REPUBLIC OF ZAMBIA

NATIONAL ADAPTATION PLAN FOR ZAMBIA

October 2023

FOREWORD

Climate change is one of the major challenges of this century. Projections by the Intergovernmental Panel on Climate Change (IPCC) indicate that if emissions of greenhouse gasses continue to rise, the global temperature is expected to increase beyond 1.5^0C. Arising from the expected temperature increase, the world will be faced with a disastrous future in rising sea-levels, shifts in agriculture growing seasons, biodiversity loss, as well as increased frequency and intensity of extreme weather events such as heat waves, storms, floods and droughts. If the rise in global temperatures is not addressed, Zambia will not be spared from these climate events.

The economy of Zambia is highly vulnerable to impacts of climate change due to its geographical location, low adaptive capacity as well as multitude of other socio-economic challenges. Subsequently, climate-sensitive sectors such as energy, agriculture, infrastructure, water, health, fisheries, wildlife and forestry are highly impacted by climate change. These impacts are already manifesting in extreme weather events such as frequent and prolonged droughts, flash floods and extreme temperatures which are expected to have far-reaching consequences. This phenomenon, threatens the realization of the Vision 2030 in which Zambia aspires to become "A Prosperous Middle-Income Nation by 2030".

In recognizing the climate change threats, the Government of the Republic of Zambia is implementing measures to address the adverse impacts to ensure that the country attains climate resilience. Among the measures taken by government is the development of the National Adaptation Programme of Action (NAPA, 2007), National Climate Change Response Strategy (NCCRS, 2010), the National Policy on Climate Change (NPCC, 2016), and the Nationally Determined Contribution (NDC, 2016). The country also developed its Initial, Second and Third National Communications on climate change.

Zambia remains committed to protecting the climate system for the benefit of the present and future generations. In this regard, the government has developed the National Adaptation Plan (NAP) in an effort to address the country's vulnerability and resilience to climate change. The NAP has identified medium to long-term adaptation actions which will enable Government to systematically implement priority adaptation actions that contribute to the implementation of the Vision 2030, National Development Plans and the NDC.

To implement this NAP, active engagement, coordination and partnership with various stakeholders, including development partners, the private sector, civil society organisations (CSOs), media, academic and research institutions, local communities, youths, persons with disabilities and children will be essential.

Hon. Eng. Collins Nzovu, MP
MINISTER FOR GREEN ECONOMY AND CLIMATE CHANGE

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The development of the National Adaptation Plan (NAP) was achieved through a broad-based consultative process involving key stakeholders at the national, and provincial levels. We wish to thank various stakeholders including traditional leaders, civil society organizations, academia, the private sector, local communities, government line ministries and departments and cooperating partners for their contribution to the development of this NAP.

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Further, Government acknowledges the technical inputs by the consultants, the Least Developed Countries Expert Group (LEG), Zambia Climate Change Network (ZCCN), International Institute for Sustainable Development (IISD), United Nations Population Fund (UNFPA), Alliance Biodiversity International (CIAT) and NAP Global Network during the formulation of the NAP.

The Government would also like to thank the drafting team, which included Prof. Felix Kalaba, Dr. Mubanga Kabwe, Dr. Charles Chisanga, and Ms. Monica Chundama.

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EXECUTIVE SUMMARY

The National Adaptation Plan (NAP) is a strategic framework developed by the Government of the Republic of Zambia to address risks and vulnerabilities in sectors to enhance the country's resilience to the impacts of climate change. It focuses on priority sectors namely: agriculture (crop, livestock, and fisheries), forestry, water, energy, tourism, infrastructure, mining, wildlife and health.

Zambia has experienced increased frequency and intensity of climate events, which include floods, dry spells, droughts, high temperatures and stormy winds. These events continue to negatively impact sectors, communities and agroecological regions and have resulted in damage to crops, livestock, fisheries and infrastructure as well as contributing to climate-related pest epidemics and diseases. Climate-induced changes are exerting considerable stress on the country's vulnerable sectors such as agriculture (crops, livestock and fisheries), wildlife, forestry, water, energy, mining, health and infrastructure.

The objectives of the NAP are to: (i) identify the country's vulnerabilities to climate change and develop medium and long-term adaptation actions to minimise the impacts; (ii) integrate climate change adaptation into the national, sectoral and sub-national planning and budgeting processes; (iii) strengthen institutional and technical capacities for the implementation of identified priority adaptation actions; (iv) strengthen institutional coordination mechanisms for climate change adaptation actions at national, sectoral and sub-national levels; and (v) leverage emerging opportunities for resource mobilization for the implementation of the prioritised adaptation actions to address current and projected climate risks.

The NAP has therefore, identified some risks and vulnerabilities in the agriculture, livestock and fisheries sector including food security; disruption of livelihoods and destruction of natural resources base; reduction of fish stock in natural water bodies and reduced availability of water for agriculture. There is also increased competition over access to natural resources of land and water as well as unsustainable cultivation methods with low adoption of conservational agriculture amidst changed climatic conditions.

To address the identified risks and vulnerabilities in the agriculture sector, the following are some of the adaptation actions proposed for implementation: promotion of climate-smart agriculture; strengthening disease surveillance and control activities; promotion of irrigation and efficient use of water resources. Others are the promotion of seed conservation of indigenous crop varieties; introduction of climate resilient and drought tolerant crop types and varieties; enhancement of food production, post-harvest and preservation techniques, and strengthening the provision of climate information services as well as agriculture insurance.

In the fisheries sub-sector, the risks and vulnerabilities identified include: increased fisheries diseases; reduced fish stock and species; and reduced breeding areas. The proposed adaptation actions to address risks and vulnerabilities in the fisheries sub-sector include the promotion of sustainable fisheries management among them, the promotion of aquaculture development and other forms of alternative livelihoods in fishing communities (utilization of fish cages and pens). Others are the conservation of habitats/ breeding areas to support healthy fish stocks; strengthening community sensitization and enforcement of fisheries regulations including fish bans.

In the advent of climate change, the livestock sub-sector faces various risks and vulnerabilities among them: increased livestock diseases and mortality; reduced availability and quality of fodder and reduced grazing land.

In the water sector, some of the risks and vulnerabilities include reduced water quality and quantity (reduced water supply and sanitation); and reduced groundwater recharge. To address these risks and vulnerabilities, some of the proposed adaptation actions include water catchment protection and conservation; improved water-harvesting techniques; developing groundwater resource utilization and efficient use for different sectors and promoting artificial groundwater recharge; investing in climate resilient water infrastructure.

With regard to the mining sector, some of the identified vulnerabilities include flooding of mining pits; reduced hydro-power supply to the mines; and potential reduction of water for mineral processing. To address the risks and vulnerabilities in the mining sector, some of the proposed adaptation actions include: designing of climate resilient tailings dumps (flood-responsive dewatering); promoting installation and utilization of alternative power sources; promote the installation of energy-efficient cooling facilities; promote the use of water-efficient mining and mineral processing.

The identified risks and vulnerabilities in the energy sector include reduced water for hydro-power generation and supply; and damage to energy infrastructure. The proposed adaptation action in the energy sector include the following: promote efficient use of alternative energy; renewable energy mix diversified and promote the implementation of off-grid power supply for households.

In the health sector, the risks and vulnerabilities include: increased incidences of malaria, diarrhoea, malnutrition, respiratory health-related infections and heat stress/stroke as a result of climate-related factors such as increased temperatures, flooding and drought. Some of the identified adaptation action in the health sector include: strengthening public health surveillance, preparedness and response for climate-sensitive diseases; integrate health services and protection measures into climate vulnerability assessments and conduct research in climate-sensitive diseases; promotion of health insurance.

In the wildlife sector, the risks and vulnerabilities include: destruction of wildlife habitats, loss of wildlife species and increased human-wildlife conflicts. The adaptation actions proposed in the wildlife sector include the provision of water points in water-stressed National Parks and GMAs (weirs, dams, reservoirs); protection and conservation of wildlife habitats. strengthen the operational capacity of community resource boards (CRB) including knowledge of climate to promote public- private community partnerships in the sustainable management of wildlife resources; enforce equitable benefit sharing arrangements among government, communities and the private sector in the management of wildlife resources and strengthen wildlife disease surveillance and control activities.

The tourism sector is faced with risks and vulnerabilities among them: disruption of tourism activities; diminished aesthetic value and damage to tourism infrastructure. The proposed adaptation measures in the tourism sector include the development of new innovative tourism products to promote indoor and non-water-based tourist activities; the development of tourism activities at other waterfalls in high rainfall areas; strengthening of the early warning systems and preparedness; enhancement of increased investment in the development of new tourism climate resilient infrastructure.

As regards the infrastructure sector, some of the risks and vulnerabilities are damage to roads; bridges; buildings and communication infrastructure. To address risks and vulnerabilities in the infrastructure sector, some of the adaptation actions include increased investments in the development of new climate-resilient infrastructure; increased funding for regular maintenance of existing infrastructure; development and implementation of enhanced windstorm-resilient standards and building codes; promotion of insurance of property against climatic hazards.

The risks and vulnerabilities identified in the forestry sector include loss of forest biodiversity, increased occurrence of forest fires; occurrence of pests and diseases and reduced forest ecosystem services. Some of the adaptation actions to address risks and vulnerabilities in the forestry sector include promoting afforestation and reforestation, assisted natural regeneration through participatory approaches; reducing deforestation and forest degradation; protection of forests and water catchments; promoting the development and implementation of forest fire management (plans) in PFAs and open forests.

The identified risks and vulnerabilities will also affect the three Agro-ecological Regions of Zambia differently. For instance, Agro-ecological Regions I and II, will be severely impacted by droughts, dry spells and floods while Agro-ecological Region III will be impacted largely by floods. To address the identified sectoral risks and vulnerabilities within the three agroecological regions, the same priority adaptation actions outlined for various sectors will apply.

To effectively implement the identified adaptation priorities, there is need to strengthen the institutional and human resource capacity at national, provincial,

district and local levels targeting key actors such as community members, traditional leaders, civil society, the private sector, academia and Government staff.

The NAP has identified the following as some of the priority areas for capacity building: Monitoring, Reporting and Verification (MRV) of adaptation actions; use of carbon markets for financing adaptation actions; mainstreaming climate adaptation into national, sectoral and sub-national plans and budgets with appropriate monitoring and tracking systems. Other capacity building areas identified include elaboration and preparation of bankable project proposal to enable the mobilisation of financing to implement prioritised adaptation actions and strengthening coordination mechanisms for the implementation of the NAP at all levels.

Implementation of the NAP will involve various stakeholders that include public sector, private sector, civil society, media and academia and research institutions. These will be coordinated through existing structures namely the Council of Ministers, Technical Committee and the National Development Coordinating Committee (NDCC) at national level, and the Provincial Development Coordinating Committees (PDCCs), District Development Coordinating Committees (DDCCs) and Ward Development Committees (WDCs) at sub-national levels.

The implementation of the NAP will require substantial national and international support in the form of finance, technical and technology development and transfer. Resource mobilisation for NAP will involve identifying, securing and allocating financial, technical and other resources to implement adaptation actions. This will be through integrating identified adaptation in national planning and budgetary processes as well as development of bankable project proposal financed through private sector financing, multilateral and bilateral arrangements.

This NAP communicates identified adaptation priorities, implementation and support needs, plans and actions, key performance indicators and their reporting systems established through a robust MEL framework. It serves as the first Adaptation Communication for Zambia pursuant to Article 7.10 of the Paris Agreement.

Reporting on adaptation actions for Zambia will follow a two-tier-reporting system at national and international levels. At national level, reporting will be through the NAP Monitoring and Evaluation framework from the WDCs, DDCCs and PDCCs. The PDCCs will in turn submit reports to the Ministry of Green Economy and Environment. The MGEE is responsible for receiving and consolidating sectoral reports on the implementation of the NAP for submission to the Technical Committee of Permanent Secretaries and the Council of Ministers on Climate Change. At international level, reporting on adaptation actions will be in accordance with the reporting obligations as outlined in the Convention and the Paris Agreement. This will be through the Biennial Transparency Report (BTR), the NDC reporting mechanisms and the National Communication.

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GLOSSARY

Adaptation

In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

Adaptive capacity

The combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

Anthropogenic

Resulting from or produced by human beings.

Anthropogenic emissions

Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities. These activities include the burning of fossil fuels, deforestation, land use changes, livestock, fertilization, etc., that result in a net increase in emissions.

Baseline/reference

The baseline (or reference) is the state against which change is measured. It might be a 'current baseline,' in which case it represents observable, present-day conditions. It might also be a 'future baseline,' which is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.

Capacity

The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals.

Catchment

An area that collects and drains precipitation.

Climate

Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a

wider sense is the state, including a statistical description, of the climate system. In various chapters in this report different averaging periods, such as a period of 20 years, are also used.

Climate change

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Climate extreme (extreme weather or climate event)

The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes.'

Climate projection

A projection of the response of the climate system to emissions or concentration scenarios of greenhouse gases and aerosols, or radiative forcing scenarios, often based upon simulations by climate models. Climate projections are distinguished from climate predictions in order to emphasize that climate projections depend upon the emission/ concentration/radiative-forcing scenario used, which are based on assumptions concerning, e.g., future socioeconomic and technological developments that may or may not be realized and are therefore subject to substantial uncertainty.

Climate scenario

A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships that has been constructed for explicit use in investigating the potential consequences of anthropogenic climate change, often serving as input to impact models. Climate projections often serve as the raw material for constructing climate scenarios, but climate scenarios usually require additional information such as about the observed current climate.

Climate variability

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate at all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

Cold days/cold nights

Days where maximum temperature, or nights where minimum temperature, falls below the 10th percentile, where the respective temperature distributions are generally defined with respect to the 1971-2000 reference period.

Disaster management

Social processes for designing, implementing, and evaluating strategies, policies, and measures that promote and improve disaster preparedness, response, and recovery practices at different organizational and societal levels.

Disaster risk

The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster risk management (DRM)

Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.

Disaster risk reduction (DRR)

Denotes both a policy goal or objective, and the strategic and instrumental measures employed for anticipating future disaster risk; reducing existing exposure, hazard, or vulnerability; and improving resilience.

Diurnal temperature range

The difference between the maximum and minimum temperature during a 24-hour period.

Downscaling

Downscaling is a method that derives local- to regional-scale (up to 100 km) information from larger-scale models or data analyses. The full definition is provided in Section 3.2.3.

Drought

A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term, therefore any discussion in terms of precipitation deficit must refer to the precipitation-related activity that is under discussion. For example, a shortage of precipitation during the growing season impinges on crop production or ecosystem function in general (due to soil moisture drought, also termed agricultural drought), and during the runoff and percolation season primarily affects water supplies (hydrological drought). Storage changes in soil moisture and groundwater are also affected by increases in actual evapotranspiration in addition to reductions in precipitation. A period with an abnormal precipitation deficit is defined as a meteorological drought. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.

Early warning system

The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities, and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

Exposure

The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected.

Extreme weather or climate event See Climate extreme.

Flood

The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods.

Governance

The way government is understood has changed in response to social, economic, and technological changes over recent decades. There is a corresponding shift from government defined strictly by the nation-state to a more inclusive concept of governance, recognizing the contributions of various levels of government (global, international, regional, local) and the roles of the private sector, of nongovernmental actors, and of civil society.

Greenhouse gas

Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, which absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, by the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Besides CO_2, N_2O, and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Hazard

The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

Heat wave (also referred to as extreme heat event)

A period of abnormally hot weather. Heat waves and warm spells have various and in some cases overlapping definitions. See also Warm spell.

Impacts

Effects on natural and human systems. In this report, the term 'impacts' is used to refer to the effects on natural and human systems of physical events, disasters, and climate change.

Insurance/reinsurance

A family of financial instruments for sharing and transferring risk among a pool of at-risk households, businesses, and/or governments. See Risk transfer.

Land use and land use change

Land use refers to the total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction, and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus have radiative forcing and/or other impacts on climate, locally or globally.

Percentile

A percentile is a value on a scale of 100 that indicates the percentage of the data set values that are equal to or below it. The percentile is often used to estimate the extremes of a distribution. For example, the 90th (10th) percentile may be used to refer to the threshold for the upper (lower) extremes.

Projection

A projection is a potential future evolution of a quantity or set of quantities, often computed with the aid of a model. Projections are distinguished from predictions in order to emphasize that projections involve assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realized, and are therefore subject to substantial uncertainty.

Resilience

The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Runoff

Part of precipitation that does not evaporate and is not transpired, but flows through the ground or over the ground surface and returns to bodies of water.

Scenario

A plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline.

Streamflow

Water flow within a river channel, for example, expressed in $m^3 s^{-1}$. A synonym for river discharge.

Sustainable development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Vulnerability

The propensity or predisposition to be adversely affected.

Warm days/warm nights

Days where maximum temperature, or nights where minimum temperature, exceeds the 90th percentile, where the respective temperature distributions are generally defined with respect to the 1971-2000 reference period.

Warm spell

A period of abnormally warm weather. Heat waves and warm spells have various and in some cases overlapping definitions.

Water demand management

Water Demand Management is the strategies and practices aimed at efficiently managing and conserving water resources to meet current and future water needs. It involves implementing measures to reduce water consumption, increase water use efficiency and promote sustainable water use behaviours.

ABBREVIATIONS AND ACRONYMS

7NDP	Seventh National Development Plan
8NDP	Eighty National Development Plan
AER	Agro-Ecological Region
AfDB	Africa Development Bank
AFOLU	Agriculture Forestry and Other Land Use
ANR	Assisted Natural Regeneration
AWARE	Accelerated Water and Agricultural Resources Efficiency
CAF	Cancun Adaptation Framework
CAGs	Cluster Advisory Groups
CCA	Climate Change Acton
CCB	Climate Change Bill
CDD	Consecutive Dry Days
CDM	Clean Development Mechanism
CGIAR	Consultative Group on International Agricultural Research
CIAT	Alliance Biodiversity International
CIF	Climate Investment Funds
CO2	Carbon dioxide
COMESA	Common Markets for Eastern and Southern Africa
COP21	Conference of the Parties
CSA	Climate Smart Agriculture
CWD	Consecutive Wet Days
DDCC	District Development Coordination Committees
DEM	Digital Elevation Model
DIPs	Integrated Development Plans
DMMU	Disaster Management and Mitigation Unit
DTR	Diurnal Temperature Range
EbA	Ecosystem-based Adaptation
ECZ	Environmental Council of Zambia
ERB	Energy Regulation Board
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Green Environment Fund
GHGs	Greenhouse gases
GMA	Game Management Area
GMPs	General Management Plans
GRZ	Government Republic of Zambia
GWP	Global Water Partnership
HEP	Hydroelectric Power
IPM	Integrated Pest Management
Irish-AID	Irish Agency for International Development
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management

LCMS	Living Conditions Monitoring Survey
LDC	Low Developed Countries
LKSC	Lower Kafue Sub-Catchment
Local	Local Climate Adaptive Living Facility
LPG	Liquid Petroleum Gas
MCA	Multi-Criteria Analysis
MGEE	Ministry of Green Economy and Environment
MLNREP	Ministry of Land, Natural Resources & Environmental Protection
MLGRD	Ministry of Local Government and Rural Development
MNDP	Ministry of National Development and Planning
MODIS	Moderate Resolution Imaging Spectroradiometer
MoFNP	Ministry of Finance and National Planning
MoH	Ministry of Health
MRV	Monitoring Reporting and Verification
MoT	Ministry of Tourism
NAP	National Adaptation Plan
NAPA	National Adaptation Programmes of Action
NCCRS	National Climate Change Response Strategy
NDC	Nationally Determined Contribution
NDCC	National Development Coordinating Committee
NEP	National Energy Policy
NGO	Non-governmental Organization
NPCC	National Policy on Climate Change
PBCRG	Performance-based Climate Resilience Grants
PDCCs	Provincial Development Coordination Committees
PPCR	Pilot Programme for Climate Resilience
PPH	People per hectare
RCPs	Representative Concentration Pathways
SADC	Southern Africa Development Community
SCF	Strategic Climate Fund
SCRiKA	Strengthening Climate Resilience in the Kafue sub-Basin
SDGs	Sustainable Development Goals
TAZARA	Tanzania Zambia Railway line
TRALARD	Transforming Landscapes for Resilience and Development
UNDP	United Nation Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WDC	Ward Development Committees
WMO	World Meteorological Organization
WWF	Wild Wide Fund
ZCCN	Zambia Climate Change Network
ZDHS	Zambia Demographic Health Survey
ZEMA	Zambia Environmental Management Agency
ZIFLP	Zambia Integrated Forest Landscape Project
ZMD	Zambia Meteorological Department

1.0 INTRODUCTION TO THE NAP FOR ZAMBIA

The National Adaptation Plan (NAP) for Zambia is a medium to long-term strategic framework developed by the Government of the Republic of Zambia. It was formulated to address identified risks and vulnerabilities in various sectors to enhance the country's resilience to the impacts of climate change. It also identifies primary hazards and recognises that climate change poses significant risks to the country's natural resources, socio-economic development, and livelihoods. This is particularly for vulnerable communities and sectors namely: agriculture (crop, livestock, and fisheries), forestry, water, transport, tourism, infrastructure, mining, wildlife and health.

The formulation of the NAP was a participatory and iterative approach involving analysis of climate risks, assessment of climate vulnerabilities, review of adaptation options, compilation and review of adaptation plans, integration of adaptation into national planning, and the establishment of implementation strategies, in line with the UNFCCC NAP guidelines. It involved participation of various stakeholders, which included government agencies, civil society organizations and academia.

The NAP is aligned to national development frameworks such as the Vision 2030, National Development Plan and the Nationally Determined Contribution (NDC). Further, it also aligns to international frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Sustainable Development Goals (SDGs) to ensure coherence and synergy with global climate and development agendas. By implementing the NAP, Zambia is contributing to the achievement of the global goal on adaptation as outlined in the Paris Agreement, which are to enhance adaptive capacity, reduce vulnerability, and increasing resilience of systems and communities.

