpond/penstroke pressure	16,662,615	98.55	66,000
Total load loss costs	**39,998,691**	**236.58**	**158,000**
Historic expenditures on vegetation and sediment control		**Annual cost (MK, millions)**	**Annual cost (USD)**
Liwonde Weed Management Station		51,286,000	366,329
Nkula power station		43,000,000	307,143
Tedzani power station		60,000	429
Kapichira power station		40,000,000	285,714
Total historic expenditures		**134,346,000**	**959,615**
Estimated future expenditures needed		**Annual costs (USD)**	**Investment costs (USD)**
Sediment control		22,000	11,602,500
Vegetation control		449,900	2,105,470
Total future costs		**471,900**	**13,707,970**

Source: LTS. 2010. Environmental and Natural Resources Management Action Plan for the Upper Shire Basin: Final baseline analysis. *pp. 145–146.*

TABLE A.10. Forest sector budgets and revenue in millions of Malawi kwacha, 2006–2017

Year[a]	Total Forest Sector Budget	Total Expenditure[b]	DoF Budget	DoF Expenditure	Regional Office Budget	Regional Office Expenditure	DoF Revenue[c]
2006			48,230,875				154.03
2007			53,406,467				150.19
2008			57,197,139				202.94
2009			61,200,939				163.16
2010	n.a.						
2011			256,770,000				433.62
2012	n.a.						
2013	n.a.						
2014	131,611,813	47,487,540	32,217,351	9,069,416	40,529,328	15,808,950	963.16
2015	136,898,753	74,802,834	34,397,720	20,946,435	50,441,408	26,084,638	664.46
2016	219,054,996	98,867,967	42,000,000	19,343,625	87,788,211	48,162,466	648.49
2017	183,821,864	109,435,518	37,481,655	19,737,983	72,051,074	40,209,176	682.95

Source: GoM. 2009–2017. *Annual Economic Reports*.

Note: a. Data for different years may not be compatible with each other. The source documents sometimes refer to 'budget', sometimes to 'other recurrent expenditures', and sometimes to 'program funding'. This particularly pertains to 2011 data. The source documents do not explain whether any of these data include personnel costs.

b. Expenditures and revenues in each year may be only up to a date slightly before the end of the fiscal year; therefore, actual expenditures that year may have been higher.

c. This is largely revenue from plantation forest activities, including royalties, log sales, concession charges, license fees, and so on.

ANNEX 8

ROAM

RESTORATION OPPORTUNITIES ASSESSMENT METHODOLOGY

The Restoration Opportunities Assessment Methodology (ROAM), produced by the IUCN and the World Resources Institute (WRI), provides a framework to rapidly identify and analyze areas that are primed for forest landscape restoration (FLR) and to identify specific priority areas at a national or subnational level.

ROAM provides decision-makers and stakeholders the following types of outcomes:

- Better information for improved land use decision-making
- High-level political support for forest landscape restoration
- Fundamental inputs to national strategies on FLR, REDD+, climate and disaster risk adaptation and mitigation, and biodiversity conservation and restoration, among others, for a mutually reinforcing convergence between such strategies
- A basis for better allocation of resources within restoration programs
- Engagement of and collaboration among key policymakers and decision-makers from different sectors, as well as other stakeholders with interests in how landscapes are managed
- Shared understanding of FLR opportunities and the value of multifunctional landscapes

Source: https://www.iucn.org/theme/forests/our-work/forest-landscape-restoration/restoration-opportunities-assessment-methodology-roam

ANNEX 9

Biomass Energy

TABLE A.11. Projected estimates for urban household charcoal demand (2008–2016) with corresponding employment and market estimates

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Urban population growth (annual %)[a]	—	3.716	3.759	3.78	3.819	3.857	3.909	3.965	4.017
Employment (low estimate)[b]	102,600	106,412.6	110,412.7	114,586.3	118,962.3	123,550.7	128,380.3	133,470.5659	138,832.1
Employment (high estimate)	114,000	118,236.2	122,680.7	127,318.1	132,180.3	137,278.5	142,644.8	148,300.6287	154,257.9
Estimated urban household consumption of charcoal (tons)	218,620[c]	226,743.9	235,267.2	244,160.3	253,484.8	263,261.7	273,552.6	284,398.9	295,823.3
Number of bags equivalent[d]	5,753,158	5,966,945	6,191,243	6,425,272	6,670,653	6,927,940	7,198,753	7,484,183.6	7,784,823.3
Market price (MK)[e]									46,708,939,672
Market price (USD)[f]									66,727,056.7