1.1 Objectives of the NAP

The following are the objectives:

i) To identify the country's vulnerabilities to climate change and develop medium and long-term adaptation actions to minimise the impacts;

ii) To integrate climate change adaptation into the national, sectoral and sub-national planning and budgeting processes;

iii) To strengthen institutional and technical capacities for the implementation of identified priority adaptation actions;

iv) To strengthen institutional coordination mechanisms for climate change adaptation actions at national, sectoral and sub-national levels; and

v) To leverage emerging opportunities for resource mobilization for the implementation of the prioritised adaptation actions to address current and projected climate risks.

1.2 Scope of the NAP for Zambia

The NAP sets clear goals and objectives for adaptation, which include reducing vulnerability, enhancing adaptive capacity, building resilience, and ensuring sustainable development in the face of climate change. The scope of the Zambia NAP includes:

Vulnerability Assessment: This involves assessing the current and future risks and vulnerabilities associated with climate change in different agro-ecological regions (AERs), geographical regions and sectors namely: agriculture (crop, livestock, and fisheries), forestry, water, transport, tourism, infrastructure, mining, wildlife and health.

Adaptation Priorities: The identified climate change adaptation priorities will be utilized to enhance adaptive capacity. Based on the vulnerability assessment, the NAP identifies priority areas where adaptation efforts should be focused. These priorities vary depending on AERs, geographical regions and sector-specific environmental, social, human, financial, institutional and physical vulnerabilities.

Implementation Strategies: The NAP outlines strategies and measures to achieve the adaptation goals and objectives. This involves policy changes, capacity building, technological advancements, financial mechanisms, and institutional arrangements.

Resource mobilization: The NAP articulates resource mobilization and financing strategies for the implementation of identified adaptation actions and strategies.

Monitoring, Evaluation, Learning and Reporting (MELR): The NAP provides mechanisms for monitoring and evaluating the effectiveness of adaptation actions. This includes indicators for MELR and allows for adjustments and improvements as needed.

1.3 The NAP formulation process

The Zambia NAP formulation process was first launched in 2014 and re-launched in 2021 following readiness grant support from the Green Climate Fund (GCF). This process builds on earlier national processes to address climate change such as the National Adaptation Programme of Action (GRZ, 2007), National Climate Change Response Strategy (GRZ, 2010), National Policy on Climate Change (GRZ, 2016), Climate Change Gender Action Plan (GRZ 2018), Green Growth Strategy for Zambia (currently under development)

and the Revised Nationally Determined Contributions (GRZ, 2021) and it is aligned with the Eighth National Development Plan (8NDP) (GRZ 2022). The NAP process commenced with a Stocktaking exercise in 2021. The Stocktaking Report benchmarked the status of the climate change adaptation activities in the country and identified gaps. This was followed by development and consensus building on the road-map for the formulation of the Zambia NAP.

The next step involved synthesizing data on vulnerabilities of sectors, geographical regions and marginalized social groups (women, youths, elderly, persons with disabilities, people living with HIV/AIDS), and current and future impacts of climate change. This also involved documentation of lessons and best practices from past and ongoing projects on adaptation.

This was followed by the prioritization of gender-sensitive adaptation actions in different sectors and geographical regions. The prioritized climate change actions identified by stakeholders were screened and appraised using a Multi-Criteria Analysis (MCA) tool, which enabled decision-makers to create a structured framework for comparing a set of defined options across a number of diverse criteria to evaluate adaptation options across a range of priorities. The MCA provided a structured approach to determine the feasibility of proposed adaptation actions against identified criteria. The tool helped decision makers to evaluate alternatives and make trade-offs while considering multiple factors. Adaptation options were evaluated across 10 criteria including institutional governance, social, environmental, gender, technical, cost-effectiveness, and inclusiveness among others.

Capacity building in the systems and tools for integration of adaptation plans and budgets; coordination mechanisms, climate finance, climate data analysis, monitoring, reviewing and reporting at national and sub-national levels was included in the whole NAP formulation process. It also included training of the National Technical Committee on Climate Change on how to use the Multi-Criteria Analysis (MCA) Tool in prioritizing adaptation options at national and provincial levels.

The principal NAP formulation process enabled medium- and long-term strategic planning and coordination of adaptation in line with National Development Planning processes. Gender was an integral dimension in the NAP process, guided by Zambia's 2018 Climate Change Gender Action Plan. The NAP formulation process recognized gender differences in adaptation needs, opportunities and capacities. In addition, the participation of youths, women and men in adaptation decision-making processes and their knowledge, concerns and experiences were taken into consideration.

The NAP formulation process in Zambia was a multi-sectorial and participatory process that required strong coordination and collaboration. The NAP provides

a framework for Zambia to ensure that medium and long-term development planning and budget processes integrate climate change adaptation in order to effectively identify climate change adaptation actions.

The NAP formulation process was participatory, engaging a diverse array of stakeholders following bottom-up and top-down approaches to ensure that the formulation process is country-driven. Sectorial and regional engagements were held at national and provincial levels with the various sector players which included government, civil society organizations, academia, and development agencies among others.

The last step involved drafting and validation of the NAP document by stakeholders at national and sub-national levels.

The following are the NAP key result areas for the formulation phase:

I. Strengthened institutional coordination and collaboration for adaptation planning in Zambia.
II. Established a system for integrating climate change adaptation into plans and budgets.
III. Prioritized adaptation actions for sectors and geographic areas.
IV. Strengthened capacity of planning authorities, sectors, and civil society in:
    - Systems and tools for integrating adaptations into plans and budgets.
    - Climate finance.
    - Climate data analysis.
    - Gender transformative approaches for climate change.
    - Monitoring, reviewing and reporting at national and sub-national levels; and
    - Use of the Multi-Criteria Analysis (MCA) Tool in prioritizing adaptation options at National and Province levels.
V. Developed a Monitoring, Evaluation, Learning and Reporting Framework for the NAP.
VI. Developed a resource mobilization strategy for the implementation of the NAP; and
VII. Developed a NAP communication strategy.

2.0 POLICIES AND PROGRAMMES ON ADAPTATION

Globally, there are several policies and strategies developed to address climate change impacts. In Zambia, the NAP process was informed by national policies and strategies among them, the NPCC that was promulgated in 2016, the NAPA, NDC, and the NCCRS among others. This is to enhance adaptation actions in the country.

Zambia's legislation and policy frameworks, prioritises the climate change agenda that promote the unlocking of bilateral and multilateral funding potential. Strong political commitment and comprehensive overarching institutional and policy coordination frameworks are key triggers of international financing for Climate Change Action (CCA). Creating an enabling environment that provides this level of support is an important first step in accessing climate finance.

Over the years, Zambia has received funding from bilateral and multilateral partners to implement various project related climate adaptation actions in different sectors and geographical areas to address climate change impacts.

Some of the implemented projects include: Accelerate Water and Agricultural Resources Efficiency in Zambia (AWARE), Pilot Programme for Climate Resilience (PPCR) Phase II, Strengthening Climate Resilience in the Kafue Sub Basin (Scrika) and Transforming Landscapes for Resilience and Development (TRALARD). Others are Strengthening Climate Resilience of Agricultural Livelihoods in Agro-ecological Regions I and II (SCRALA), Ecosystems-Based Adaptation (EbA) project as well as the Local Climate Adaptive Living (LoCAL) mechanism. Civil Society Organisations are also implementing adaptation projects, such as the Voices for Climate Action (VCA) project implemented by a consortium of Civil Society Organisations, which include Wild Wide Fund (WWF), Zambia Climate Change Network (ZCCN), Action Aid Zambia, HIVOS, and Civil Society for Poverty Reduction (CSPR).

Table 1 below summaries milestones in the implementation of climate change mitigation and adaptation initiatives in the country from 2000 to 2026.

Table 1. Climate Change Milestones 2000 - 2026

2000-2005	2006-2010	2011-2015	2016 to 2020	2021 to 2026
• 1st National Communication • Initial engagement on CDM (World Bank) • Research on impacts of Climate Change on hydro power in the Zambezi Basin	• Rapid CRVA to inform the NAPA • NAPA • DNA for CDM • CDM (Lusaka sustainable energy) • CDM (3 Rocks) • Climate Change Facilitation Unit • CC Response Strategy • CC Information Needs Assessments • Economics of Climate Change in Zambia. GHG Inventory (2006 Guidelines) IUCN CC and Development report ILUA Phase I National Policy on Environment (NPE) in 2007 National Adaptation Programme on Climate Change (NAPA) in 2007 National Climate Change Response Strategy (NCCRS) in 2010.	• ICCS • Zambia SPCR (PPCR) • 2nd National Communication • Mainstreaming CC into the SNDP • CC Technology Needs Assessment and Action Plan • LECB project – Nationally Appropriate Mitigation Actions • National Meteorological Policy, 2014 • NDA for GCF • 1st NAPA project – agriculture • 2nd NAPA Project – Climate Information and Early warning • 3rd NAPA Project – Promoting climate resilient community-based regeneration indigenous forests • Enhanced capacity on LEDS (USAID) • ILUA Phase II • GEF 5 project in the Greater KNP and Lunga NP National Strategy for Reducing Emissions from Deforestation and Forest Degradation (REDD+) in 2015 Zambia National Determined Contribution (NDC) in 2015)	• NPCC • Nationally Determined Contribution • CC Coordination Framework • Climate Change Department • CC mainstreaming into 7NDP • REDD+ Strategy • Investment Plan for reducing emissions from deforestation • 3rd National Communication • NDC Partnership • Cabinet approval on CC Bill • LEDS Modelling Project • Zambia Integrated Forest Landscape Programme • NDE CTCN • Additional Finance (AF) for the PPCR • TRALARD Project • NDC CAEP Support • NDC Support Program • Innovative Technologies to Improve Climate Resilience in the Zambian Agricultural Sector • SCRALA (GCF) • NAP Readiness Proposal (GCF) • EbA Project Proposal (GEF) • Renewable energy financing framework (GCF) • Mainstreaming climate resilience in 11 DDPs under SCRiKA • National Policy on Climate Change (NPCC) in 2016 Second National Agriculture Policy in 2016Climate Smart Agriculture Strategic Framework in 2018 Climate Smart Agriculture Investment Plan in 2019 Seventh National Development Plan 2017 to 2021 Climate Change Gender Action Plan 2016 to 2020	Eighth National Development Plan 2022 to 2026

Source: GRZ (2020), Ministry of Lands and Natural Resources.

Key lessons learnt from implemented projects:

- Policies and leadership: strong leadership and consistent policies are critical for mainstreaming climate change and implementation of adaptation efforts in development planning.
- Stakeholder participation: this is key in participatory processes for adaptation planning to foster ownership and enhance livelihoods as well as community values;
- Indigenous knowledge and science: blending of indigenous knowledge and science contributes to building adaptive capacities in communities;
- Benefits and trade-offs: Unequal distribution of benefits and environmental trade-offs threaten the successful implementation of adaptation actions where common resources have multiple uses and beneficiaries such as farmers versus gatherers in forest ecosystems. Acknowledging and understanding the multiple uses and beneficiaries is key to the successful implementation of Ecosystem Based Adaptation (EbA) approaches;
- Planning: Integrated Planning at district level has been central in delivering technical solutions at implementation level;
- Inclusivity: Inclusion of vulnerable groups, women and youths in project implementation increases their access to the available natural resources for improved livelihoods at household level;
- Financing: Bilateral and multilateral partners as well as private sector are important in providing supplementary technical and financial assistance;
- Institutional arrangements: the use of existing government and project implementation structures is key in the integration of adaptation activities in development planning;
- Adaptation and resilience: Climate change adaptation and resilience building require partnerships beyond the primary sector focus areas to include local communities, civil society as well as private sector in order to address felt needs;
- Governance and infrastructure management: In addition to providing communities with physical assets that help to build resilience, there is also need to focus on local governance capacities and socio-cultural values. This enhances accountability in project implementation and promotes community participation; and
- Capacity building: Adaptation initiatives require continuous learning and feedback loops. These elements need to be incorporated in the project design and implementation.

3.0 CLIMATE CHANGE, HISTORICAL EVENTS, TRENDS AND FUTURE PROJECTIONS

Zambia is faced with extreme climatic conditions such as droughts, seasonal and flash floods, extreme temperatures, wet spells and dry spells characterized by increased intensity, frequency and magnitude. Changes in rainfall patterns threaten the productivity of livestock, fisheries, aquaculture and rainfed agriculture in Zambia (FAO, 2015; Rojas-Downing et al., 2017; Ngoma et al., 2021). Climate variability continues to be a major threat to sustainable development in the agricultural sector leading to threatened food security, disruption of livelihoods, destruction of natural and agricultural resource base, poor adaptive capacity among farmers, inadequate research and development, reduced productivity, inability to measure, and report greenhouse Gas (GHG) emissions from Agriculture Forestry and Other Land Use (AFOLU), livestock and crop disease outbreak.

Increasing trends in temperature and variability in rainfall of about 0.34^{o}C per decade and 1.9 mm per month, respectively, threaten the livelihoods of 60% of the population that depend on agriculture (Mubanga et al. 2020). At the agricultural field level, the consequences of this new scenario have led to waterlogged fields, water shortages, destruction of crops and higher incidences of crop and livestock diseases. Crop simulation models indicate an increase in maize yield by more than 25% in parts of Agro-Ecological Region (AER) III but this is likely to decrease by the same magnitude in parts of AER IIa (World Bank Group, 2019). Further, the simulation studies suggested that while overall production may increase, net exports of most of the agricultural commodities are declining including net trade (World Bank Group, 2019).

Agriculture is a key sector of Zambia's economy which is however sensitive to climate change and climate-related impacts. The agriculture production output is projected to decline by 30% by 2080 under the current climate change scenarios unless adaptation actions are applied and the Agriculture Policy is climate-proofed (ZaAS, 2013). Much of the agricultural land will be lost due to climate change (UNFCCC, 2006) to other Land Use/Land Cover Changes (LULCC) (Chisanga et al., 2022c). There are many factors that compound the impacts of the current climate change and variability in Zambia and these have negative effects on the ability of the country to cope. These include poverty, limited infrastructure, illiteracy, weak institutions, lack of technology and information, low level of primary health care and low management (UNFCCC, 2006).

Floods, stormy winds, dry spells and droughts are extreme rainfall patterns that impact sectors, agro-ecological regions, provinces and the communities. Flash floods and floods generally occur in the rainy season, particularly from December to February (DJF) where high-intensity precipitation events are most prominent (Hachigonta and Reason, 2006). Zambia is vulnerable to and has

experienced high intensity of floods in 2006/2007, 2007/2008, 2008/2009, 2009/2010 and 2011/2012 (Sichingabula, 1998; ZVAC, 2009, 2010, 2012). In 2009-2010, flash floods and riverine floods due to heavy rainfall events over Zambia caused water logging and affected over 238,258 people (Mubanga and Chisanga, 2020; Mubanga et al., 2020). In other seasons, floods have damaged crops, livestock, and infrastructure and contributed to pest epidemics (GRZ 2007; 2010). The flooding events during the 2006/2007 rainy season saw nearly 1.5 million people (Neubert et al., 2011) affected in 41 out of 72 districts in Zambia (GRZ, 2007). According to the Zambian Vulnerability Assessment Committee (ZVAC) report, some 1.4 million people depended on food relief following the floods in 2006/07. The magnitude and timing of the floods also caused problems, as the regions that are used to the floods were caught unprepared by earlier occurrences and higher magnitudes (Kalantary, 2010).

Droughts and dry spells occur even more frequently than floods (Thurlow et al., 2012; Libanda et al., 2019) and notably, AER1 is the country's most drought-prone region (Mubanga et al., 2020). These can span multiple years and have intense effects on livelihoods and food security. Cattle, which are crucial to the livelihoods of many Zambians, are stressed during times of extreme drought, as a result of reduced plant growth and a shortage of pasture (Gannon et al., 2006). Small-scale droughts also occurred in 1994-1995, 2004-2005, and 2017-2018 (Thurlow et al., 2012; Libanda et al., 2015; Libanda and Ngonga, 2018). It is important to understand broad-scale changes in the climate (WMO, 2020, 2021). However, the most acute impacts of weather and climate are often felt during extreme meteorological events such as heavy rain, droughts, heat waves and windstorms, including tropical storms (WMO, 2020, 2021).

Climate trends in Zambia have shown that many climate-induced hazards such as droughts, floods and extreme temperatures have increased in frequency and intensity over the past few decades (Figure 1). Projections show that by 2030, Zambia will experience a notable rise in compound heat, drought and flood events compared to current baseline conditions. This implies that the existing climate risks observed on the ground will be exacerbated even further in the future.

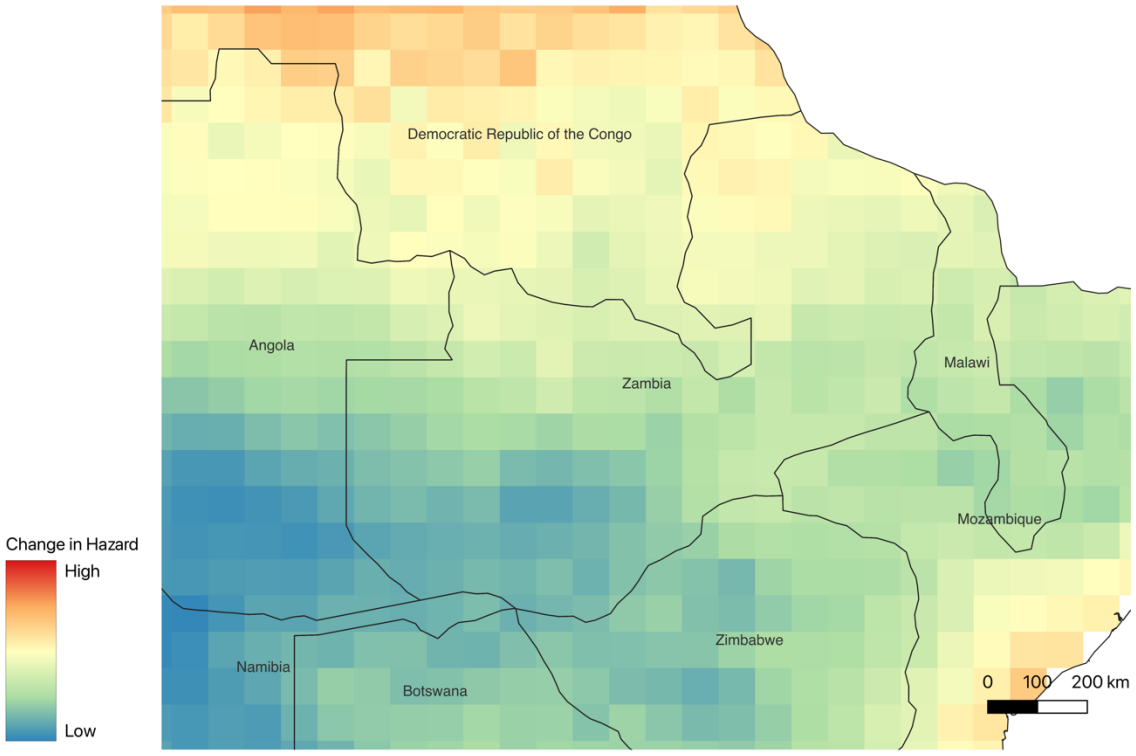

Figure 1. This map illustrates the shift in compound flood, heat and drought events when comparing baseline (1981 to 2010) hazard risks to the projected future conditions in 2030

3.1 Statistically downscaled rainfall and temperature datasets

The projected changes in rainfall show a decreasing trend over provinces and Zambia as shown in Figure 2. Results show that rainfall under Representative Concentration Paths (RCPs; RCP4.5, RCP8.5) would reduce in future from 2010-2099. Furthermore, rainfall would decrease by 26.47 mm (2025; RCP4.5), 50.87 mm (2055; RCP4.5), 52.30 mm (2085; RCP4.5), 65.63 mm (2025; RCP8.5), 62.00 mm (2055; RCP8.5) and 77.34 mm (2085; RCP8.5) (Figure 2). Mean rainfall over Zambia shows spatial and temporal variability.

The maximum and minimum temperatures exhibit an increasing trend under both scenarios (RCP4.5 and RCP8.5). The mean temperature is projected to increase by 1.23 ^{o}C (2025; RCP4.5), 1.41 ^{o}C (2055; RCP4.5), 2.33 ^{o}C (2085; RCP4.5), 3.38 ^{o}C (2025; RCP8.5), 2.91^{o}C (2055; RCP8.5) and 5.62 ^{o}C (2085; RCP8.5) (Figure 2) under future climate scenarios. The increase in surface air temperature and variability in rainfall will have impacts on all the sectors (Chisanga et al., 2022b) namely: Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport and Water.

The rate of warming is projected higher in the southern and western regions compared to the northern and eastern regions of Zambia. Climate-induced changes are exerting considerable stress on the country's vulnerable sectors such as agriculture and food security, wildlife, forest, water, energy, health and infrastructure. Therefore, the agriculture sector is extremely vulnerable to rainfall patterns which have become more unpredictable under the changing climate (NAPA, 2007; Phiri et al., 2013). Adaptation and mitigation strategies aimed at reducing the impacts and risks associated with extreme weather patterns require a concerted effort by all sectors to reduce the GHG emissions identified as major contributors to the changes in climatic patterns globally.

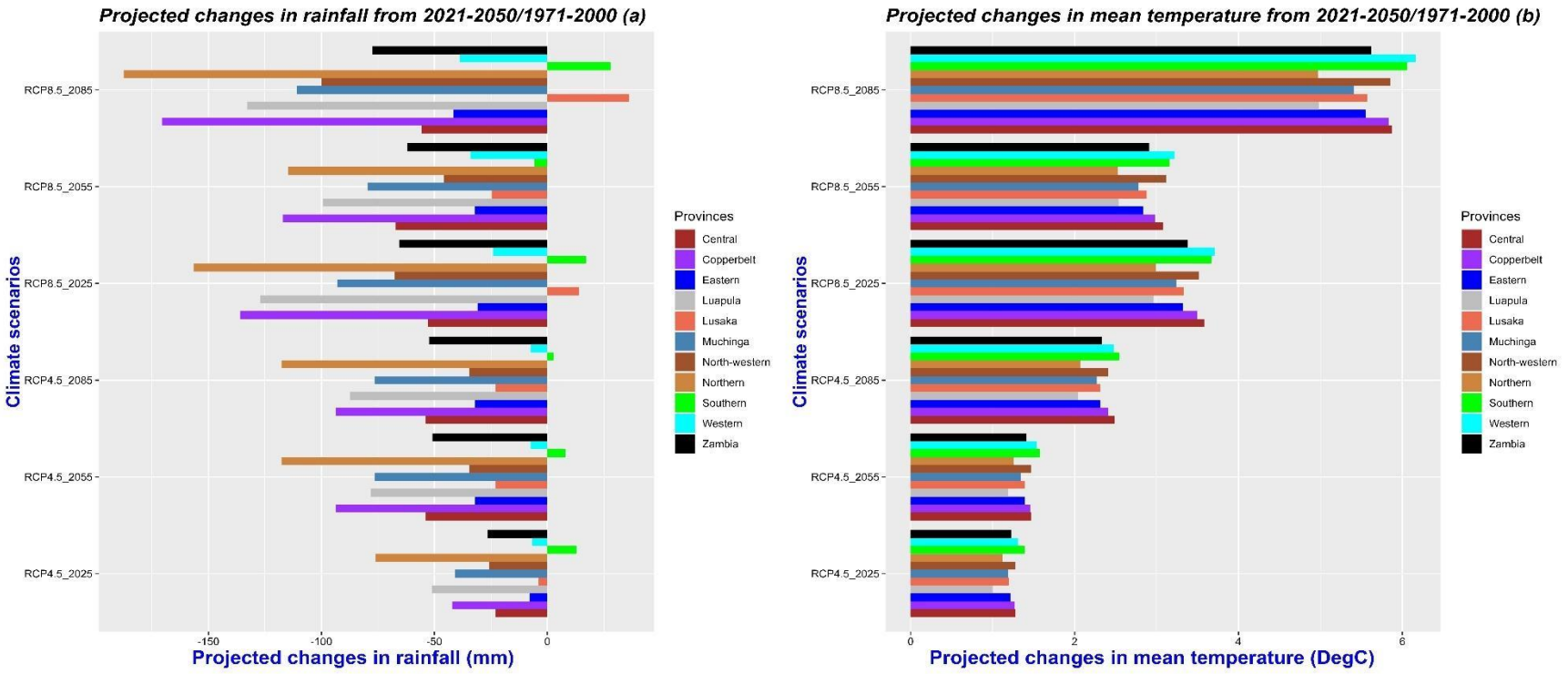

Figure 2. Projected changes in total rainfall (Left) and mean temperature (Right) from 2010-2039 (RCP4.5, RCP8.5), 2040-2069 (RCP4.5, RCP8.5) and 2070-2099 (RCP4.5, RCP8.5) relative to 1971-2000 (Baseline) at Provincial and National level)

3.2 Climatic conditions in agro-ecological regions

Zambia is divided into three major AERs (AER I, AER IIa, AER IIb and AER III) (Figure 3), which are largely based on annual rainfall amounts but also integrate soils and other climatic characteristics (Chabala et al., 2013). Zambia's AERs are experiencing warmer winters and hotter summers and annual rainfall has decreased by 1.9 mm per month (2.3% per decade) since 1960 particularly in the months of December, January and February (GRZ, 2010; UN, 2012). Temperature-based climate indices have had statistically significant impacts on AERs and ecosystems (Mubanga et al., 2020; Chisanga et al., 2022b). The projected future changes in rainfall due to climate change indicate that AERI will receive more rainfall from January to March and October to December by 2050 (Chisanga et al., 2020a; Mubanga et al., 2020). In contrast, AER II will experience minimal decreases in rainfall in these periods and AER III is projected likely to receive less rainfall (*Table 2*). The projected changes in rainfall are statistically non-significant.

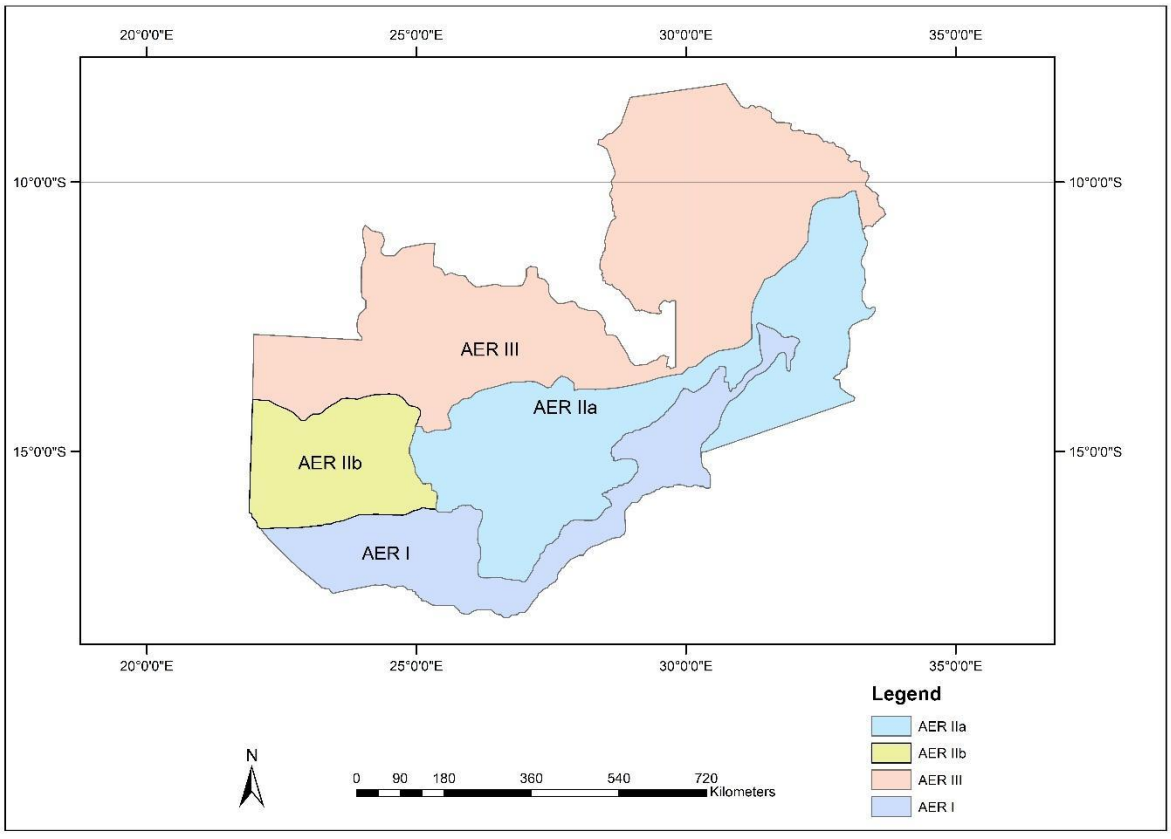

Figure 3. Agro-ecological Regions of Zambia

Table 2. Summary of projected climate changes across AERs of Zambia for key climate variables by 2050

Region	Average temperature (°C)	Total annual rainfall (mm/year)	Number of heavy rainfall (Days/year)	Rainy days (Days/year)
AERIII	**Increasing** +2 °C to +3 °C by 2050s but changes evident in next decades	**Normal to increasing**, no change by 2015, but change ranging from no change to clear increase of up to15% could become evident after 2070s	**Normal to increasing**, ranging from no change to increasing by 2050, but generally increasing by up to 50% by 2100	**Normal to decreasing**, ranging from no change to decreasing of up to 10% by 2100. Change may become evident from 2060s
	Increasing +1.5 °C to +3 °C by 2050s but changes evident in next decades	**Normal to decreasing**, no change by 2015, but change ranging from no change to clear decrease of up to 20% could become evident after 2070s	**Normal to increasing**, ranging from no change to increasing by 2050, but generally increasing by up to 50% by 2100	**Normal to decreasing**, ranging from no change to decreasing by 2050, and generally decreasing by up to 15% by 2100
AERII	**Increasing** +2 °C to +3 °C by 2050s but changes evident in next decades	**Normal to decreasing**, ranging from no change to a clear decrease of up to 35% by 2100. Change may become evident from 2040s	No consistent signal in projections	**Normal to decreasing**, ranging from no change to decreasing by 2050, and generally decreasing by up to 35% by 2100
AERI	I**ncreasing** +1.5 °C to +3 °C by 2050s but changes evident in next decades	**Normal to decreasing**, ranging from no change to a clear decrease of up to 35% by 2100. Change may become evident from 2020s	No consistent signal in projections	**Normal to decreasing**, ranging from no change to decreasing by 2050, and generally decreasing by up to 35% by 2100

Adapted with permission from: AfDB Group (2022)

3.3 Projected changes in selected climate indices over Zambia

The Summer days (SU; daily temperature > 25 ^{o}C), Monthly maximum of daily maximum temperature (TXx), Cool Nights (TN10p), Warm Nights (TN90p), Cool Days (TX10p), Warm Days (TX90p), Diurnal Temperature Range (DTR), Maximum 1-day precipitation (Rx1day), Maximum 5-day precipitation (Rx5day), Annual total wet-day precipitation (Total rainfall; PRCPTOT), Consecutive Dry Days (CDDs) and Consecutive Wet Days (CWDs) under Representative Concentration Pathways (RCP4.5, RCP8.5) are shown in Table 3, Figures 4-6. These climate indices exert impacts on sectors. Climate indices such as annual precipitation total, diurnal temperature range, simple daily intensity index, and annual contribution from very wet days are societal impact indices. Changes in the frequency and magnitude of extreme weather events have an important impact on mortality rates, especially among elderly people.

Table 3. Computed Expert Team on Sector Specific Indices during 2021-2050 relative to 1971-2000 scenarios at annual basis

Indices	Description	Sector	2021-2050/1971-2000 Change (RCP4.5)	2021-2050/1971-2000 Change (RCP8.5)
CDD	Consecutive dry days (PR<1.0 mm)	Water, Agriculture, Health, Transport, Energy, Forestry	-24.27 to 29.63	-17.40 to 13.90
CWD	Consecutive wet days (PR>1.0 mm)	Water, Agriculture, Health, Transport, Tourism, Wildlife	-100.37 to -5.43	-83.37 to -4.50
SU	Summer days (daily temp >25^{o}C)	Health, Tourism, Wildlife, Agriculture	0.03 to 170.73	0.03 to 162.37
DTR	Diurnal temperature range	Agriculture	0.03 to 1.25	-0.21 to 0.100
PRCPTOT	Sum of daily PR>=1.00 mm	Water, Agriculture	-342.64 to 116.68	-294.12 to 221.15
Rx1day	Maximum 1-day PR total	Water, Agriculture, Infrastructure, Energy, Forestry, Tourism, Wildlife	-8.84 to 10.42	-08.79 to 7.48
Rx5day	Maximum 5-day PR total	Water, Agriculture, Infrastructure, Mining, Energy, Forestry, Tourism, Wildlife, Transport	-21.19 to 24.97	-19.64 to 17.49
TN10p	Percentage of cold nights (%)	Agriculture, Health	-0.48 to 0.30	-0.36 to 0.33
TN90p	Percentage of warm nights (%)	Agriculture, Health	-0.32 to 0.37	-0.22 to 0.35
TX10p	Percentage of cool days	Agriculture	-0.09 to 0.50	-0.18 to 0.34
TX90p	Percentage of hot days (%)	Agriculture, Health, Water, Transport	-0.08 to 0.50	-0.02 to 0.48
TXx	Warmest daily maximum TX (^{o}C)	Agriculture, Health, Water, Mining, Water, Wildlife, Infrastructure, Transport	1.44 to 2.44	1.56 to 2.39

*Summer days (SU; daily temperature > 25 ^{o}C), Monthly maximum of daily maximum temperature (TXx), Cool Nights (TN10p), Warm Nights (TN90p), Cool Days (TX10p), Warm Days (TX90p), Diurnal Temperature Range (DTR), Maximum 1-day precipitation (Rx1day), Maximum 5-day precipitation (Rx5day), Annual total wet-day precipitation (PRCPTOT), Consecutive Dry Days (CDDs) and Consecutive Wet Days (CWDs) under Representative Concentration Pathways (RCP4.5, RCP8.5)

**Agriculture: Crop, Fisheries, Livestock

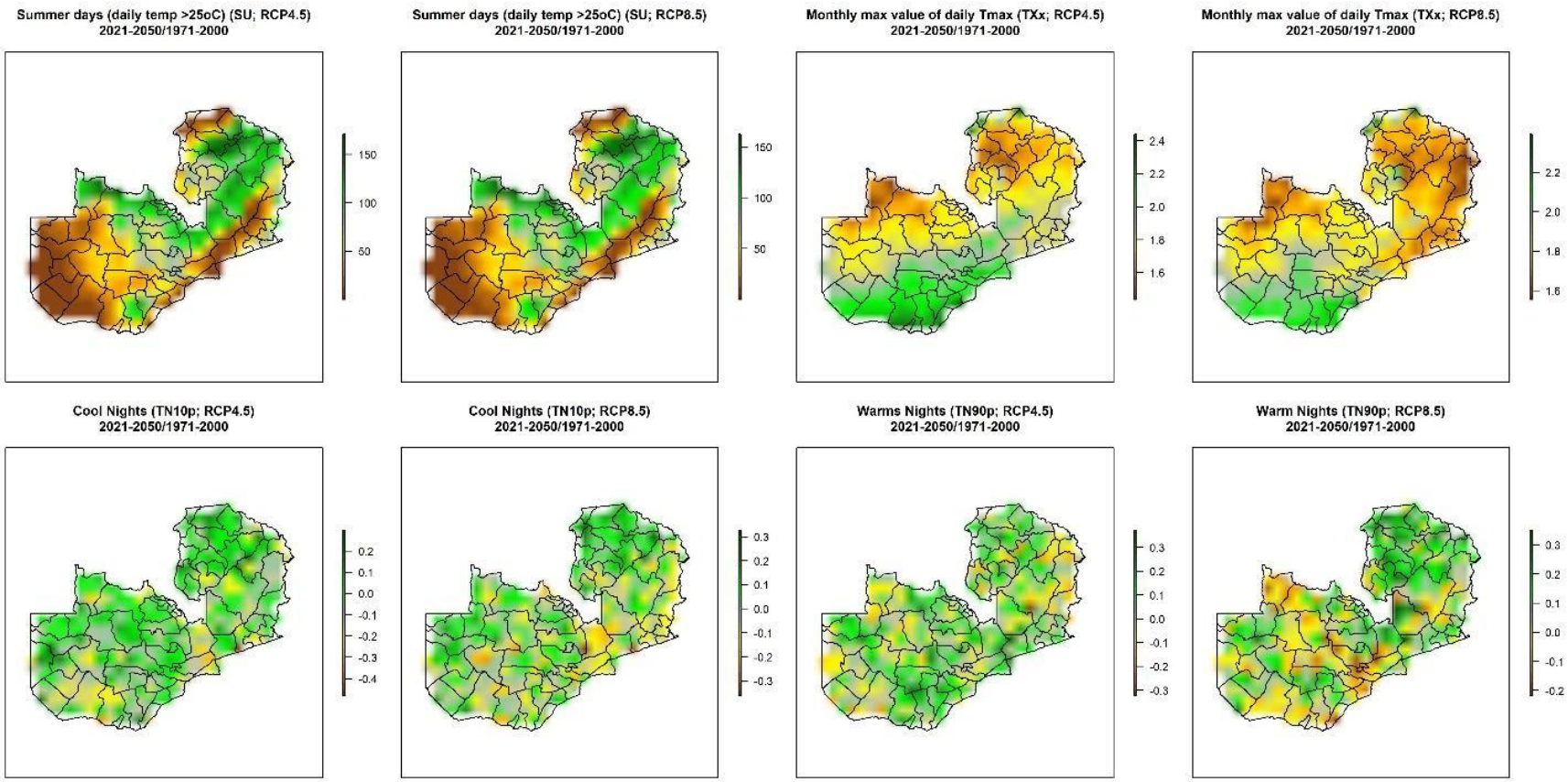

Figure 4. The projected changes in Summer days (SU; daily temperature >25oC), Monthly maximum of daily maximum temperature (TXx), Cool Nights (TN10p), Warm Nights (TN90p) during 2021-2050/1971-2000 under Representative Concentration Pathways (RCP4.5, RCP8.5)

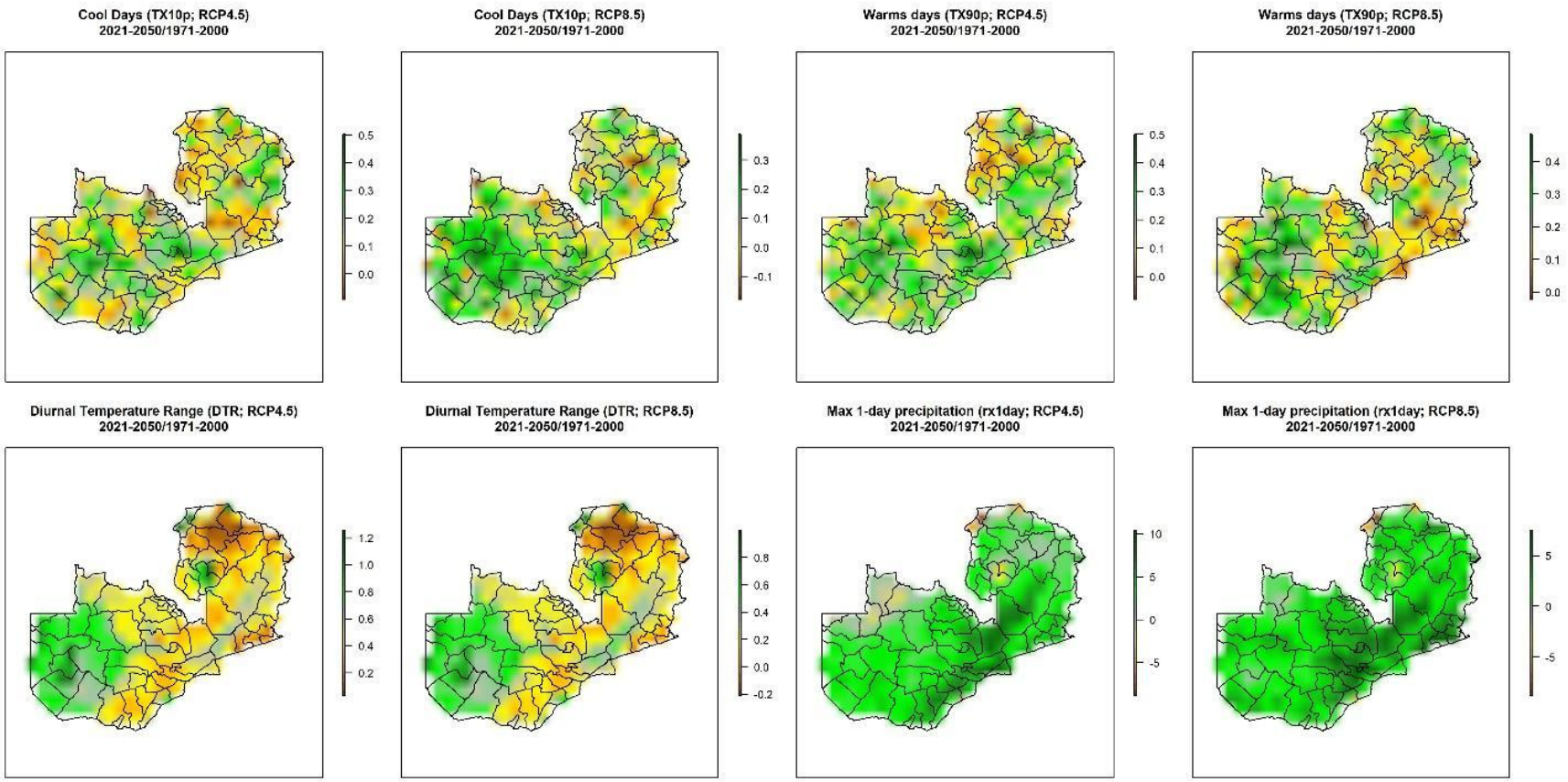

Figure 5. The projected changes in Cool Days (TX10p), Warm Days (TX90p), Diurnal Temperature Range (DTR), Maximum 1-day precipitation (Rx1day) during 2021-2050/1971-2000 under Representative Concentration Pathways (RCP4.5, RCP8.5)