Note: a. World Bank estimates based on United Nations World Urbanization prospectives data were used to estimate urban population growth (annual percentage).

b. MARGE (2009) estimated that 57% of wood fuel employment was attributed to the charcoal sector (102,600–114,000 people).

c. 2008 estimate for urban household demand for charcoal taken from MARGE (2009).

d. A standard bag weighs about 38 kg[3].

e. Assuming an average bag sold cost around MK 6,000 in Blantyre.

f. USD 1 = MK 700.

TABLE A.12. Energy demand trends (%)[409]

		Census	ISH2	ISH3	ISH4
		1998	2006	2012	2017
Total	Charcoal	2.5	6.8	8.9	16.0
	Firewood	94.3	89.9	87.7	80.5
	Electricity	2.2	1.7	2.5	1.9
	Other	1.0	1.4	1.0	1.5
Urban	Charcoal	15.5	48.2	44.6	62.2
	Firewood	69.0	37.9	41.9	27.9
	Electricity	13.3	11.5	12.6	9.4
	Other	2.2	2.4	0.9	0.6
Rural	Charcoal	0.4	1.2	2.3	5.2
	Firewood	98.5	97.0	96.2	92.9
	Electricity	0.4	0.4	0.6	0.2
	Other	0.7	1.4	1.0	1.8

409 GoM. 2009. *Malawi Biomass Energy Strategy.*

TABLE A.13. Wood fuel consumption by household (%)[410]

		ISH2	BEST	Interpolated	Consumption among Users as Main Fuel	ISH3		ISH4	Extrapolated			
		2006	2008	2008		2012	2015	2017	2018	2020	2025	2030
		% of HHs	kg per year	% of HHs	kg per year	% of HHs	% of HHs	% of HHs	% of HHs	% of HHs	% of HHs	% of HHs
Rural	Fuelwood	97	601.1	96.6	**622**	96.2	94.2	92.9	92.5	91.7	89.6	87.6
	Charcoal	1.2	7.21	1.8	**412**	2.3	4.0	5.2	5.6	6.4	8.3	10.2
Urban	Fuelwood	38	292.2	39.9	**732**	41.9	33.5	27.9	26.6	23.9	17.2	10.6
	Charcoal	48	94.0	46.4	**203**	44.6	55.2	62.2	64.0	67.5	76.2	85.0

Note: HH = Household.

410 GoM. 2009. *Malawi Biomass Energy Strategy.*

TABLE A.14. Wood fuel summary data, 2008–2030

	2008	2015	2018	2020	2025	2030	Notes and Sources
Population (million)							
Rural	11.30	14.49	15.67	16.45	18.52	20.66	https://esa.un.org/Unpd/Wup/
Urban	2.33	2.82	3.19	3.44	4.26	5.31	https://esa.un.org/Unpd/Wup/
Total	***13.63***	***17.31***	***18.86***	***19.89***	***22.78***	***25.97***	
Wood fuel consumption (kg per year)							
Rural fuelwood	601	586	576	570	558	545	622 kg per year among users (BEST 2008), extrapolated using ISH data
Rural charcoal	7.2	16.6	23.0	26.2	34.1	42.0	412 kg per year among users (BEST 2008), extrapolated using ISH data
Urban fuelwood	292	245	195	175	126	77.4	732 kg per year among users (BEST 2008), extrapolated using ISH data
Urban charcoal	94.0	112	130	137	154	172	203 kg per year among users (BEST 2008), extrapolated using ISH data
Fuelwood consumption ('000 tons air dry)							
Rural	6,790	8,500	9,020	9,380	10,330	11,260	
Urban	680	690	620	600	540	410	
Total	***7,470***	***9,190***	***9,640***	***9,980***	***10,870***	***11,670***	
of which traded	15.0%	15.0%	16.5%	17.5%	18.8%	20.0%	Assumed to rise from 15% to 20% by 2030
	1,100	1,400	1,600	1,700	2,000	2,300	
balance collected	6,370	7,790	8,040	8,280	8,870	9,370	
Charcoal consumption ('000 tons)							
Rural	82	241	360	430	631	867	
Urban	219	315	413	471	657	914	
Total	***300***	***556***	***774***	***901***	***1,288***	***1,781***	
'000 tons wood equivalent	*1,300*	*2,500*	*3,400*	*4,000*	*5,700*	*7,900*	
Kiln efficiency (tons wood/tons charcoal)	4.45	4.45	4.45	4.45	4.45	4.45	22.5% wood:charcoal conversion
Roundwood consumption ('000 tons wood equivalent)							
Fuelwood (collected)	6,370	7,790	8,040	8,280	8,870	9,370	
Fuelwood (traded)	1,100	1,400	1,600	1,700	2,000	2,300	
Charcoal (wood equivalent)	*1,300*	*2,500*	*3,400*	*4,000*	*5,700*	*7,900*	
Total roundwood consumption	***8,770***	***11,690***	***13,040***	***13,980***	***16,570***	***19,570***	