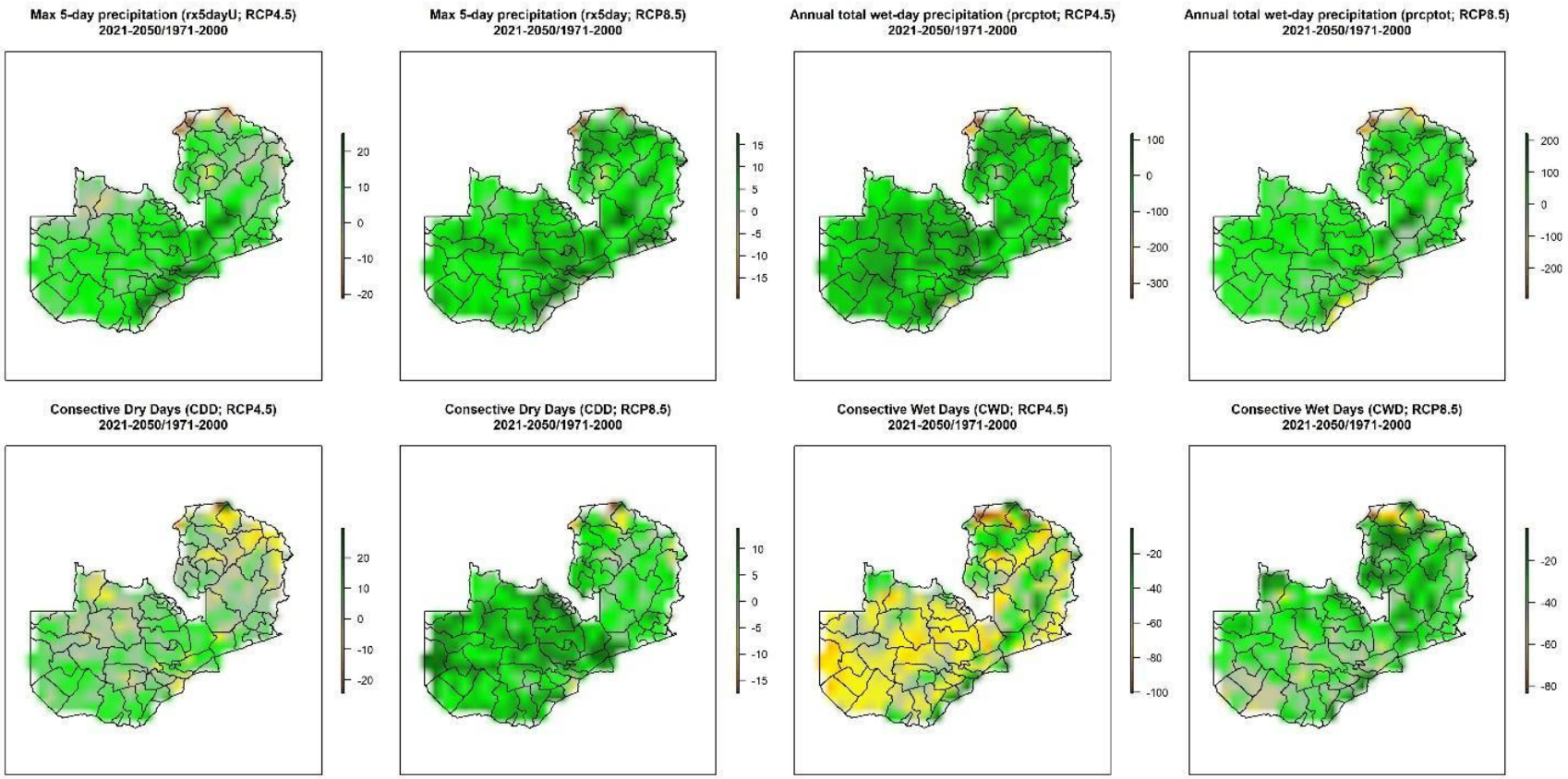

Figure 6. The projected changes in Maximum 5-day precipitation (Rx5day), Annual total wet-day precipitation (PRCPTOT), Consecutive Dry Days (CDDs) and Consecutive Wet Days (CWDs) during 2021-2050/1971-2000 under Representative Concentration Pathways (RCP4.5, RCP8.5)

The summer days exhibits an increase in daily temperature > 25^{o}C during 2021-2050 relative to the baseline (1971-2000) under RCP4.5 and RCP8.5. The summer days show an increase in days of 0.03-170 and 0.03-162 days under RCP4.5 and RCP8.5, respectively. The summer days show an increase in the northern part of Zambia. However, the monthly maximum of daily maximum temperature under RCP8.5 shows an increase in the monthly maximum of daily maximum temperature from 1.56^{o}C to 2.39^{o}C. The number of cool nights and warm nights exhibits both an increase and decrease in cool and warm nights in selected parts of the country. There are both increase and decrease in the number of cool days under RCP 4.5. The number of cool days and warm days shows an increasing trend from 2021-2050 relative to 1971-2000 under RCP4.5 and RCP8.5 (Figure 5). The occurrence of a larger number of cool days (-0.09 to 0.50 days) and warm days (-0.08 to 0.50 days) will occur under RCP4.5.

Diurnal temperature range during 2021-2050 relative to 1971-2000 under RCP4.5 (0.03-1.25 ^{o}C) and RCP8.5 (-0.21 to 1.00 ^{o}C). The diurnal temperature range is an important indicator of climate change (Braganza et al., 2004; Qu et al., 2014) and has significant impacts on agricultural production and productivity. The factors influencing the diurnal temperature range include; land use/land cover changes (LULCC), urbanization, irrigation, station moves, desertification, and other climatic effects (Qu et al., 2014). The diurnal temperature range is an important meteorological indicator of global climate change with higher values inducing stroke morbidity (Lei et al., 2020).

The maximum 1-day precipitation, maximum 5-day precipitation and annual total wet-day precipitation exhibit an increase and decrease in the amount of rainfall under RCP4.5 and RCP8.5. Figure 6 shows a higher reduction compared to an increase in Rx5day under RCP4.5. However, the Total rainfall shows a decreasing trend in selected northern, central and southern parts of Zambia.

The Consecutive Dry Days and Consecutive Wet Days exhibit both an increase and decrease in consecutive dry and wet days under RCP4.5 and RCP8.5. The Consecutive Wet Days will increase/decrease under RCP4.5 (-24.27 to 29.63 days) and RCP8.5 (-17.40 to 13.90 days). The trend in Consecutive Wet Days is statistically significant in selected parts of Western, North-western, Southern, Northern, Muchinga and Lusaka provinces. Consecutive Wet Days for most of the country was statistically non-significant. The Consecutive Wet Days for the period 2021-2050 under RCP8.5 shows a decreasing trend of 0.6 days in Eastern and selected parts of Muchinga, Northern, Luapula, Central, Copperbelt and Southern provinces. However, all the trends observed under RCP8.5 are statistically non-significant. There is a higher reduction in Consecutive Wet Days under RCP4.5 (-100.37 to -5.43 days) compared to

RCP8.5 (-83.37 to -4.50 days). The Consecutive Wet Days and Consecutive Wet Days have implication on agriculture productivity and production.

4.0 CLIMATE VULNERABILITIES OF SECTORS AND AGRO-ECOLOGICAL REGIONS

This section focuses on the vulnerabilities of sectors and agro-ecological regions. The vulnerability of smallholder farmers and other vulnerable groups is discussed in more detail in Section 3.1.11. Zambia's economically important sectors have continuously been ravaged by risks and vulnerabilities because of climate change impacts. The vulnerability of Zambia's sectors to climate change impacts has been manifested through increased frequency and intensity of droughts, floods, extreme weather, heat stress and heat waves. The severity of the impacts of extreme and non-extreme weather and climate events depends strongly on the level of vulnerability and exposure of sectors and individuals' extreme climatic events.

According to the Global Climate Risk Index, Zambia is ranked 26th out of 182 countries and was classified as being high risk in the 2018 Climate Change Vulnerability Index. Among the factors responsible for Zambia's classification as high risk is the country's high natural variability with frequent droughts, seasonal and flash floods, extreme temperatures and dry spells, all of which are expected to intensify with climate change under future climate scenarios.

On the other hand, the poor are particularly vulnerable to climate change impacts due to their heavy reliance on climate-sensitive economic activities. Zambia has low adaptive capacity due to limited financial, technical and institutional capacity, limited access to climate information and early warning systems, inadequate infrastructure and weak governance systems.

The majority of the livelihoods among the population in Zambia are agriculture-dependent. For households that rear livestock or depend on other natural resources, their vulnerability is as a result of insufficient water during droughts and too much water or water-logging due to excessive and unpredictable rainfall during floods. The elderly, female-headed households and single or divorced male-headed households are the most vulnerable. Frost and heat stress are also increasing and as climate patterns become more erratic; water and energy resources, infrastructure and housing, and animal and human health are increasingly affected.

4.1 Agriculture sector

4.1.1 Climate vulnerabilities and risks of crop sub-sector

The variability in rainfall patterns in Zambia over the last century has rendered the crop sub-sector vulnerable to the impacts of climate change (Mubanga and Umar, 2014; Mubanga and Steyn, 2020). This is because climate change has the potential to cripple food systems by changing the patterns of the growing conditions of crops (Schingabula, 1997). The increase in the unpredictable

distribution of precipitation has contributed to devastating extreme events and shifts in the occurrence of pests and diseases (World Bank Group, 2015). In recent years, Zambia has recorded heat waves particularly in low-lying areas of the country (GRZ-TNC, 2020). As a way of combating crop yield reduction and enhancing the resilience of food systems, measures such as food storage are put in place (Mwitwa, 2018; GRZ-TNC, 2020). Climate-driven changes in weather patterns such as droughts and floods as experienced in Zambia in the 2021/2022 planting season is an example of agriculture vulnerability to climate change especially in terms of crop production because many losses are incurred.

Changes in the prevalence and distribution of climate-driven pests have contributed to the vulnerability of crop production as pathogens take up about ten to sixteen percent (10-16%) of the global harvest. With the increased temperatures recorded in the country over the recent years, climate-driven pest vulnerability is likely to increase because plants are at risk of exposure to these pathogens (GRZ-TNC, 2020). Warmer temperatures are known to increase the metabolic rate and insect breeding cycle population leading to more pests eating away at the crops. Insects that would normally have two breeding cycles a year may increase in the rates of breeding causing a population boom because some species are able to take advantage of changes in living conditions and this in turn renders crops vulnerable to damage and loss in production at harvest time (Porter and Semenov, 2005).

In addition to the common effects of floods as a result of climate change on the environment such as submerged land, the floods also cause water pollution. Flood water, which moves at high speed does not settle long enough to be purified either in a wetland or on the surface soil. This in turn means that the water carries with it a lot of pollutants contained in the soil which is picked up as the water moves (Nath and Banerjee, 2006). Further, the flow of water also eats away at streams and river banks, hence eroding them and carrying a lot of vegetation with it, including crops.

4.1.2 Climate vulnerabilities and risks of the Livestock sub-sector

Over the recent decades, Zambia has been experiencing increasing temperature trends (GRZ-TNC, 2020). Changes in seasons are projected to contribute to longer hot seasons and shorter cold seasons. This will have a direct impact on animal growth and reproduction. During the hot seasons, for example, heat waves are likely to be experienced and cause stress to the animals because they are unable to perform their body metabolism at normal levels. According to Townsend et al. (2013), when this happens, the animals eat less hence, they experience a drop in weight and an inability to be active. Since temperatures like heat in this instance vary between locations, species from different parts of the world are affected differently.

Generally, indigenous livestock species can adapt to gradual changes in the environment. However, when these changes are random and extended over a long period of time it leaves them exposed to extreme conditions and may at times be life-threatening. Studies indicate that the negative effects of hot weather in summer outweigh any positives incurred by warmer winters. Some animals have to alter their breeding and feeding patterns just to survive the adverse effects of climate change they experience. This may affect the quality of offspring produced in the long run.

Climate change also influences the animal production systems including the breeding patterns of parasites and diseases which affect livestock. Instances of diseases such as bovine respiratory diseases are on the rise and this is linked to the change in migratory patterns of these parasites due to changes in temperatures in many regions around the globe (Mwitwa, 2018; GRZ-TNC, 2020). The unpredictable rainfall patterns have led to changes in spatial distributions of diseases which are quite sensitive to moisture. Some of these diseases include; blackleg, haemorrhagic septicaemia, anthrax and vector-borne diseases.

The increasing frequency and intensity of droughts have the potential to reduce the availability of pasture for livestock, leading to starvation and in some cases even death. Dry spells do not only affect land animals but fish as well because there is an increased risk of them becoming extinct due to draining water tables. As rivers dry up, all the toxic chemicals such as pesticides from farms that would otherwise be absorbed by the water become more concentrated, causing the suffocation of river-dwelling fauna. During flooding, animals' food is mostly swept away by the water and lost. Warmer climates also make it easier for invasive plants to thrive and eventually outgrow the main sources of food for wildlife (FAO, 2015).

Climate change has had a direct effect on the characteristics of a land type and the type of pasture that grows in particular areas. The varying changes in heat, rain, humidity and wind caused by climate change have affected the quality, quantity and composition of pastures. Some factors which determine the growth of pasture include; the soil type and condition, slope of the area, tree cover, evaporation and ground cover (World Bank, 2008). With the changes in climate over the years, however, these elements are becoming scarcer leading to a noticeable reduction in the availability of pasture for livestock to feed or graze.

Additionally, the interaction of sunlight, rainfall and temperature has a direct effect on pasture growth. This is so because pasture grows better during warmer periods of the year with the provision of enough moisture. Even though growth is minimal in colder times of the year, there is a quality of protein content in the pasture. With the random changes in climate, however, pasture

lacks the necessary protein even when it grows in colder weather (Mwitwa, 2018; GRZ-TNC, 2020).

Box 1: Impact of climate change – case of agriculture sector

Projected changes in temperature and rainfall directly threaten the overall agricultural crop production system in Zambia. The predicted rainfall across the provinces indicates that mean monthly and total annual rainfall will reduce during the 2050s relative to the baseline (1971-2000) (Syampaku et al., 2019; Hunter et al., 2020; Mubanga and Chisanga, 2020). Future projected rainfall will also vary on an interannual basis as well as spatially within each season (Hunter et al., 2020). Further, this will affect the effective timing of the onset of the rainfall season at the start of the growing season. The average reduction in national rainfall predicted for the start of the rainy season is likely to vary between provinces and AERs (Hunter et al., 2020; Mubanga and Chisanga, 2020). Additionally, this may result in inadequate rainfall to support the effective establishment of crops and pastures during the months of October/November, which is traditionally associated with the start of the growing season. This in turn will result in changes to the timing of various agricultural activities such as field preparation, planting of seed, and weeding etc. The majority of the rainfed agricultural growing season is characterized by monthly rainfall deficits and is likely to result in fundamental changes to choice of crop choices and agricultural practices by the year 2050 (Chisanga et al., 2020b, 2021, 2022a; Hunter et al., 2020).

Researchers (Syampaku et al., 2019; Hunter et al., 2020; Chilambwe et al., 2022) have studied the impacts of climate change on maize, millet, sorghum, beans, cowpeas, groundnuts, soybeans and cassava in each of the Provinces. The study indicates that all provinces are expected to experience negative impacts on beans. However, Northern, Muchinga, North-western, Western, Lusaka and Eastern provinces are likely to be particularly vulnerable. Maize yields will reduce under future climate scenarios due to an increase in temperature and variability in rainfall (Syampaku et al., 2019; Chisanga et al., 2020c, 2022a; Hunter et al., 2020). The impacts of climate change on maize production are estimated to be at least a loss of 252,000 tonnes and a total replacement cost of USD 58 million per year, while the projected impacts for late-maturing maize cultivars are twice as severe (Hunter et al., 2020). Soybean showed less sensitivity to future climate scenarios in Eastern Province (Chilambwe et al., 2022).

The recommended actions by researchers (Chisanga et al., 2020c; Hunter et al., 2020) include additional investments in research and development to identify locally-adapted and drought resilient cultivars to be promoted as alternative crops to vulnerable staples such as maize. Moreover, investment is required in post-harvest processing facilities and marketing. Cassava has been recommended as the likely crop to be an option for climate-resilient farming systems under future climate scenarios, particularly in comparison with annual cereal and legume crops which are poorly adapted to erratic rainfall. Additionally, promoting the adoption of alternative, climate-resilient crops such as sorghum, beans, cowpeas, groundnuts and pigeon peas is inevitable. Research findings by Hunter et al. (2020) show that millet and sorghum will not be impacted as negatively as maize and may be an appropriate option for

further promotion and development as a climate-resilient alternative in combination with other staple cereal and legume crops.

4.1.3 Climate vulnerabilities and risks of the Fisheries Sector

A study on commercial fisheries by GRZ and UNDP (2007), MTENR et al. (2007), UNDP et al. (2014) and Irish-AID (2017) on the effect of climatic indicators on freshwater fisheries and fish farming revealed that lower rainfall reduced nutrient levels in water bodies (lakes, rivers) negatively impacting breeding activities and leading to depletion of fish species in the long-term. Commercial fish like breams and sardines were considered to be vulnerable to drought, especially in AERs I and II (GRZ-TNC, 2020).

The impacts of climate change on fisheries and aquaculture are expected to be both direct and indirect. The direct effects include influencing the physical and physiology of finfish and shellfish stocks in production systems. The indirect effects may occur through altering the primary and secondary productivity, and structure of the ecosystems, input supplies or by affecting product prices, fishmeal, and fish oil costs, and other goods and services needed by fishers and aquaculture producers. The impacts of climate change on fisheries include rising surface temperatures, rising or receding water levels, changes in salinity and water acidification, extinction of some fish species, species range and genetic variability, reduced fish stocks, reduced dissolved oxygen, infestation of fouling, organisms, reduced primary production, pests and aquatic diseases. The impact of climate change on fisheries is expected to worsen in the future due to the increase in temperatures.

Fish reproduction, growth and migration patterns are all affected by temperature, rainfall and hydrology. Poikilothermic animal growth, and reproduction activities are directly influenced by the change of temperature. In addition to the stress that fisheries resources already face due to over fishing, the impacts of climate change on fisheries have worsened the depletion of fish stock in the water bodies of sub-Saharan Africa (Mohammed and Uraguchi, 2013). Further, the impacts of climate change on fisheries are classified into physical and biological changes. Physical changes include rising surface temperature, rising water levels, and changes in salinity and water acidification; while biological changes include changes in primary production and fish stock distribution (Mohammed and Uraguchi, 2013). The impact of climate change on fisheries are expected to worsen an in future due to increase in temperatures.

4.1.4 Transport and Infrastructure Sectors

4.1.4.1 Transport Sector

The aviation industry in Zambia is dominated by private companies that service domestic and regional passenger flights, and most recently a government-owned company, Zambian Airways, has joined the industry. However, according to the Zambia Climate Change Response report (GRZ, 2010), there has been little investment made in the air transport industry and the contribution of water transport is currently negligible.

The transport sector in Zambia, as earlier mentioned, facilitates the growth of various economic activities such as mining, agriculture, forestry, trade, infrastructure development, etc.; and the delivery of social services such as health and education to different parts of the country. According to a report by MTENR (GRZ 2010) 80% of goods and human commute in Zambia is conducted by road transport which relies on infrastructure such as roads, drainages, waterways and bridges that have been reported to be highly susceptible to damage during extreme climate events (ZVAC, 2010). Thus, the over-dependence on road transport in the transport sector in Zambia increases the sector's vulnerability to climate change; ultimately increasing the risk of other sectors being impacted by climate change.

4.1.4.2 Infrastructure Sector

Infrastructure is vulnerable to extreme weather events and shocks associated with climate change, particularly when it is old and outdated (GRZ & IUCN, 2018). This is because climatic elements such as temperature and rainfall compromise the structural integrity of such infrastructure, leading to deterioration and eventual total collapse. In recent years, infrastructure in Zambia has suffered the onslaught of both high rainfall and extreme temperatures due to climate change. This has resulted in disruptions in the provision of various services including the provision of water, transportation, electricity, and the general movement of goods and services (GRZ-TNC, 2020). While the threat to infrastructure resulting from climate change impacts is eminent, few studies, if at all have been conducted on climate-resilient and sustainable infrastructure in Zambia. This calls for further research on the subject matter.

4.1.5 Energy Sector

Zambia's energy sector is crucial for the socio-economic development of the country as it enables the operation of manufacturing, mining, construction, commerce, as well as small and medium enterprises to run (GRZ, 2019). Zambia is endowed with various energy sources; among them wood fuel, hydropower, coal and solar (ERB, 2020). With the country housing abundant

fresh water in Southern Africa (MLNREP, 2014), hydroelectric power consumption in the country's energy mix stands at 82.76 percent, with other power sources contributing the following: coal, 10.35 percent; HFO, 3.80 percent; diesel, 3.06 percent; and solar, 0.04 percent (ERB, 2018; Sikaundi and Phiri, 2020).

Zambia's over-reliance on climate-sensitive hydroelectric power has resulted in the sectors vulnerability to climate change. In the 2014/2015 rainy season, the country experienced a drought that resulted in low power generation from its hydroelectric power plants (ERB, 2016, 2018; Sikaundi and Phiri, 2020). This resulted in an increase in the power deficit from 560 MW in April 2015 to 1,000 MW in December 2015. This prompted the Zambian government to seriously consider coal power plants for the generation of electricity. In 2016, the 300 MW Maamba Coal Power Plant was commissioned, as well as the 120 MW Itezhi-Tezhi hydropower plant (ERB, 2016). Together, these helped reduce the power deficit to 520 MW and this reduction was partially attributed to the good rains experienced in the 2016/2017 rainy season. Despite the increase in rain received in the 2016/2017 rainy season, the country's energy sector is still cognizant of its vulnerability to climate change and this vulnerability is worsened by the increasing demand for energy. Therefore, the country's agency to develop alternative sources of energy is still present. In 2020, Dangote Cement (after being granted all necessary approvals) commissioned and successfully integrated the Dangote Cement Zambia Coal-fired thermal power plant into the national grid. This increased the electricity supply from 2,981.31 MW in 2019 to 3, 011.23 MW in 2020, leaving a deficit of 810 MW (ERB, 2020).

The second NC sheds more light on the vulnerability of the energy sector to climate change. The NC revealed the influence of rainfall fluctuations on run-off, reservoir storage capacity and hydropower potential on the Zambezi River. The run-offs of Kariba sub-catchment were observed to have been responsive to rainfall fluctuations. Droughts had a devastating effect on the hydropower generation in Zambia with a significant economic reduction in the power potential as a result. The report also mentions that projected dry years and very wet years are likely to cause a reduction of power generation either by low runoffs or the destruction of infrastructures to generate electricity (MLNREP, 2014).

4.1.6 Water Sector

Zambia is a landlocked country with diverse ecosystems that make up its water sector. Almost all of Zambia's territory sits within transboundary river basins, the Zambezi and Congo River Basins each covering approximately 75% and

25%, respectively, of Zambia's territorial area.[1] Zambia's diverse ecosystems comprising regions prone to drought, and others to floods, or both, make it vulnerable to the impact of climate change (GRZ & IUCN, 2018). In Zambia, it is projected that temperature will increase up to 2.3 degrees by 2100; and rainfall reduce by 3% in 2050 and a further 0.6% by 2100 (GRZ-TNC, 2020). The temperature and rainfall changes are estimated to reduce water availability by about 13 % by 2100. In fact, Zambia has already recorded water scarcity and reduced water levels in streams and rivers due to its location downstream of shared watersheds, exacerbated by climate change (GRZ & IUCN, 2018). The link between climate change and water security has been emphasized by the World Bank Group, which estimated that water scarcity will rise to 2.8 billion people by 2025 (Rodriguez et al., 2013; World Bank Group, 2015, 2019).

It is important to note that Zambia's water cycle is shifting as a result of climate change. Rainfall intensity is expected to increase with longer dry periods between storms, particularly for semi-arid regions (GRZ & IUCN, 2018). Increased water shortages resulting from rainfall and temperature variation will impact socio-economic development and livelihoods in sub-Saharan Africa, particularly in Zambia where there is inadequate infrastructure to protect the country against climate change (MTENR, 2010). This situation is likely to worsen because of increased demand for portable water-borne out of the need to cope with temperature rise. The resulting effect will be over-exploitation of wetlands, and reduced water flow in rivers and streams, which has the potential to harm ecosystems and surrounding communities (GRZ & IUCN, 2018).

Some of the observed impacts of climate change in Zambia include the shrinking of flood plains and wetlands, the silting of dams, and reduced water levels in major rivers. For example, reduced water levels for hydropower generation have resulted in load shedding of up to 8 hours a day (GRZ-TNC, 2020). This has had grave consequences on other sectors of the economy including agriculture which is the largest consumer of water in Zambia, at 75 % of total water use (GRZ & IUCN, 2018). Climate change impacts may worsen the plight of 50-70 % of Zambians who live in peri-urban areas, where water supply and sanitation services are poor, inadequate, and unreliable. Statistics show that at least 56 % of the population do not have access to a safe water supply, and 90 % do not have access to satisfactory sanitation facilities (GRZ & IUCN, 2018). Lack of access to sanitation facilities and improved drinking water exacerbates the spread of water-borne diseases including diarrhea, cholera, and dysentery. Further, poor sanitation has had negative impacts on girls to miss school on a regular basis, hindering their education compared to their male counterparts (GRZ & IUCN, 2018). Climate-induced water shortage

[1] https://unece.org/media/news/367981#:~:text=Almost%20all%20of%20Zambia's%20territory,respectively%2C%20of%20Zambia's%20territorial%20area

can make it difficult for girls to manage their menstrual hygiene which in turn also affects either school attendance and/or their self-esteem. At home, the girls will have to walk longer distances to fetch water increasing their risk of sexual violence and abuse but also taking away time to focus on school work. Climate-induced water shortage can make it difficult for girls to manage their menstrual hygiene which in turn also affects either school attendance and/or their self-esteem. At home, the girls will have to walk longer distances to fetch water increasing their risk of sexual violence and abuse but also taking away time to focus on school work.

4.1.7 Tourism and Wildlife Sectors

4.1.7.1 Tourism Sector

The tourism sector, which is key to employment creation, foreign exchange generation, and economic growth in Zambia, is vulnerable to climate change. The vulnerability of the tourism sector in Zambia to climate change is linked to two factors namely; dependence on weather and climatic factors, and reliance on natural resource assets (MTENR, 2010; Nhamo and Dube, 2018; Dube and Nhamo, 2019). Zambia's key tourist attractions including wildlife and the Mosi-oa-Tunya/Victoria Falls, which are both natural endowments, are sensitive to weather and climatic factors including rainfall and temperature (GRZ-TNC, 2020).

Research evidence suggests that changes in temperature observed in the Zambezi River Basin pose a threat to wildlife including fish stocks, affecting spot fishing on Lake Kariba (Kupika et al., 2016; Dube and Nhamo, 2019). Furthermore, high temperatures experienced during drought years have resulted in the deterioration of vegetation and increased heat stress, which have negatively impacted on wildlife health and productivity (Nhamo and Dube, 2018; Dube and Nhamo, 2019). Conversely, it can be argued that high rainfall, which is a characteristic of climate change, may present both vulnerabilities and opportunities for tourism. However, there is little information on climate change vulnerabilities of tourism in high rainfall areas in Zambia.

According to Lépy et al. (2014), tourism destinations that rely on natural resource assets such as biodiversity, landscapes and ecosystems, including forests, rivers, waterfalls, and wildlife are more prone to the adverse effects of climate change. In this vein, the Zambian tourism sector's endowment with vast nature reserves, wildlife and numerous waterfall and other unique natural features exposes it to the risks of climate change (Cattaneo, 2007).

The negative effects of climate change on tourism are projected to be significant by the year 2050 and cause economic disruptions worldwide (Mushawemhuka et al., 2018). Tourism is a growing sector with immense potential to compliment other sectors such as mining and agriculture that have predominantly contributed to Zambia's economy (Cattaneo, 2007; GRZ &

IUCN, 2018). The fluctuations in the prices of copper, which is the country's main mineral export, have forced Zambia to diversify its economy from mining to agriculture and tourism (GRZ & IUCN, 2018). In the framework of economic diversification, tourism has the potential to generate employment, earn foreign exchange, contribute to government revenues, promote rural development, and stimulate the local economies of tourism centres (GRZ-Government of Republic of Zambia, 1999, 2015; MFED, 2015). It is for this reason that in 1996 the GRZ reclassified tourism from a social sector to an economic sector.

The reclassification of tourism as an economic sector is reiterated in the vision of the Tourism Master Plan stated as "to develop a high quality, diversified and sustainable tourism industry that will make a major contribution to the economic and social wellbeing of Zambians" (GRZ-TNC, 2020). Its contribution to the economy has steadily risen from 2% of GDP in 2001 to 7.3% in 2019 (PMRC, 2013).

With regard to employment creation, the contribution of the tourism sector increased from 11,000 jobs in 2001, to 469,000 jobs (7.2% of total employment) in 2019 representing a 44% rise (PMRC, 2013). Furthermore, international visitors spent USD 849 million or 10% of Zambia's total exports.

There is a paradox with regard to the link between tourism and climate change, recognized by the UN and other agencies for decades (UNFCCC, 2007). On one hand, tourism depends on stable climatic conditions: tourists want to enjoy lovely local weather, and see sites in their natural settings. On the other hand, the actions of tourists and the tourism sector, such as construction, transportation, and the provision of energy intensive amenities like air-conditioning, are major contributors to climate change (GRZ & IUCN, 2018).

It is important to strike a balance between expanding the tourism sector for socio-economic gain, and preserving the environment for future generations. To achieve the balance between socio-economic gain and environmental sustainability requires knowledge about the adaptive capacity of the tourism sector to climate change. However, there is little information regarding the adaptive capacity of Zambia's tourism sector, signaling the need for further studies.

4.1.7.2 Wildlife Sector

Wildlife is among the key nature-based sectors in Zambia that is vulnerable to climate change. The vulnerability of the wildlife sector to climate change, as is the case with tourism, is linked to two factors namely; dependence on weather and climatic factors, and reliance on natural resource assets (MTENR, 2010; Nhamo and Dube, 2018; Dube and Nhamo, 2019). Zambia's wildlife estate is vast consisting of 20 National Parks and 36 Game Management Areas (GMAs)

which cover 236, 376 square kilometres, equivalent to 31.4% of the country's national territory (GRZ-Government of Republic of Zambia, 2015). In addition, Zambia boasts of 2 bird sanctuaries and 2 wildlife sanctuaries (GRZ-TNC, 2020). This vast wildlife estate comprises about 224 species of mammals 757 species of birds, 74 species of amphibians and over 490 fish species (GRZ-TNC, 2020).

Wildlife growth and survival is threatened by climate change impacts that result from changes in temperature and rainfall. For example, changes in temperature observed in the Zambezi River Basin posed a threat to wildlife (Dube and Nhamo, 2019; Chisanga et al., 2022b). This is because changes in rainfall and temperature had an influence on soil moisture content and the productivity of the grasslands upon which wildlife thrives (GRZ-TNC, 2020). However, there have been few studies on climate change impacts on wildlife in Zambia. Available work mainly focuses on the potential impacts of climate change. For example, documented studies only provide predictions on the impacts of climate change such as the reduction of fodder productivity due to droughts, affecting wildlife diversity, distorting predator-prey interactions, separating animals from food sources, and reducing habitat span (MTENR, 2010; Hamududu and Ngoma, 2020).

4.1.8 Health Sector

The health sector is climate sensitive, and therefore, vulnerable to the impacts of climate change. The vulnerability of the health sector to climate change results from changes and variability of climatic factors namely, temperature and rainfall (Kalantary, 2010). In recent years, Zambia has recorded an increase in both mean daily temperature and mean annual temperature. The mean annual temperature has increased by 1.3°C since 1960 (USAID, 2012; Irish-Aid, 2017). Temperature in Zambia is projected to increase by 1.9°C in 2050 and by 2.3°C in 2100 (Hamududu and Ngoma, 2020). The outbreak, prevalence and spread of disease are influenced by changes in temperature and variability in rainfall.

Climate change has affected the rainfall pattern in Zambia such that the country has experienced both droughts and floods, which have implications for the health sector. The health sector has been negatively affected by the occurrence of droughts and floods (GRZ-TNC, 2020). Costs to the health sector increase during droughts and floods because of outbreaks of diseases such as cholera, dysentery, and typhoid; vector-borne diseases including malaria; respiratory diseases such as asthma, and pneumonia; and migratory vector-diseases (Kasali, 2008; GRZ-TNC, 2020).

In Zambia, research has shown that vector-borne diseases such as malaria are more prevalent in areas with high rainfall, high humidity and high temperature (NAPA, 2007; Ngarakana-Gwasira et al., 2016). Research has shown that

disease transmission rates are generally low during the cold season, suggesting that temperature is a major limiting abiotic factor (NAPA, 2007). In Zambia, extreme weather events, particularly heavy rainfall and rising temperatures, facilitate the breeding of malaria spreading mosquitoes. For example, studies have shown that malaria and cholera incidences increased with high rainfall received, thereby implying that rainfall is another influencing factor (NAPA, 2007; Riché, 2007). Climate change has increased the geographic coverage and survival of mosquito populations thereby increasing the vulnerability of Zambians who previously may not have been exposed to Malaria (USAID, 2012; Ngarakana-Gwasira et al., 2016).

The influence of rainfall on incidences of disease is evident in Lusaka where outbreaks of cholera and other diarrheal diseases are common. High rainfall events, compounded by such factors as; poor drainage systems, contaminated water, unsecured pit latrines, and lack of access to potable water increased outbreaks of cholera and other diarrheal diseases (USAID, 2012). The vulnerability to climate risks is estimated to be high for water, and vector-borne diseases currently, with projections showing high severity in future (GRZ-TNC, 2020). Respiratory diseases revealed a moderate vulnerability to climate risks both in the present and for future projections. In Zambia, pregnant women are among the most susceptible to the rise in diseases such as malaria which affects about four million Zambians annually.[2] "Under-five-year-old children and pregnant women are the most vulnerable, especially those in more remote and impoverished areas, with 35-50% of under-five mortality and 20% of maternal mortality attributable to malaria" (GRZ & IUCN, 2018). This shows the threat to maternal and newborn health and the cases of vector-borne diseases expected to increase owing to climate impacts in East and Southern Africa (Trisos et al., 2022) which is also a major concern for Zambia's health sector. Zambia's Gender Action Plan highlights that pregnant women are among the demographic most at risk from the escalation of diseases like malaria, which affects around four million Zambians annually. Particularly vulnerable are children under the age of five and expectant mothers, especially those residing in remote and disadvantaged regions. Studies indicate that 35-50% of deaths in children under five and 20% of maternal deaths resulting from malaria are attributed to this condition (GRZ & IUCN, 2018). These statistics underscore the threat posed to both maternal and newborn well-being given that vector-borne diseases are projected to surge due to climate-related impacts in East and Southern Africa (Trisos et al., 2022).

The indirect impacts of climate change through droughts and floods on the health sector relate to the disruption that they cause on food production, water security, sexual and reproductive health services and energy sources. Energy sources for cooking and lighting have been shown to impact adversely on human health, particularly on the respiratory system (MOH, 2017). This

2 Climate Change Gender Action Plan of Zambia of 2018

problem is particularly rampant in Zambia where the urban population, depend on fuel wood and charcoal as energy sources for cooking (Kabisa et al., 2019). This indicates that a large proportion of the population, regardless of their geographical location, rely on hazardous sources of cooking energy that have huge potential to compromise their respiratory health (MOH, 2017).

Droughts and floods compromise the quality of water, sanitation, and hygiene (Mwitwa, 2018). This raises health concerns and increases women's vulnerability to risks of attack as they look for water, compromised menstrual hygiene, physical stress, and loss of time in other productive areas (GRZ & IUCN, 2018). Droughts and floods influence food production and other sources of livelihood, particularly those dependent on rain-fed agriculture which employs a significant proportion of the workforce in Zambia (GRZ & IUCN, 2018). The increased frequency and intensity of droughts and floods leads to poor crop yields, compromising food security and exacerbating poverty among the rural and peri-urban populations. Food insecurity is associated with poor nutrition, especially among children.

Climate change vulnerabilities are increased by non-climatic stresses including inadequate healthcare facilities and providers, high poverty levels, poor water supply and sanitation, food insecurity, and poor nutrition (USAID, 2012). The risk of water and vector-borne diseases is more pronounced in AERs I and II which are most vulnerable to climate change (NAPA, 2007; GRZ-TNC, 2020). However, there is data on climate change vulnerabilities of the health sector in Central, Southern, Eastern, Lusaka and Western provinces. Moreover, data is lacking for Copperbelt, Luapula, Muchinga, Northern, and North Western provinces and this warrants the need for additional studies.

4.1.9 Forest Sector

Forests in Zambia cover approximately 66%, or about 50 million hectares of the country's total land mass (GRZ & IUCN, 2018). Forests are vulnerable to the impacts of climate change because their growth, composition and regeneration capacity are influenced by natural and human factors. Natural factors relate to weather and climatic factors, while human factors refer to activities humans engage in for their livelihood. With regard to forest vulnerability to climate change due to natural factors, temperature rises and rainfall variability are implicated. Changing weather patterns such as frequent drought events and temperature rises destroy forests as they lead to increased forest fire incidences.

The frequency and severity of forest fires are expected to increase in tropical regions, including in Zambia, which are projected to experience warmer weather conditions arising from increasing surface air temperature (Moore and Allard, 2008). Forest characteristics including tree-growth, yield and quality of

wood and non-wood products are altered by high rainfall patterns and temperature rises induced by climate change. This is because variability in temperature and rainfall is likely to extend the range of pests and pathogens, important to the balance of forest characteristics and ecosystems (Moore and Allard, 2008).

The vulnerability of forests to climate change arising from human factors relates to the activities community members engage in to earn a living. It is important to note that the impacts of climate change disrupt key sectors of the economy including agriculture, tourism, water sector and health. Therefore, communities respond to the disruption of these sectors by seeking forest and non-forest products for survival. Forest resources are vital because, in addition to the ecosystem services they provide, forests supply products of economic value including; timber, fuel wood, food, medicines and other non-timber forest products (GRZ & IUCN, 2018).

Activities such as agriculture, construction, and charcoal production, particularly in rural communities to meet urban energy demands, all contribute to deforestation and forest degradation (Moore and Allard, 2008; GRZ & IUCN, 2018). In Zambia, the annual rate of deforestation is estimated at 172,000 ha of forest, which is approximately 0.50-0.60% of total forest cover (Kabisa et al., 2019; Ngoma et al., 2021). Furthermore, deforestation rates vary between provinces with the most deforested regions being Luapula, Eastern, and Copperbelt with rates of 2.47%, .85% and .84%, respectively (GRZ & IUCN, 2018). It is important to note that deforestation and forest degradation are associated with periods of socio-economic development, as well as periods of economic decline.

Forests are essential to the achievement of a low carbon green economy and sustainable development (GRZ-TNC, 2020). However, Forest degradation and deforestation also have serious ramifications with regard to reduced biodiversity and the ability to deliver important forest goods and services. Continued exploitation of forests amid declining forest resources by communities striving for survival will result in desertification, wildlife habitat destruction, poor watershed function, and general land degradation (MTENR, 2010; Kabisa et al., 2019). Further, deforestation and destruction of forests are key drivers of climate change as they are major anthropogenic sources of GHG (GRZ & IUCN, 2018).

4.1.10 Mining Sector

Zambia's social and economic backbone has always been its mining industry. The country is endowed with mineral resources that include among others uranium, silver, cobalt, copper, coal, lead, zinc, precious stones, and gold; with copper mining being the most dominant (MNDP, 2017). Income derived from

export of these mining products, their sales and taxes generated by the sector are an integral part of Zambia's economy, making up 26% of the national GDP and employing approximately 82,725 persons as of 2015 (GRZ-TNC, 2020). Mining companies operating in Zambia are; Barrick Gold Corporations, First Quantum Minerals Ltd, and Glencore Plc (Glencore Xstrata Plc) among others. These operate large scale mines that are the major contributors to GDP. There are also small scale and artisan miners in different parts of the country.

The two most common forms of mining in Zambia are open pit mining and underground mining. Even though climate change does not change the existence of mineral resources, the mining sector has not been spared by the effects of the phenomena. Extreme climate events such as floods can adversely impact mining operations. An example of such an event in Zambia is from 2005 at the Nkandabwe Coal Mines in Sinazongwe, where floods caused water clogging of the mines and disrupted mining activity, forcing the mine to shut down for four (4) months (ERB, 2006). Apart from the actual mining pits, impacts of extreme climate events on mining can include the following scenarios: flooding of tailings storage facilities (TSFs) containing acidic tailings can potentially overflow into the nearby environment causing local environmental degradation such as bleaching; extended periods of drought can cause challenges of dust suppression; droughts in some case causes a reduction in available water needed in mineral processing; droughts cause a reduction in power supply generated from hydroelectric power (HEP) that is distributed to the mines; mining firms that rely on marine transport for shipping of their raw materials, purchasing spare parts when an asset or piece of equipment breaks down tend to lose times as extreme climate events can make it more challenging for mining firms to obtain these items; mining firms can resort to unclean power alternatives that could potentially result in them ruining their reputation in an effort to mitigate against the impacts (e.g. a mining firm might resort to constructing a coal power plant, which is not clean energy, to mitigate against the erratic supply of HEP) (MTENR, 2010).

The negative impacts of climate change on the mining sector that have been highlighted have ripple effects on mineral production (i.e., they increase costs and slow down productivity) and ultimately reduce the sector's contribution to the economy (GRZ-TNC, 2020). For instance, the 2014/2015 season influence of rainfall fluctuations on run-off, reservoir storage capacity and hydropower potential on the Zambezi River led to a drop in power generation. Many mine companies had to suffer extra costs to keep their operations running through energy alternatives such as diesel generators (MLNREP, 2014). Despite the apparent negative effects of climate change on the mining sector, a potential positive impact of climate change on Zambia was highlighted in the National Climate Change Response Strategy (NCCRS). It is anticipated that as more countries make efforts to mitigate climate change by reducing GHG emissions in the mining industry, they may relocate to Zambia where the power generated for use in the mines in clean (i.e., HEP) (MTENR, 2010).

To effectively respond to the adverse impacts of climate change in Zambia and to achieve the overall objective of the UNFCCC, the NCCRS was developed (MTENR, 2010). The mission of the NCCRS is "to ensure that the most vulnerable sectors of the economy are climate proofed, and sustainable development achieved through the promotion of low carbon development pathways." To achieve its mission, the NCCRS ensure that the climate risks of the most sensitive economic sectors are addressed in the national development plans in order to minimize the impacts of climate change and to ensure effective development (MTENR, 2010). According to MTENR (2010), the objective of the NCCRS for the mining sector is to develop a less carbon-intensive and climate change-resilient mining industry through the pillars of the strategy which are: climate change adaptation and disaster risk reduction; mitigation and low carbon development; cross-cutting issues (i.e., gender and HIV/AIDS, climate change communication, education and awareness, capacity building, technology development and transfer, research and development); Governance of climate change; and finance and investment framework.

4.1.11 Social dimensions of vulnerabilities

Just as much as sectors and particular geographical regions in the country are at risk from climate change, so too are individuals and social groups. Table 4 details social groups recognized as vulnerable to climate change impacts/risks in view of their social conditions. Zambia has a relatively high incidence of poverty, which is projected to continue into the future. Levels of poverty are highest in the predominantly rural provinces of Luapula and Western compared to the more urbanised provinces such as Lusaka and Copperbelt (ZAMSTAT, 2022). The rural communities are more dependent on the climate-sensitive sectors such as small-scale agriculture, harvesting forest products, and use of wildlife and other natural resources for their livelihoods.

Women and other marginalized groups are often disproportionately affected by climate change challenges (UNFCC, 2022). The agriculture sector is the main livelihood source for 60 percent of households in Zambia, with women providing 70 percent of agricultural labour (CIAT-World Bank, 2017) Thus women are vulnerable to climate change as they engage in the climate-sensitive sector and their vulnerabilities are reflected in the structural inequalities and marginalization that are rooted in societal social structures, such as gender, age, and low income. Women's vulnerability includes poverty, limited access to assets; low levels of education, poor access to information and discriminatory social-cultural norms. Women are relatively poorer than men (ZAMSTAT, 2022) and female-headed households are considered to be more vulnerable (Ngoma et al., 2022) to climate shocks.

Nevertheless, women and girls are not only victims of climate change but also active and effective agents of climate action as they have important knowledge and capacities that can be harnessed for climate adaptation. Therefore, the gender differences in vulnerabilities between men and women are due to their differences in their gender roles and responsibilities, their participation in decision making, access to land and natural resources, opportunities and needs, which are influenced by norms. Climate change is also impacting Zambian adolescent girls' views and lived experience about their lives and futures (Mazingi and Muyumbwa, 2021).

The impacts of climate change also put children at risk; more so those with underlying social vulnerabilities. Children under 18 years suffer from at least three deprivations or more which include lacking access to nutrition, education, health, water, sanitation, and adequate housing among others. On the other hand, older persons (65 years+) have the highest poverty rates (ZAMSTAT, 2022) and their vulnerabilities include isolation from the community, isolation from information, lack of family support and the burden of orphans. Without adequate resources, poor grandparent headed households are becoming more and more challenged in the provision of food, health care and decent accommodation for themselves and their dependents.