	2008	2015	2018	2020	2025	2030	Notes and Sources
Value of wood fuel (USD, millions)							
Fuelwood (collected)	*389*	*678*	*814*	*928*	*1,281*	*1,743*	Assumes firewood price rise matches that of firewood collected
Fuelwood (traded)	*67*	*122*	*162*	*191*	*289*	*428*	Assumes firewood price rise matches that of firewood collected
Charcoal	45	118	191	247	454	809	MK 6,000 per 38 kg bag in 2016, that is, USD 226/t (5.2% per year rise since 2008)
Total value (traded wood fuel)	***112***	***240***	***353***	***438***	***743***	***1,237***	
GDP (current USD)	3,500	6,373	7,459	8,183	10,507	13,492	https://data.worldbank.org extrapolated post-2015 at 5% per year
Traded wood fuel as % of GDP	***3.2***	***3.8***	***4.7***	***5.4***	***7.1***	***9.2***	
Employment generated by wood fuel (years)							
Fuelwood (collected)	127,000	156,000	161,000	166,000	177,000	187,000	6 days per ton (300 working days per year) BEST 2008
Fuelwood (traded)	59,000	75,000	85,000	91,000	107,000	123,000	16 days per ton (300 working days per year) BEST 2008
Charcoal	58,000	107,000	150,000	174,000	249,000	344,000	58 days per ton (300 working days per year) BEST 2008
Total employment (traded wood fuel)	***117,000***	***182,000***	***235,000***	***265,000***	***356,000***	***467,000***	
Taxable revenue lost to illicit payments (USD, millions)							
Fuelwood	6.7	12.2	16.2	19.1	28.9	42.8	Assumed losses half those of charcoal, as less transported
Charcoal	9.0	23.6	38.2	49.4	90.8	161.8	Kambewa (2007) high estimate of 20%
Total	***15.7***	***35.8***	***54.4***	***68.5***	***119.7***	***204.6***	

ANNEX 10

Changes in Fish Catch 2006–2016

TABLE A.15. Fish catch by water body, 2006–2016

Year	Lake Malawi-Artisanal (tons)	Lake Malawi Commercial (tons)	Lake Malombe (tons)	Lake Chilwa (tons)	Lake Chiuta (tons)	Upper, Lower & Middle Shire (tons)	Total (tons)	Landed Value (MK '000)	Beach Price (MK/kg)
2006	51,796	4,413	780	4,350	1,085	3,840	65,484	6,810,336	104.00
2007	50,527	4,102	530	5,904	1,024	3,643	65,200	7,563.200	116.00
2008	56,846	3,597	671	6,006	1,018	3,128	71,266	9,478,378	133.00
2009	56,850	3,752	590	5,879	1,034	3,184	71,289	16,895,493	237.64
2010	80,623	3,470	3,336	8,019	2,549	1,197	95,724	19,900,000	210.00
2011	56,923	1,296	4,109	16,960	2,627	451	82,366	18,944,180	230.00
2012	106,769	2,367	1,608	7,993	1,322	269	120,328	35,903,597	298.38
2013	102,079	1,867	1,847	2,982	290	823	109,889	52,422,568	477.05
2014	105,284	2,455	4,170	2,889	293	1,037	116,128	74,332,669	640.09
2015	127,438	2,672	5,904	5,660	1,150	1,491	144,315	108,703,888	753.24
2016	143,556	4,416	4,053	2,834	1,298	1,111	157,268	129,738,211,690	824.95

Source: Department of Fishers (DoF).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