Persons with disabilities are also another category of vulnerable social groups and disability in the country is more prevalent in urban areas for both males and females (MCDSS, 2018). The majority of Zambians with disabilities live in poverty compared to persons without disabilities and often have to resort to street begging as a means of survival (International Labour Organisation, 2013). Low literacy levels and limited access to information limit the understanding of and preparedness for climate risk. Vulnerability to risk is also gendered. Women and girls with disabilities are at greater risk of violence, physical abuse, and sexual exploitation after disasters. Persistent gender disparities in labour force participation leave women with less financial independence and connectedness to power than men.

Farming is the most widespread occupation among Zambia's chronically poor and it is highly vulnerable to climatic shocks (Dumenu and Tiamgne, 2020). In the past 30 years, extreme weather events have increased and intensified for instance, the drought/dry spells/flood events of the 1991/1992, 2015/2016, 2017/2018 and most recently the 2021/2022 seasons left many smallholder farmers facing significant hardships (Makondo et al., 2014). Female farmers are particularly hard hit while rural farmers lack communication assets such as TV radio and cell phones which in turn limits their access to climate information. Similarly, education levels are low among farmers and female-headed households are more vulnerable and less resilient.

People living with HIV/AIDS have also been identified as a social group vulnerable to climate risks. The prevalence of HIV/AIDS is higher in the urban areas compared to the rural areas while higher among women than men. Generally, people with the least resources are affected most by climate change as poverty tends to drive risky behaviour. Food security, availability of clean water and access to health services is critical to those who are immune-compromised without which individuals are vulnerable to serious infections and/or death.

Table 4. Summary of social groups' vulnerabilities

Social group	Indicators of vulnerability	Climate vulnerabilities of social groups
The poor • Overall poor • Extremely poor-urban areas • Extremely poor-rural areas	• Overall poverty~ 54.4 per cent of national population • Extreme poverty ~40.8 percent of national population • Rural poverty 76.6percent; Urban poverty 23.4 percent	• Income losses from failed agriculture production exacerbates food insecurity deepens poverty for the poor; • Low to medium vulnerability to respiratory diseases (Pneumonia & Asthma) from overcrowding during floods; • High vulnerability to vector borne diseases (malaria) • High vulnerability diarrhoeal diseases from lack of water and poor hand hygiene in rural areas and unplanned urban settlements; • High under-nutrition from limited nourishment in times of floods and drought;
Women and girls •Female heads of households •Rural women	• ~ 50.5% of the national population are females**;** • ~56.7 percent of FHH female heads were poor of MHH, 53.8 percent were poor • 0f total national school going age who left school 5.3 percent females left to get married compared to only 0.5 percent for males	• Inadequate capacity to seek and use information to respond to climate risk; • Limited access to extension services to help understand crop failure thus unable to adapt effectively; • Limited access to information and opportunities to better health, nutrition and education for families; • Reduced attendance/permanent end of school for young girls and adolescents; • Reduced time for learning and academic achievement; • Limited choices available for future potential for human development and/or climate resilience • Greater risk of physical and sexual violence against women and girls; • Child marriages to reduce financial burden of caring for girls.
Orphaned and vulnerable children and other vulnerable children • Orphaned children; • Child headed household; • Children living outside of family care • Street children; Child headed households	• 53.4 percent of population under the age of 18 years; • 59.4 per cent of children live in poor households; 45.4 per cent living in extreme poverty; • 10.2 per cent of children have lost one or both parents • ~0.3 percent of population are children HH	• Inadequate food intake and malnutrition, • Poor access to clean water, exacerbated during times of drought and floods • Cover long distance to access water • School drop outs, child marriages and livelihood perspectives • Limited knowledge of climate information among children
Elderly persons (65yrs+) • Elderly persons living alone • Households headed by elderly persons	~ 2.1% of the population in 2020 Poorest by age groups category	• Vulnerability to malnutrition and disease infection in times of (drought and floods) • Deteriorating health conditions in times of extreme/high temperatures • Physical weakness makes older people particularly vulnerable to disease, extreme weather and decreasing livelihood options. Climate change will bring on increased disease burden. Food and water shortages are likely to exacerbate old people's precarious nutritional and health status
Persons with disabilities • Male and female	• ~ 7.7 percent of population • ~7.2 percent of rural area population; 8.5 percent in urban areas • ~ 20.2 percent d & 19.7 percent of	• At increased risk due to heightened vulnerability • Less able to escape from hazards in view of difficulty in moving, hearing, seeing, communicating or learning; • Difficulty accessing basic needs, including food, water, shelter, latrines

	females disabled population use assistive device;	and health care services; ● Experience more difficult time securing additional resources or recovering from the loss; ● Long term consequences of emotional distress and trauma
Smallholder/subsistence farmers ● Rural Female headed households ● Rural male headed households	● ~ 58.7 percent of employed persons in Agriculture; ● ~ 63.2 percent of employed persons in Agriculture are female ● ~ 86.4 percent of persons employed in agriculture are in rural areas ● 88.7 percent of rural persons employed persons in Agriculture are females ● ~ 80.3 percent of HH engaged in agriculture are smallholders	● The larger the household size, the higher the level of vulnerability; ● farmers with lower literacy levels tend to have limited employable skills in non-climate-sensitive sectors which increases vulnerability; ● Households with low-income levels unable to secure their livelihood in times of climatic shock. ● Prime dependence on farming for household income compromises their livelihood security particularly in times of low crop production ● Single source of income limits option; failure to secure ● needs and to minimize the resultant impacts of adverse events; ● Limited access to climate change information leading to deeper vulnerability to changes
People living with HIV/AIDS • Adults- Male and female ● Children-male and female	● ~ 11.1% of adults age 15-49 HIV positive; ● HIV prevalence: ○ highest -Copperbelt (15.4%) & Lusaka (15.1%); ○ lowest-Muchinga (5.4%)	● Adult deaths among the infected have been shown to correlate with reduced agricultural productivity. ● Higher proportion of household income is directed towards meeting the cost health care leaving ● Families less able to cope.

Sources: Adapted with permission from (Riché, 2007; Thurlow et al., 2009; MOH, 2015, 2017, 2019; MCDSS, 2018; Ngoma et al., 2021, 2022)

5.0 ADAPTATION ACTIONS TO CLIMATE HAZARDS

Droughts, floods, high temperatures and winds were identified as the main hazards affecting the sectors, geographical regions and social groups. In assessing the vulnerability of sectors and geographical regions as well as the adaptation actions, five (5) vulnerability elements were considered, namely environmental, social, human, financial, physical and institutional vulnerabilities. The tables in the sections below for each hazard are in two parts. The first part focuses on vulnerability (Exposure to Hazards, Sensitivity, Adaptive capacity, and Climate Risk level). The second focuses on adaptation actions and target groups to respond to vulnerability and affected areas (Sectors, Provinces and AERs).

5.1 Adaptation actions to droughts

Droughts are a major climate hazard that exacerbates vulnerabilities among different groups and societies in Zambia (Table 5). Drought as used under this section refers to seasonal droughts, intraseasonal droughts and dry spells. With over 60% of the Zambian population dependent on farming for their livelihood, droughts are a major climatic vulnerability that impacts nearly all sectors of the Zambian economy. The assessment involved a description of how droughts have made these elements vulnerable, the variants of the elements exposed to hazards, the adaptive capacity of the communities which are susceptible to these vulnerabilities as well as the ranking of the climate risk which droughts pose on the identified vulnerability elements. Further, adaptation actions for managing the vulnerabilities as a result of droughts were identified while the susceptible regions in Zambia to these vulnerabilities were also identified.

Table 5. Vulnerabilities and adaptation actions to droughts (periodic and seasonal, dry spells, intra-seasonal drought [Onset and cessation])

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Environmental	Loss of the natural resource base (land, ecosystems, pasture, water sources, forests) due to droughts	High – Regeneration of miombo woodlands takes very long once degraded, water resources easily dry up in drought-prone areas, and pastures dry up in drought periods Increased desertification	High – The natural resource's ability to regenerate and bounce back from a perturbation is high	Low	High	• Sustainable forestry management • Rangeland management • Assisted natural regeneration • Water catchment protection and conservation • Tree planting to increase tree cover • Reduce deforestation and forest degradation • Creation of awareness on the importance of forest conservation • Promote utilization of alternative non-wood fuel sources of energy • Promote agroforestry • Promotion of the use of locally adapted livestock (indigenous) strains/breeds • Promotion of the consumption of livestock and livestock products from locally adapted livestock strains/breeds	Natural Resource Managers and communities	Agriculture Livestock Fisheries Wildlife Forestry Water	All Provinces	All AERs
	Declining fish stock in natural water bodies due to droughts	Medium – Drying up of water bodies due to droughts could reduce fish stock	Medium- Most of the fish is in perennial water bodies which do not dry as a result of droughts	Medium	Medium	• Water catchment protection and conservation • Protection and restoration of critical habitats (Fish breeding areas) • Sensitize communities towards sustainable fish farming practices • Rehabilitate aquatic environments around river mouths	Water Resource managers, Water users associations	Water Fisheries	Southern, Western, Central, Luapula, Northern, Lusaka	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased fish diseases and outbreaks	Low – Quality of water reduces due to droughts which makes fish susceptible to disease outbreaks e.g. epizootic ulcerative syndrome	Medium - Most of the fish is in perennial water bodies which do not dry as a result of droughts	Medium	Medium	• Water catchment protection and conservation • Control the spread of fish disease to other natural water bodies • Strengthen aquaculture regulations	Fishing Communities, Water management agencies, Fishery Resource Managers	Fisheries Water	Southern, Western, Eastern	AER I & II
	Reduced water availability for wildlife due to droughts	High – Game areas that do not have perennial rivers are highly susceptible to reduced water from droughts	High – Existence of water stress zones in national parks	High	High	• Provision of water points in water-stressed national parks and GMAs (weirs, dams, reservoirs) • Promote artificial groundwater recharge	Wildlife managers, Community Resource Boards (CRBs)	Wildlife, Water	Southern, Western, Eastern, Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased mortality of wildlife due to droughts	High – Animals become susceptible to drought induced stress due to reduced water points and food	Medium	Medium	Medium	• Establish a mechanism for surveillance of the well-being of wildlife • Restock depleted national parks • Improve planning and management of wildlife estates • Supplementary feeding and water provision for wildlife • Creating community wildlife ranches and reserves as an additional conservation effort for the conservation of endangered species as well as biodiversity enhancement. • Establish community game ranches/ community parks for the conservation of wildlife species • Strengthen the operational capacity of Community Resource Boards (CRB) including knowledge of climate	Wildlife managers, Community Resource Boards (CRBs)	Forest, Wildlife and Tourism	Southern, Western, Eastern, Central	AER I & II
	Increased wildlife habitat loss due to increased incidences of fire	Medium – Droughts and high temperatures exacerbate incidences of forest fires	Medium – The country is a combination of miombo and savannah rangelands. While much of the miombo habitat is resilient, the grasslands are less so	Low	Medium	• Develop and implement fire management plans for national parks and game management areas • Promote the development and implementation of forest fire management (plans) in PFAs and open forests	Wildlife managers, Community Resource Boards (CRBs) Community Forest Management Groups (CFMGs)	Forestry Wildlife	Southern, Western, Eastern, Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Reduced stream flow due to droughts	High – Hydrological droughts and dry spells which commonly occur contribute to reduced stream flow	Low – Human environmental degradation reduces the capacity for stream flow	High in AER I, II and low in AER III	High	• Strengthen compliance with environmental water flows • Monitoring and management of water resources • Water catchment protection and conservation	Water Resource managers Water users associations	Water	Southern, Western, Central, Luapula, Northern, Lusaka	AER A. II & III
	Increased forest loss/tree mortality due to droughts	Medium - The local forests are largely miombo woodlands which are quite resilient to droughts	Medium – Local forests are not adapted to long-term water stress as a result of droughts	High	High	• Afforestation • Reforestation • Protection of water catchments located in forests • Assisted natural regeneration	Community Resource Boards, Community Forest Groups Forest users	Agriculture Forests	All provinces	All AERs
	Reduced Non-Wood Forest Products e.g. mushrooms due to droughts	High – Increased frequency and intensity of droughts have contributed to reduced non-wood forestry products	Low – Non-wood forestry products are not adapted to long-term droughts and dry spells	High	High	• Promote participatory forestry management (CFMGs) • Promote forest management anchored on ecosystem and /or landscape approaches	Community Forestry Management Groups, Community Forest Groups Forest users	Forestry	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Moisture stress/ changes in phenology at the start and end of the growing season	High – Late onset of rains entail intra-seasonal droughts which makes it a challenge for plants to grow. Further, the early offset of rain also contributes to moisture stress on plants	Medium – Most woodlands in Zambia can still grow with reduced rainfall and dry spells	Medium	Medium	• Promote Assisted Natural Regeneration (ANR) in indigenous forests /or Restoration of degraded areas	Community Forestry Management Groups, Community Forest Groups Forest users	Forestry	Southern, Western, Eastern, Central	AER I & II
	Shift in forest species distribution /loss or reduced forest biodiversity due to droughts	Medium – Droughts and increased temperatures affect the diversity of species and introduce new one	Medium – The duration of droughts and temperatures in Zambia do not enhance species diversity change	Medium	Medium	• Undertake regular or periodic forest inventories to assess species composition, stocking levels and distribution	Community Forestry Management Groups Forest users	Forestry	Southern, Western, Eastern, Central	AER I & II
	Increased temperatures and drought conditions contribute to frequent risks of forest fires	Medium – Droughts and high temperatures exacerbate incidences of forest fires	Medium – The country is a combination of miombo and savannah rangelands. While much of the miombo habitat is resilient, the grasslands are less so	Low	Medium	• Establishing fire management infrastructure in and around protected forest areas (PFAs) • Establishment of forest fire early warning and rapid response system • Development of fire risk maps which specifies high and low risks	Wildlife managers, Community Resource Boards (CRBs)	Forestry Wildlife	Southern, Western, Eastern, Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Social	Reduced water quality and quantity as a result of droughts	High – Droughts can induce water scarcity and often reduced water in water bodies compromise the water quality which affects populations utilising the resource	Low – Most rural communities have only one source of water e.g. a river, or a stream and when water quantity and quality are affected they become vulnerable	High	High	• Promote rainwater harvesting • Construction of new and rehabilitation of existing dams in accordance with climate-smart codes and standards • Development of well fields • Promote recycling and use for domestic, agricultural and industrial use • Water quality monitoring and control • Improve resource management around water points and boreholes • Mapping and assessment of available groundwater resources • Strengthen Water Catchment Management and Protection	Rural Communities Water Resource managers Water utility companies	Water Agriculture Energy Transport	All provinces	AERA I, II & III
	Reduced groundwater levels due to droughts	High – Droughts can enhance the reduction of groundwater due to limited water seepage in the ground	Medium – High rainfall areas have a high adaptive capacity as there is reduced incidences of droughts while low rainfall areas have low adaptive capacity due to frequent drought occurrences	High	High	• Strengthen regulations for borehole drilling • Improve domestic water supply by utility companies • Protection of groundwater recharge zones • Construction of artificial ground recharge infrastructure • Expansion of climate-resilient water supply infrastructure • Protection of wetlands and wetland resources based on the EbA approach	Water Resource Managers, Disaster Risks Managers, Insurance Companies	Water Agriculture	Southern, Eastern	AER I

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
++Human	Reduced availability of water supply and sanitation	High – Especially for communities whose water sources are affected by droughts and those without health posts	Low – Especially for communities dependent on a single natural source of water	High	High	• Enhance water demand management • Improved water harvesting techniques • Promote ecological sanitation which uses less water • Enhance water resource management	Small-scale farmers that are exposed to drought hazards Communities with water challenges, Disaster Risks Managers, Insurance Companies	Water Agriculture	Southern Western Eastern Central	AER I & II
	Reduced interest in agriculture due to droughts affecting crops	Low – Agriculture is still the mainstay for most households in Zambia even in drought-prone areas	High – Availability of alternative livelihoods to agriculture	Low	Low	• Promote water harvesting • Incentivizing the agriculture sector (policy and financial incentives) • Agro-processing & value addition	Small-scale farmers Communities with water challenges	Agriculture	Southern Western Eastern Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased human-wildlife conflicts	High – This is due to drought induced movement of wildlife into human settlements	Low due to increased frequency and severity of droughts	High	High	• Development of participatory village land use plans • Provision of water points in national parks • Enforce equitable benefit sharing arrangements among government, communities and the private sector in the management of wildlife resources. • Relocating humans from wildlife corridors • Awareness of animal behaviour and how to interact with wildlife. • Training community members as blasters aimed at scaring animals from human settlements • Promote public private community partnerships in the sustainable management of wildlife resources	Communities living in GMA, Wildlife Resource Managers	Wildlife	Western, Southern, Eastern, Central, Lusaka	AER I $ II
	Crop failure and food insecurity due to droughts	High – Intra-seasonal droughts and dry spells severely contribute to crop failures and food insecurity	Low – Drought prone areas and small-scale farmers have minimal capacity to deal with food insecurities due to droughts	High	High	• Encouraging crop diversification to drought-tolerant crops and varieties • Promoting use of indigenous food and crop varieties which are tolerant to droughts; • Enhancing alternative livelihoods in low-rainfall regions • Improved grain storage facilities for produce at national level • Promote seed conservation of indigenous crop varieties • Promotion use of indigenous and local knowledge in food production systems	Small scale farmers, Disaster Risks Managers, Insurance Companies	Agriculture	Southern Western Eastern Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased incidence of climate-sensitive diseases, water-borne diseases (diarrhoeas: cholera, dysentery and typhoid); vector-borne (Malaria) and airborne respiratory conditions	High – This is due to high prevalence of water challenges (both quality and quantity) and a lack of health posts in most communities	Low – Especially for rural communities due to reduced access to healthcare	High	High	• Strengthening public health emergency preparedness and response to climate-sensitive diseases • Strengthening of surveillance activities (Tracking of diseases and trends related to climate change) • Integrate health services and protection measures into climate vulnerability assessments • Strengthen surveillance for water quality at the sources • Domestic (household) water purification in hotspots • Research in climate-sensitive diseases • Malaria control activities (vector control (i.e., IRS, ITN etc.) • Surveillance of malaria incidence • Surveillance of non-pneumonia disease incidence • Implement health promotion activities	Health care managers Rural and Urban Communities affected by water quality issues	Agriculture Health	Southern Western Central Lusaka Eastern	AER I &II
	Poor nutrition levels due to reduced food productivity and production.	High - Failure to grow healthy foods by communities in drought-prone areas due to water challenges	Medium – Concentration is on a maize diet which reduces on the diet richness and encourages stunting in children	High	High	• Promote health education on how to prepare and use available foods • Promote cultivation of fortified food crops (orange-fleshed sweet potatoes and maize) • Promoting the preparation and preservation of foods • Enhance food production and post-harvest and preservation techniques.	Small scale farmers	Health Agriculture	Southern Central Western Eastern Lusaka	AER I&II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Financial	Reduced income from agriculture, livestock and fisheries due to reduced productivity and yield as a result of droughts	High – Droughts contributing to reduced productivity have severely affected small-scale farmers' income from selling crops, livestock and fish	Low – Inadequate financial capacity to take adaptation actions or drought mitigation measures	High	High	• Agriculture insurance. • Income diversification • Promotion of the use of locally adapted livestock (indigenous) strains/breeds • Promotion of the consumption of livestock and livestock products from locally adapted livestock strains/breeds	Small scale farmers, Disaster Risks Managers, Insurance Companies	Agriculture	Southern Western Eastern Central	AERs I & II
	Effect on input supplies by affecting product prices, fishmeal, and fish oil costs, and other goods and services needed by fishers and aquaculture producers.	High – Increased prices due to reduced availability of supply as a result of droughts	Low – High prices coupled with low financial capacity	High	High	• Promote alternative livelihoods such as rice farming, beekeeping, etc.	Small scale farmers	Agriculture Fisheries	All provinces	All AERs
	Reduced income from tourism and wildlife-based activities due to reduced tourist visits to the water-based tourism sites	High – Most of Zambia's tourist activities are eco-based which are susceptible to droughts	Medium – There is potential for alternative tourist sites in high rainfall regions and non-nature-based tourism	Medium	Medium	• Enhancing tourism in high-rainfall areas	Community-Resource Boards (CRBs) Tour Operators, Communities benefiting from tourist activities	Tourism, Wildlife	All provinces	AERs I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Costs to the health sector increase during droughts because of outbreaks of diseases.	High – Increased disease and health conditions related to droughts resulting in high costs of health access	High – Low financial capacity to deal with health complications related to disease outbreaks	High	High	• Promotion of health insurance • Promotion of production of crops enhancing balanced diets	Small scale farmers Communities without health posts	Health	Southern Western Eastern Central Lusaka	AER I & II
	Droughts in some cases cause a reduction in available water needed for mineral processing resulting in reduced income from mines	Low – Most mines in drought-prone areas have alternative sources of water	High – Most mines have alternative	Low	Low	• Promotion of efficient utilisation of hydro-schemes upstream water to enhance or ensure availability of water downstream for hydro-power production. • Recycle water in mining and mineral processes • Practice water recycling to minimize the pumping of water • Use water-efficient mining and mineral processes	Institutions operating in the mining sector	Water, Mining	Copperbelt Southern North-Western Luapula	AER I & III
	Reduced income/ loss of livelihood for local fishers	Medium – Increased frequency of droughts contributes to loss of household incomes from affected fisheries	Low – Most fishers lack viable alternative livelihoods	Medium	Medium	• Promote alternative livelihoods such as rice farming, beekeeping, etc.	Fishers in various communities, Disaster Risks Managers, Insurance Companies	Fisheries	Luapula Southern Lusaka Western Central	AER I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Droughts causes a reduction in power supply generated from hydroelectric power (HEP) that is distributed to the mines and manufacturing industries	High – Reduced water in water bodies such as the Zambezi affecting power generation to the mines and manufacturing industries	Medium – Mines have the financial capacity to utilise alternative power sources even though this may increase the cost of production	Medium	Medium	• Use of clean power alternatives that are locally accessible, e.g. creating hydro-electric power from water that is pumped from the pit, setting up a solar power plant. • Investment in exploring alternative energy sources such as solar energy, thermal energy, and nuclear energy.	Institutions operating in the mining sector	Energy, Water Mining	Copperbelt Southern North-Western Luapula	AER I & III
Physical	Loss of soil nutrients and damage to soil structure due to droughts	High – Top fertile soils in drought-prone areas are exposed to objects of erosion such as wind, and water	Medium – Conventional farmers have a low adaptive capacity but farmers practising climate-smart agriculture face fewer such challenges	High	High	• Irrigation schemes operationalized • New irrigation farming developed • Promotion of Climate-Smart Agriculture • Irrigation infrastructure constructed and rehabilitated • Promotion of irrigation and efficient use of water resources. • Strengthen soil and water conservation technologies	Organisations and projects supporting agriculture Small scale farmers	Agriculture Water	Southern Western Eastern Lusaka Central	AER I & II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Loss of water-based tourism sites as sites dry up due to prolonged droughts	High – Most water-based tourism sites in drought-prone areas are susceptible to droughts	Low – Most of Zambia's tourism is water-dependent and there is generally poor natural resource management techniques employed at tourism sites	High	High	• Promote non-water based tourism products and packages • Intensive Management programs such as drilling water points for wildlife • Promote supplementation of feed for wildlife during drought periods • Encouraging participatory approach to rangeland management involving communities living in or around wildlife-protected areas, and who depend on rangeland resources for their livelihoods	Tourism managers Community-based tourism groups Wildlife Managers	Wildlife, Tourism Water Agriculture Wildlife Forestry	Southern Western Central Eastern	AER I & II
	Reduced hydropower supply to the households due to droughts	High – Increased incidences of droughts affect hydropower generation which affects supply to households	Low – Few but expensive alternatives available such as solar which hinders uptake of alternative sources of power	High	High	• Promote installation and utilization of alternative power sources • Promote implementation of off-grid power supply for households so that there is more energy diverted to mineral production • Augment processes for transitioning to Renewable Energy Technologies (RETs) • Promote increased use of alternative energy • Conduct research and produce an atlas of Zambia's renewable energy hot spots	Managers in energy-providing institutions (Public and Private sctors) Households	Energy	All Provinces	AER I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Reduced power supply from hydro, resulting in low production by industries	High – High incidences of droughts contributing to load-shedding to industries	Medium – Most small-scale industries may not have the financial capacity to utilize alternative sources of power	High	High	• Install and utilize alternative power sources • Increased use of alternative energy	Electricity producers Industries	Energy	All Provinces	AER I, II & III
	Increased dust levels in mining areas	Medium – Droughts tend to contribute to increased dust among mining sites and surrounding areas	High – Mining companies have the capacity to manage the dust around mining activities	Medium	Medium	• Undertake regular dust suppression measures • Plant trees and allow vegetation to regenerate in areas that are not utilized	Institutions operating in the mining sector	Mining	Copperbelt Southern North Western	AER I & III
Institutional	Weak community structures to cope with drought-induced hazards	Medium – Increased incidences of droughts affecting communities in drought-prone areas	Low – The lack of technical skills and structures that make communities manage drought-induced impacts	Medium	Medium	• Strengthening community structures for managing droughts	Farmer cooperatives, Water User Associations, Women Groups, Agriculture Extension Officers, Disaster Risks Managers, Insurance Companies	Agriculture Water Financial	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Weak or inexistent infrastructure meant to improve tourism diversification from ecosystem-based tourism	High – Ecosystem-based tourism is highly susceptible to droughts which are prevalent in the southern part of Zambia	Low – Generally, there is low capacity to absorb the latest technology, poor capacity to generate and disseminate tourism information, as well as inadequate financial capacity to develop and manage tourism infrastructure	Medium	Medium	• Providing early warning information • Develop infrastructure in tourism sites • Diversify tourism from an ecosystem-based	Tourism managers Community-based tourism groups	Tourism	Southern Western Northern Eastern Luapula	All AERs
	Inadequate early warning systems for predicting droughts	High – There are increased frequencies and intensity of droughts	Medium - Poor capacity of weather makers to predict incidences, frequency and intensity of droughts and dry spells	High	High	• Developing emergency response mechanisms • Application of drones, GIS/remote sensing in mapping of drought-prone areas • Integrated Indigenous Knowledge Systems (IKS) with modernized early warning systems • Increase the installation of automatic weather stations • Enhance early warning systems • Up-scaling on dissemination of climate services	§ Small-scale farmers that are exposed to droughts, Disaster Risks Managers, Insurance Companies	All sectors		

5.2 Adaptation actions to floods

With climate change certain areas in the country are at higher risk of flooding than others but anywhere that receives prolonged and heavy rainfall can also be at risk. Table 6 below details the climate vulnerabilities and adaptation action associated with floods. Floods affect all provinces, AERs and sectors. The increased frequency and intensity of floods leads to poor crop yields, compromising food security and exacerbating poverty among the rural and peri-urban population.—Food insecurity is associated with poor nutrition, especially among children. Floods obliterate food resources, leading to food insecurity and inadequate dietary diversity which in turn leads to the prevalence of malnutrition cases in Zambia (NAPA, 2007; GRZ-TNC, 2020).

Floods compromise the quality of water, sanitation, and hygiene (Mwitwa, 2018). This raises health concerns and increases women's vulnerability to risks of attack as they look for water, compromised menstrual hygiene, physical stress, and loss of time in other productive areas (GRZ & IUCN, 2018). The mining sector has also not been spared. Extreme climate events such as floods can adversely impact mining operations.

The vulnerability of the wildlife sector to climate change is linked to the vulnerability of tourism. High rainfall presents both vulnerabilities and opportunities for tourism. However, there is little information on climate change vulnerabilities of tourism in high rainfall areas in Zambia.

Floods have implications for the health sector (NAPA, 2007; GRZ-TNC, 2020). Further, costs to the health sector increase have increased with floods because of outbreaks of diseases. The diseases associated with floods include waterborne diseases. Climate change has increased the geographic coverage and survival of mosquito populations thereby increasing the vulnerability of Zambians who previously may not have been exposed to Malaria (USAID, 2012; Ngarakana-Gwasira et al., 2016). In recent years, infrastructure in Zambia has suffered the onslaught of high rainfall. High rainfall and floods compromise the structural integrity of such infrastructure, leading to deterioration and eventual total collapse.

Table 6. Vulnerabilities and adaptation actions to floods (periodic and seasonal, water logging)

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Environmental	Loss of terrestrial vegetation from extreme flooding	High- removal of trees /vegetation poor survival of trees and plants from by high velocity waters and inundation	Medium – slow flood waters recession and dry out of soils delays regrowth of vegetation Poor adoption of resource conservation methods/ technologies	Medium	Medium	• Promote sustainable forestry; • Rangeland/pasture management; • Mapping and zoning of flood prone areas • Sustainable floods management; • Water catchment conservation and management • Promotion of climate-smart agriculture • Up-scaling on dissemination of climate services • Promoting agroforestry • Promote conservation agriculture (CA)	Natural resource managers; Community groups (in water, forests, wildlife and agriculture)	Agriculture , Water, Wildlife Forestry; Civil society	All provinces	AER I, II & III
	Increased wildlife mortality due to floods	Medium- wildlife drowning and disease proliferation and habitat destruction; Break down of predator-prey relationships	Medium - mobility and ability of wildlife to move out of the way of rising waters to higher ground	Medium	Medium	• Sustainable floods management; • Protection of wildlife habitats and corridors • Protection of wildlife breeding grounds • Conservation of habitats to support wildlife in protected and open areas	Wildlife Management Officer; Ecologists; Water resource managers; Community Resource Boards	Tourism and Wildlife, Water	All provinces	AER I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increase in erosion and sedimentation in dams, lakes and rivers	Medium-erosion and collapse of river banks obstruction of river beds and streams, suffocating aquatic organisms, and destroying habitats	Medium-erosion and sedimentation have less negative impact on more less degraded and intact	Low	Medium	• Mapping, zoning and protection of ecologically sensitive areas; • Maintenance of vegetated buffer strips along watercourses • De-silting of dams	Land use Planners; Foresters; Agriculture extension officers	Lands; Agriculture ; Forests	All provinces	AER I,II & III
	Decline in ecosystems services due to extreme floods	High-seasonal inundation of low-lying areas; river bank erosion and deposition; sanitation breakdown	Medium-ecosystem recovery following extreme floods highly variable; small floods increase in primary production, water regulation; ground water recharging, recreation and tourism	Medium	Medium	• Water catchment protection and conservation; • Promote sustainable flood management; • Manage species and habitats to protect ecosystem functions; • Increase knowledge and information on impacts and responses of fish, wildlife, and vegetation to floods; • Improve pond site selection and design processes	Water Resources Managers; Land use planners; Disaster managers; Civil Society Organisation	Water, Forestry, Agriculture and local government; Disaster management	All	AERs I, II, & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Decline in fish stocks due to flooding	Low-periodic flooding in aquatic ecosystems (rivers and wetlands)	High-fish stock recovery quick provided that instream habitat is not dramatically affected; Small seasonal floods can be beneficial to native fish stocks	Low	Medium	• Sustainable fisheries Management • Strengthening of the early floods warning systems and preparedness; • Sensitize communities towards sustainable fish farming practices • Rehabilitate aquatic environments around river mouths • Strengthen community sensitization and enforcement of fisheries regulations including fish bans • Conservation of habitats to support healthy fish stocks	Fisheries Officers; Fish management and conservation groups;	Fisheries and Forestry sectors	Southern; Central; Luapula; Northern	Agro-Ecological Regions (AER) II & III
Social	Disruption of the socio-economic status of urban, peri-urban and rural people.	High-Direct effect on production assets, displacement of people and livestock; damage to infrastructure (roads dwellings etc.).	High-poor livelihood conditions of communities in flood prone locations	High	High	• Sustainable flood Management; • Emergency humanitarian response (food, water, sanitation and protection, especially to women and children) • Relocating communities affected to higher ground • Adoption of alternative livelihoods such as rice farming, beekeeping, etc.; • Enhanced social protection programs with improved targeting of beneficiaries (social cash transfer, FSP, FISP	Disaster mitigation managers; District planners; Community Development Officers; agriculture extension staff; Health staff; Vulnerable groups (Small scale rural farmers, women and girls; OVCs, the elderly; PWD and PLWHIV/AIDS)	Disaster mitigation and management; Health, Fisheries; Forestry, Community Development; Local government; agriculture and Civil society	All	Agro-Ecological Regions (AER) I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased personal risk for women and adolescent girls in search for clean water	Medium - Decreased household water sources of household water supply sources	Medium - Lack of access to clean and safe water; Dangerous, time-consuming and physically demanding water fetching	Medium	Medium	• Awareness and sensitization in climate change climate change issues and their implications • Improving access to clean water and sanitary facilities • Developing local rainwater harvesting measures	Institutions responsible for water resource development, water supply and sanitation, civil society, VWASHE, DWASHE	Water supply sector; Health, Infrastructure	All	Agro-Ecological Regions (AER) I, II & III
Human	Reduced crop production due to flooding	High - damage to cultivated crop land due to flooding and water logging	High - poor adoption of CSA technologies; Poor agriculture floods control	High	High	• Promote flood protection structures on crop lands, water sources and ecosystems; • Introduction of climate resilient and drought tolerant crop types and varieties; • Investment in community-based floods early warning system	Agriculture Planners; Agriculture extension Workers	Agriculture, Water sectors	All	AER I,II & III
	Increased under nutrition or malnutrition from food shortages caused by floods	High - Reduced nutritional status especially for low income communities	High - Limited food intake and poor access to sufficiently nutritious foods	High	High	• Promote health education and on how to prepare and use available foods • Promoting the preservation of indigenous foods; • Diversifying foods and enhanced diet supplement • Diversifying growing of indigenous plants, roots, tubers and fruits • Food fortification • Infant and child feeding at under-five clinics and School Health Nutrition in schools	Health planners; nutrition and agriculture extension staff. Community groups, civil society	Health, Agriculture; Community Development; Civil Society organisations	All provinces	AER I,II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased human-wildlife conflicts	High – This is due to flood induced movement of wildlife into human settlements	Low due to increased frequency of floods	High	High	• Relocating humans from wildlife corridors • Awareness of animal behaviour and how to interact with wildlife. • Training community members as blasters aimed at scaring animals from human settlements	Communities living in GMA, Wildlife Resource Managers	Wildlife	Western, Southern, Eastern, Central, Lusaka	AER I $ II
	Pollution of water sources from flood waters	High- communities at risk of contaminated of surface and groundwater	High-Inadequate water resources management	High	High	• Mapping and zoning of flood prone areas • Integrate landscape approaches in land use plans • Protection of ground and surfaces water sources from pollution • Water quality monitoring and control • Enhanced water catchment management and protection	District planners; water resource managers; Forests managers; urban and rural communities (and small-scale farmers flood areas)	Water, Forestry, Health, Infrastructure	All	Agro-Ecological Regions (AER) I, II & III
	Increase in waterborne, (zoonotic-vector borne) diseases	High- exposure to high risk diseases from and stagnant waters	High- Poor surveillance and early warning of flood induced water borne, diseases.	High	High	• Strengthening public health emergency preparedness and response for climate sensitive diseases • Strengthening disease surveillance and control activities • Strengthening research in climate sensitive diseases; • Promoting sustainable medical facilities and practices	Public health and water resources managers	Health, Water	All	AER I, II, & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased flooding of mining pits	Medium - damage to mining infrastructure and disruption of mining operation	Medium - Inadequate dewatering of mining pits and damage to equipment	Medium	Medium	• Designing and implementing flood responsive mine dewatering plans • Installation of adequate mining pits water pumping equipment during flood events	Mining operations regulators; Mining establishment; small scale miners	Mining	All provinces	Agro-Ecological Regions (AER) II & III
	Flooding of mines tailings storage facilities causing local environmental degradation such as bleaching	Medium- damage to the local environment from acidic tailings	Medium Inadequate management of tailings storage facilities	Medium	Medium	• Improve pollution control around tailings storage facilities • Design of climate resilient tailings dumps (flood responsive dewatering) • Design of tailings dumps that respond to the threats of floods • Location of tailings storage facilities away from human settlements/activity • Neutralising tailings in all tailings storage facilities to avoid bleaching/breaching in case of floods	Mining operations regulators; Mining establishment; small scale miners	Mining	Copperbelt; North-western provinces	AER III
	Flooding of hydro-electric generation power stations	Medium - Damage to power generation equipment and reduced power supply	Low-Inadequate emergency flood management for hydro power generation stations	Low	Low	• Catchment protection and conservation • Promote alternative use of power locally available e.g., solar or geothermal • Promote insurance of hydro-electric power plants and stations	HEP power supply companies, Insurance companies	Energy, Water	Southern, Central; Northern	AER I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Financial	Reduced agriculture (crops and livestock) productivity, fish as a result flooding and water logging	Medium- reduced income from crop, fish and livestock sales	High- financial capacity to take adaptation actions or flood mitigation measures	High	High	• Engaging communities in alternative income generating activities outside of crop farming • Providing financial incentives to the agriculture sector • Encouraging precision agriculture/ use of ICTs • Adoption of alternative livelihoods such as rice farming, beekeeping, etc. • Promote insurance of hydro-electric power plants and stations	Rural based small-scale farmers, Insurance companies	Finance, Fish and livestock	All provinces	AER I, II & III
	Disruption of mining operations	Medium- reduced income from mining to the economy	Medium- inadequate climate risk measures for mining activities	Medium	Medium	• Formulate a disaster management for flooding events to mitigate losses (life or damage to equipment) • Promote insurance of mines	Large and small; Small scale miners	Mining	Southern, Copperbelt, Central;	AER I&II
	Reduced incomes resulting from disruption of tourism activities	Medium- reduced incomes from tourist activities	Low-Inadequate risk reduction climate risk measures in tourist areas	Low	Medium	• Diversification of tourism product to more indoor activities	Tourism planners Tourist operators; Community groups	Tourism, Wildlife, Tourism	All provinces	AER I, II & III
Physical	Loss of agricultural fields, soil fertility	Medium - Degradation of farm lands, soils and conservation structures	Medium - Poor floods risk management measures in agricultural fields	Medium	Medium	• Construction of climate smart infrastructure • Promote CSA	Small-scale farmers that are exposed to flood hazard	Agriculture	All	Agro-Ecological Regions (AER) I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased damage to infrastructure (roads, water, building bridges and tourist roads)	High - collapse of infrastructure such as roads, culverts with secondary impacts on health and education from extreme flooding	High - Lack of climate resilience guidance for infrastructure development	High	High	• Increase funding for regular maintenance of existing road infrastructure and buildings • Enhance climate proofing of water infrastructure • Promote application of climate smart resilient codes in for roads development (including roads in National Parks and Game Management Areas and in high potential agricultural areas) • Construction, rehabilitation and maintenance of loop roads in National Parks and Game Management Areas in tourist sites in accordance with climate smart building codes and standards • Periodic dredging of water canals • Development of climate resilient building codes and standards • Undertake training for climate proofing of infrastructure • Promote insurance of infrastructure and buildings	Government departments, local authorities Road and building contractors, Insurance companies	All sectors	Southern, Lusaka; Central, Copperbelt and Eastern	Agro-Ecological Regions (AER) I, II & III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Institutional	Preparedness and response by institutions (national, and subnational) for floods management	Medium - centralisation of preparedness for response (planning to respond)	Medium - gaps in stakeholder community participation	Low	Medium	• Strengthen and decentralise national flood management • Implement multi-sectorial response to ensure recovery, rehabilitation and restoration; • Strengthen coordination among institutions for timely assistance to severely affected people. • Investments to enhance emergency preparedness and response • Strengthen gender and indigenous knowledge systems mainstreaming in flood risk management	Sector focal points; Disaster manager; district planners Community institutions	All sectors	All provinces	Agro-Ecological Regions (AER) I, II & III

5.3 Adaptation actions to high temperatures

Temperature in Zambia is projected to increase by 1.9^{o}C and 2.3^{o}C by 2050 and 2100, respectively (Hamududu and Ngoma, 2020). Climate change has already led to a rise in global temperatures, causing more frequent and intense heat waves. Zambia, like many other countries, has experienced the impacts of these extreme weather events. In recent years, the country has witnessed prolonged periods of high temperatures, with consequences on agriculture, infrastructure, livestock and human health among others.

The impacts of high temperatures and heat waves are felt across Zambia, but some sectors and regions are particularly vulnerable. Agriculture, which is a key sector for the country's economy, is particularly susceptible to the effects of climate change. Prolonged dry spells and high temperatures have led to crop failures, reduced yields, and livestock deaths, resulting in food insecurity and loss of income for many farmers. In addition, vulnerable regions such as the Southern and Western provinces, which are already prone to drought, are facing an increased risk of water scarcity due to reduced rainfall and increased evaporation. Poor communities, particularly those in rural areas, are also at risk of health problems such as heat stroke and dehydration, which can be fatal without proper medical attention.

The prolonged dry spells and high temperatures will contribute to food insecurity and water scarcity in the country. Table 7 shows high temperature hazards, vulnerabilities and proposed adaptation actions.

Table 7. Vulnerabilities and adaptation actions to high temperatures (heat waves and heat stress) in geographical regions and sectors

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Environmental	Increased incidences of forest fires	Medium - high temperatures will increase incidences and intensity of forest fires	Medium – Rangelands, grasslands have medium adaptive capacity while woodlands have a high adaptive capacity to forest fires	Low	Medium	• Establishing fire management infrastructure in and around protected forest areas • Development of fire risk maps which specifies high and low risks • Early burning of fires in forests, cultivated fields and rangelands • Establishment of forest fire early warning and rapid response systems. • Installation of fire control measures infrastructure in tourism sites • Develop and implement fire management plans for national parks and game management areas	Community forest groups, Forest, department, Department of Wildlife and National Parks Small-scale farmers, livestock farmers	Forestry, agriculture, tourism, wildlife and livestock	All provinces	I,II, III
	Changes in fish species distribution	Medium - high temperatures will negatively affect the functioning of aquatic ecosystems and affect fish growth and reproduction thereby changing distribution of fish species	Medium- fish species have temperature ranges which if exceeded will lead to changes in their distribution	Medium	Medium	• Adoption of alternative livelihoods by households in fish dependent communities.	Fishing communities	Fisheries	Luapula, Lusiaka, Western, Southern, Northern, Central	I,II,III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased exposure to pests and diseases including heat stress, stroke and heat waves.	Medium – high temperature will increase pests and diseases for crops, livestock, fish and wildlife.	Low adaptive capacity due to inadequate surveillance of pests and diseases (crops, livestock, wildlife, fisheries).	Medium	High	• Promotion of the use of locally adapted livestock (indigenous) strains/breeds. • Promote Integrated Pest Management (IPM) • Characterisation and promotion of indigenous livestock strains/breeds • Promotion of animal health delivery. • Strengthen monitoring among fishers and fish farmers	Livestock farmers, fishers and smallholder farmers.	Agriculture, Forestry, fisheries, livestock, Wildlife, Health	All provinces	I, II, III
	Reduced water availability for various social activities	High- high evapotranspiration and limited ground water recharge.	Medium due to degraded water catchment areas.	Medium	High	• Investing in climate resilient water infrastructure • Develop groundwater resource utilization and efficient use for different sectors	Livestock farmers, water utility companies,	Water, livestock, forestry	Southern, Western, Central, Lusaka	I, II
	Reduced productivity (land, ecosystem, fisheries).	High exposure of native biodiversity in ecosystems to high temperatures.	Medium adaptive capacity of ecosystems	Medium	High	• Rehabilitate aquatic environments around river mouths. • Promote afforestation and reforestation of catchment area. • Promote Assisted Natural Regeneration	Fishers, forest dependent communities and smallholder farmers.	Fisheries, Forestry and Agriculture.	All provinces	I,II, III
	Reduction in animal growth and productivity.	High exposure of wildlife and domestic animals and insufficient water to support growth and development of domestic and wildlife	Low adaptive capacity due to reduced access to water	Medium	High	• Provision of water points in water stressed areas including national parks (weirs, dams and reservoirs.	Livestock farmers and Department of National Parks and Wildlife	Livestock, wildlife	Western, Southern, Central, Lusaka and Eastern provinces	I, II

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	▪ Drying of streams	High exposure of streams which is exacerbated by unsustainable land use practices.	Low adaptive capacity of streams coupled with degraded catchments	High	High	• Promote sustainable land management • Integrate landscape approaches in land use planning in river catchments	Small scale farmers, livestock farmers, Water User Associations, Traditional leaders	Agriculture, livestock, wildlife, Forestry, Water	Western, Southern, Central, Eastern, Lusaka Copperbelt	I, II, III
	▪ Migration of fish to better micro-climates due to rising temperatures	High – high temperatures affecting aquatic ecosystems resulting to unfavourable conditions for native species.	Medium due to inability of fish to grow and reproduce under changing climatic conditions.	Medium	Medium	• Promote aquaculture development and other forms of alternative livelihood in fishing communities (utilization of fish cages and pens) Promote utilization of fishponds and fish cages • Integrate landscape approaches in land use planning in river catchments • Reforestation along river channels	Fisher at various stages of the value chain, Traditional leaders	Fisheries	Western, Southern, Central, Luapula Eastern, Lusaka Copperbelt	I, II, III
Social	▪ Disruption of livelihoods of smallholder farmer economic sources of income and loss of livestock.	High exposure of people due to high reliance on climate sensitive natural resources based livelihood strategies.	Low –Poor capacity (technology, information, finance, knowledge) of individuals and rural communities to adapt and limited livelihood options.	High	High	• Diversification in agriculture • Characterization and adoption of indigenous livestock strains/breeds	Smallholder farmers and	Agriculture, Water	All provinces	I,II, III
Human	▪ Increased proliferation of pathogens ▪ Spatial and temporal widening of the vector populations	High exposure to increase incidences of climate sensitive diseases.	Low due to - low disease surveillance, Inadequate health promotion activities and limited access to health services.	Medium	Medium	• Implement health promotion activities.	Communities in areas prone to heat stress and heat waves	Health	All provinces	I, II, III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased heat stress for tourists	Medium exposure as tourism sites lack heat - relieving amenities	▪ No tourism heat - relieving amnesties to respond to heat stress.	Low	Low	• Provision of climate smart cooling facilities • Reforestation around tourist camps and facilities • Planting of trees around tourist camps and facilities	Tourist operators, wildlife managers, CRBs	Tourism, Wildlife, Forestry, Infrastructure	Western, Lusaka, Southern & Eastern	I, II
Financial	Reduced income arising from low productivity and yield (agriculture, fisheries, livestock, and wildlife). Reduced or disruption of economic activities in the in mining and tourism sectors	High exposure Income from selling crops, livestock, fish, wildlife, and revenue from water	Low adaptive capacity due to lack of financial capacity to take adaptation actions or high temperature mitigation measures	High	High	• Adoption of alternative livelihoods by households in fish dependent communities • Promotion of efficient reproduction capacity eg use of artificial insemination • Promotion of improved grasses and legumes for ruminant feeding • Adoption of alternative livelihoods by households that are dependent on natural resources • Install adequate and energy efficient cooling facilities underground to protect the health and safety of workers	Smallholder farmers including youths and females, households livings in around GMAs and forest area	Agriculture, fisheries, livestock, forestry, wildlife	All provinces	I,II, III

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Sensitivity	Climate Risk Level	Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Physical	Increased threat of loss of infrastructure to fires Increased cost of maintenance of infrastructure Increased fires in rangeland and forest	Medium exposure of infrastructure to high temperature resulting in compromised structural integrity of infrastructure (roads, buildings)	Medium - Lack of risk mitigation measures Lack of building codes for green buildings Inadequate enforcement of building regulations	Low	Medium	• Increased investments in the development of new climate resilient infrastructure i.e. roads, bridges, etc. • Design and construct climate proofed infrastructure for health services • Revision of building codes and standards • Promote Insurance of property against loss to fires and other climatic hazards • Revision of building codes and standards to include provision for fire resistant material • Enforcement of building codes • Building capacity by training stakeholders on the principles for green building designs	Entire populations, Insurance companies	Infrastructure, transport, health	All provinces	I,II III

5.4 Adaptation actions to wind storms

The windstorm or wind gust intensity and frequency is projected not to increase significantly with climate change (Cheng and Lopes, 2014; Xu, 2019). However, the absolute damages caused by windstorms will ultimately increase under future climate scenarios due to rising asset values as the economy grows and expands. Severe windstorms/or wind gusts can cause widespread flying debris, and damage to forests, properties, buildings, and transport and energy (power lines) infrastructure. Further, windstorms, wind gusts and/or hailstones can damage roofs and tiles, dent vehicles, properties (buildings, agricultural structures, etc.), glasshouses and bring down vegetation. Strong winds can cause mechanical damage to crops which reduces income by affecting their growth and yield while increasing pest and disease incidences. On the other hand, falling trees can block roads, damage fences and hedges and bring down utility lines as well as damage nearby buildings or vehicles. The windstorm, wind gusts and hailstones affect all target groups, sectors, AERs and provinces.

The impacts of extreme winds could be reduced by implementing a range of adaptation actions, such as the development and implementation of enhanced windstorm-resilient standards and building codes as presented in Table 8. Table 8 shows vulnerability elements, vulnerabilities, and exposure by hazards, adaptive capacity, action actions, target groups and affected sectors, AERs and provinces.

Table 8. Vulnerabilities and adaptation actions to windstorms in geographical regions and sectors

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Environmental	Severe windstorms cause widespread flying debris, damage to vegetation and livestock infrastructure e.g., trees, forests, livestock structures, etc.	Medium - Increased exposure to windstorms that damages forests and trees	Medium - lack of climate resilient infrastructure	Medium -	Medium	• Promote tree planting • Plant trees and allow vegetation (grass included) to regenerate in areas that are not utilised • Plant trees and allow vegetation to regenerate in areas that are not utilized • Neutralise tailings in all tailings storage facilities to avoid bleaching in case of windstorms • Sprinkle work areas with water in order to settle dust • Install sprinklers in areas where dust is generated • Undertake regular dust suppression measures • Design mine pits that are responsive to the threat of windstorms • Design of tailings storage facilities should be changed to response to the threats of windstorms • Tailings storage facilities should be located far from any human activity	All groups	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Social	Severe windstorms cause widespread flying debris, damage energy, & infrastructure, vehicles and causes personal injury & death, e.g. transport, livestock, energy, dwellings, etc. ▪ Compromised quality and strength of buildings	Medium - Blocked roads, damaged fences, utility lines, buildings and vehicles Medium	Medium – lack of financial capacity Medium – lack of climate resilient construction codes	Medium – lack of capacity to integrated alternative energy sources and climate resilient construction codes Medium - lack of climate resilient construction codes	Medium Medium	• Promote use of alternative energy • Promote provision of alternative sources of energy • Strengthen early warning system • Lobby government to implement off-grid power supply for households • Revision of building codes and standards	All groups	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs
	Strong winds can cause mechanical damage to crops, & livestock pasture which will affect growth, yields and pest and disease incidence	Medium - Increased susceptibility to disease affects harvest quality, and crop may not meet the requirements of its intended market	Medium – low adaptive capacity to prevent mechanical damage to crops due to strong winds	Low – lack of finances	Low	• Promote planting of hedges and wind breaks • Strengthen early warning system • Enhancing market linkages for the produce	All groups	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Health	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Severe windstorms can cause widespread damage to buildings, and transport and energy (power lines) and water infrastructure	Low – Damage infrastructure and buildings	Medium – low adaptive capacity	Medium – Increase maintenance costs	Medium	• Promotion of climate resilient infrastructures • Designing climate proof infrastructure • Enhance surveys and trimming of problem trees • Planting of grass, & trees as hedges and wind breaks	All groups	Energy, Health, Infrastructure, Livestock, Mining, Tourism, Wildlife, Transport, Water	All provinces	All AERs
Human	Crop failure and food insecurity	Medium - Reduced crop and pasture yield	Medium - Formulate a disaster management plan to be used during windstorm events to mitigate loss of life or damage to equipment and property	Medium – damage to crops, equipment and property	▪ Medium	• Weather-based crop, aquaculture, and livestock insurance • Promotion of Climate Smart Agriculture • Promoting agroforestry or • Promote conservation agriculture (CA) • Strengthen early warning system	All groups	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Health	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Power outages, damage to buildings and vehicles, and personal injury and death Compromised quality and strength of buildings	Medium - Blocked roads, damaged fences, utility lines, buildings and vehicles Medium – damaged infrastructure & building	Medium – lack of resources to maintain buildings and infrastructure Medium – lack of resources to maintain buildings	Medium – power outages Medium - Designing climate proof infrastructure	Medium Medium	• Promote use of alternative power that is locally accessible • Provision of alternative sources of energy • Lobby government to implement off-grid power supply for households • Strengthen early warning system • Maintain wind breaks and hedges • Revision of building codes and standards • Access to mechanization	All groups	Energy, Infrastructure, Transport, Health	All provinces	All AERs
	Damage to infrastructure & buildings such as health, residential, etc. Falling trees can block roads, damage fences and hedges and bring down utility lines as well as damage nearby buildings or vehicles	Medium - Flying debris and falling trees are the primary cause of damage during a windstorm	Low – insufficient climate information Medium – lack of research in wind-based climate indices	Low – insufficient tree assessment surveys	Low	• Carry out tree assessment surveys on a regular basis to identify and prune or remove problem trees prior to storms occurring. • Strengthen early warning system	All groups	Agriculture, Energy, Tourism, Water, Health, Forest, Infrastructure	All provinces	▪ ll AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	High winds and hailstones can damage buildings, utilities, roads, water & livestock infrastructure and other farm structures.	Low – Lack of research in climate change and wind-based climate indices	Low – Lack of climate resilience infrastructure	Low - Weak enforcement of construction codes	Low	• Enforcement of construction codes • Strengthen research in climate change and windstorm-based climate indices • Improved accessibility to weather and climate information • Strengthen early warning system	All groups including farmers	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs
	Reduced agricultural productivity Increased livestock mortality Increased incidence of eye and respiratory diseases	Medium - Soil erosion Medium - Reduced soil fertility and productivity Medium - High winds reduces crop quality & yields due to increased stem, and tissue damage and disease incidence	Medium - Poverty, limited infrastructure, illiteracy, weak institutions, lack of technology and climate information Low adaptive capacity	Medium – Increased poverty and reduced household food security Medium	Medium	• Increase extension services • Up-scaling on dissemination of climate services • Promote insurance of property against loss to fires and other climate hazards • Promote crop-livestock integration • Promotion of the use of improved grasses and legumes • Up-scaling on dissemination of climate services • Promote improved manure management • Planting of trees and vegetation to minimize dust • Sprinkle work areas with water in order to settle dust • Install sprinklers in areas where dust is generated • Undertake regular dust suppression measures	All groups including farmers	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Financial	Disruption of hydroelectric power supply to the mines Increased demand for green and climate resilient buildings Increased infrastructure maintenance costs e.g. Livestock, etc. Reduced income from rentals and agricultural land due to reduced livestock and crop productivity and yield	Medium – lack of alternative energy sources Medium - Reduced income from damaged crops, rental houses and businesses, etc. Medium - Reduced income from business due to power outage Medium - Reduced income from business due to power outage	Medium – lack of financial capacity Medium - Lack of financial capacity to implement climate change adaptation actions Medium - Limited financial & access to climate information and early warning system Medium - inadequate infrastructure and weak governance systems	Medium – lack of capacity to integrated alternative energy sources and climate resilient construction codes Medium - lack of climate resilient construction codes	Medium - lack of climate resilient construction codes	• Build the capacity by training stakeholders on the principles for green and climate resilient building designs • Develop maintenance schedule for every infrastructure • Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water, lodges, etc. • Development of alternative transport infrastructure i.e., airports and railways based on climate resilient infrastructure codes and standards • Promote insurance for agriculture, infrastructure and buildings	All groups, Insurance companies, Contractors, Government institutions responsible to infrastructure	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Physical	Disruption of hydroelectric power supply to the mines	Medium – lack of power supply	Medium – lack of financial capacity	Medium -	Medium -	• Promote use of alternative power that is locally accessible e.g., mini hydro power stations, setting up a solar power plant and geothermal utilization • Revision of building codes and standards	All groups	Energy, Mining	All provinces	All AERs
	Damage to infrastructure and buildings such as residential, schools, health centres, etc. Reduced agricultural productivity Increased dust levels in mining areas	Medium – Increased damage to property, buildings, utilities, roads and other structures Medium – Increase soil erosion & reduced soil fertility and productivity High winds can cause soil erosion leading to loss of soil nutrients	Medium - Limited infrastructure Medium - Weak institutions Medium - lack of technology and climate information Medium - Poor windstorm adaptation actions	Medium – lack of climate proof infrastructure design plans	Medium	• Enhance designing and construction of climate proofed infrastructure • Promotion of climate resilient infrastructures • Maintain wind breaks and hedges • Promotion tree grass & planting • Strengthen early warning system	All groups, Traditional leaders, Government institutions responsible for infrastructure	Agricultural (Crops, Livestock, Fisheries, & Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
	Increased deterioration of road infrastructure Increased dust levels in mining areas Increased damage to water infrastructure	Medium - Increased exposure to windstorms damage property	Medium - lack of climate resilient infrastructure	Medium – deterioration of infrastructure	Medium	• Regular maintenance of existing road infrastructure • Promotion of climate resilient infrastructures • Designing climate proof infrastructure • Enhance revision of building codes and standards	All groups	Agricultural (Crops, Livestock, Fisheries, Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Transport, Water	All provinces	All AERs
	Windstorms bring severe damage to properties, hailstones can damage roofs and tiles, dent vehicles, damage glasshouse and bring down vegetation.	Medium - Blocked roads, damaged fences, utility lines, buildings and vehicles	Medium - limited availability of data from observations & high degree of uncertainty associated with model projections of extreme wind speed	Medium – increased damage to property	Medium	• Enhanced verification and enforcement of revised road codes and standards • Increase investment in the construction of climate-smart buildings • Conduct research and produce an atlas of Zambia's windstorms	All groups	Infrastructure, Agriculture, Livestock, Tourism, Energy, Mining	All provinces	All AERs

Vulnerability Elements	Description of vulnerabilities	Exposures by hazards	Adaptive capacity	Climate Risk Level	Sensitivity	• Adaptation actions	Target Groups	Affected areas		
								Sectors	Provinces	AER
Institutional ▪	Loss of access to social amenities Difficulty in transporting goods and services to different parts of Zambia Weak community structures to cope with windstorms	Low – lack of social amenities Medium – damaged road infrastructure Low - Weak institutional structures	Medium - Communities have weak structures to respond to windstorms Medium - Limited infrastructure Medium - illiteracy, technical and institutional capacity	High - lack of technology and climate information	Medium	• Develop access roads to social amenities such as clinics and schools based on climate resilient infrastructure codes and standards • Utilization of alternative forms of transport such as rail and air in accordance with climate smart codes • Development and implementation of enhanced windstorm-resilient standards and building codes • Strengthen early warning system	All groups, Traditional leaders, Government institutions responsible for infrastructure	Agricultural (Crops, Livestock, Fisheries, and Aquaculture sub-sectors), Energy, Health, Infrastructure, Mining, Tourism, Wildlife, Forest, Transport, Water	All provinces	All AERs

5.5 Synergies between adaptation actions and disaster risk reduction

The Government of the Republic of Zambia is strongly committed to the implementation of the transformative 2030 Agenda for Sustainable Development. The country's first Voluntary National Review (VNR) underscores this commitment. Integrating the SDGs into the National Planning Framework and putting in place strong coordination and reporting mechanisms, further demonstrate the country's resolve to anchoring its development trajectory on the 2030 Agenda. Presently, the Government of Zambia is seeking partnerships to accelerate synergy between climate change adaptation and SDGs.

Addressing the climate emergency requires effective adaptation and Disaster Risk-Reducing (DRR) actions. It is critical to guard against risk-blind planning, particularly to avoid maladaptation and creating new risks. A comprehensive approach to risk management is required. There are a number of factors to wittingly strengthen synergies between climate change adaptation and DRR, identifying mutually beneficial opportunities across policies, projects and programmes.

Synergy is achieved if the outcome from interactions between the two interventions is greater than that gained from having the interventions act independently of each other. The synergies between adaptation actions and DRR are crucial for building resilience to climate change and reducing the impact of disasters. Adaptation actions identified in this NAP focus on reducing vulnerability and enhancing the ability of sectors, geographical regions and communities to cope with climate change impacts, such as extreme weather events, floods, droughts, higher temperatures, heat waves and heat stress. Meanwhile, DRR strategies aim to identify, assess, and manage the risks associated with climate hazards. By combining the two approaches, sectors, geographical regions and communities can implement effective measures to mitigate the impact of disasters and enhance their adaptive capacity. Synergies between climate adaptation action and DRR can include the generation, analysis, and interpretation of climate science information (at different temporal and spatial scales), implementing early warning systems, improving infrastructure, strengthening social networks, and promoting ecosystem-based adaptation approaches that help protect against climate hazards.

5.6 Integration of climate change adaptation and gender in annual budgeting

For annual budgeting Ministries, Provinces and Spending Agencies (MPSAs) prepare and implement annual budgets in accordance with policy and ceilings from the MoFNP which capture their key sectoral objectives and activities for the budget year. The MPSAs then develop their budget priorities as well as the total amount of budgets for the prioritized programmes. This identification of

annual priorities and budget preparation should serve as an entry point for the alignment of NAP priorities into the sectoral plans and programmes. Consequently, the MPSAs may:

- Adapt and screen identified sectoral/district priorities against climate vulnerabilities described in the NAP;
- Incorporate short- and medium-term adaptation priorities described in the NAP that are relevant to the sector/district's priorities;
- Reference the sector-specific indicators and targets included in the NAP Monitoring, Evaluation and Learning framework; and
- Invest in human capacities to review climate-change adaptation considerations in budgetary review processes.

As part of the NAP development process tools have been identified for use in screening against climate vulnerabilities and adaption priorities identified in the NAP. MPSAs may adapt these templates to achieve alignment with climate targets and national priorities of key climate change policy documents and frameworks.

Since the budget process is the gateway for resource allocation for the government, it is important to ensure that gender is integrated into the planning and budgeting processes. The gender-responsive budgeting takes into consideration gender concerns and ensures that the different needs and priorities of men and women are incorporated in the process. The Gender Division under the office of the President in Zambia is finalizing the guidelines and checklist for gender-responsive planning and budgeting which will guide government ministries and agencies in mainstreaming gender perspectives in the budgeting process. This means that in the process of preparing and implementing the budgets, Ministries, Provinces and Spending Agencies (MPSAs) would commit resources to identified gender priorities at various levels including implementation, analysis, monitoring and evaluation. Further, this includes budgets allocated for adaptation.

6.0 STRATEGIES FOR IMPLEMENTING ZAMBIA'S NAP

6.1 Implementation Plan

The implementation of identified adaptation priorities in the NAP, will be achieved through stakeholder participation at national and subnational levels, civil society organizations (CSOs), Non-Governmental Organisations (NGOs), Faith Based Organisations (FBOs), cooperating partners, media, private sector, research and academic institutions among others. Government line ministries will coordinate actions within their sectors but will leverage on the capacities and experience of stakeholders to ensure effective implementation. The adaptation actions will be implemented in the medium and long-term. Appendix 1 shows detailed implementation plans using the Monitoring, Evaluation and Learning (MEL) approach. The implementation of adaptation actions will require funding, technical support, and regular monitoring and review to ensure effectiveness of actions.

6.1.1 Integration of adaptation actions at all levels

Integration of adaptation actions entails their incorporation in policies, projects and programmes across sectors. This approach ensures that adaptation strategies and actions are consistent, mutually supportive, synergised, and coherent across all levels of government, promoting more effective and efficient responses to climate change impacts. Integration is done both horizontally and vertically.

Horizontal / Sectoral integration

Horizontal/sectoral integration is key for smooth implementation of adaptation actions. The process requires inclusion of climate change adaptation priorities in national and sectoral policies, strategies, plans, budgets, projects and programmes. This helps to leverage resources and catalyse actions to minimise unnecessary expenditure and avoid duplication of efforts.

Vertical integration

Vertical integration require the involvement of various stakeholders at sub-national level among them public sector, communities, civil society organizations (CSOs), Non-Governmental Organisations (NGOs), Faith Based Organisations (FBOs), cooperating partners, media and private sector. By bringing these actors together, it allows for the exchange of information, good practices, sharing of resources, and collaborative decision-making, enabling a holistic and comprehensive approach to adaptation planning and implementation.

To promote and strengthen adaptation planning and implementation in Zambia, the Local Climate Adaptive Living (LoCAL) mechanism was designed to increase climate change resilience in communities and economies. This increases investments in Climate Change Adaptation (CCA) at the local level through implementation of performance-based climate resilience grants (PBCRG). Ultimately, this contributes to the achievement of the Paris Agreement, the NAP process and the Sustainable Development Goals (SDGs), particularly the specific goals of poverty eradication (SDG1) and climate action (SDG13).

In order to effectively undertake horizontal and vertical integration, Zambia will leverage on relevant tools including the integrative framework for NAPs and SDGs (NAP-SDG iFrame) developed by the LEG, to better explore interlinkages within sectors to optimise the implementation of adaptation activities. The NAP-SDG iFrame makes it easy to build and manage the synergies between development and adaptation goals, allowing for more integrated and cost-effective planning, implementation, monitoring and evaluation (Figure 7).

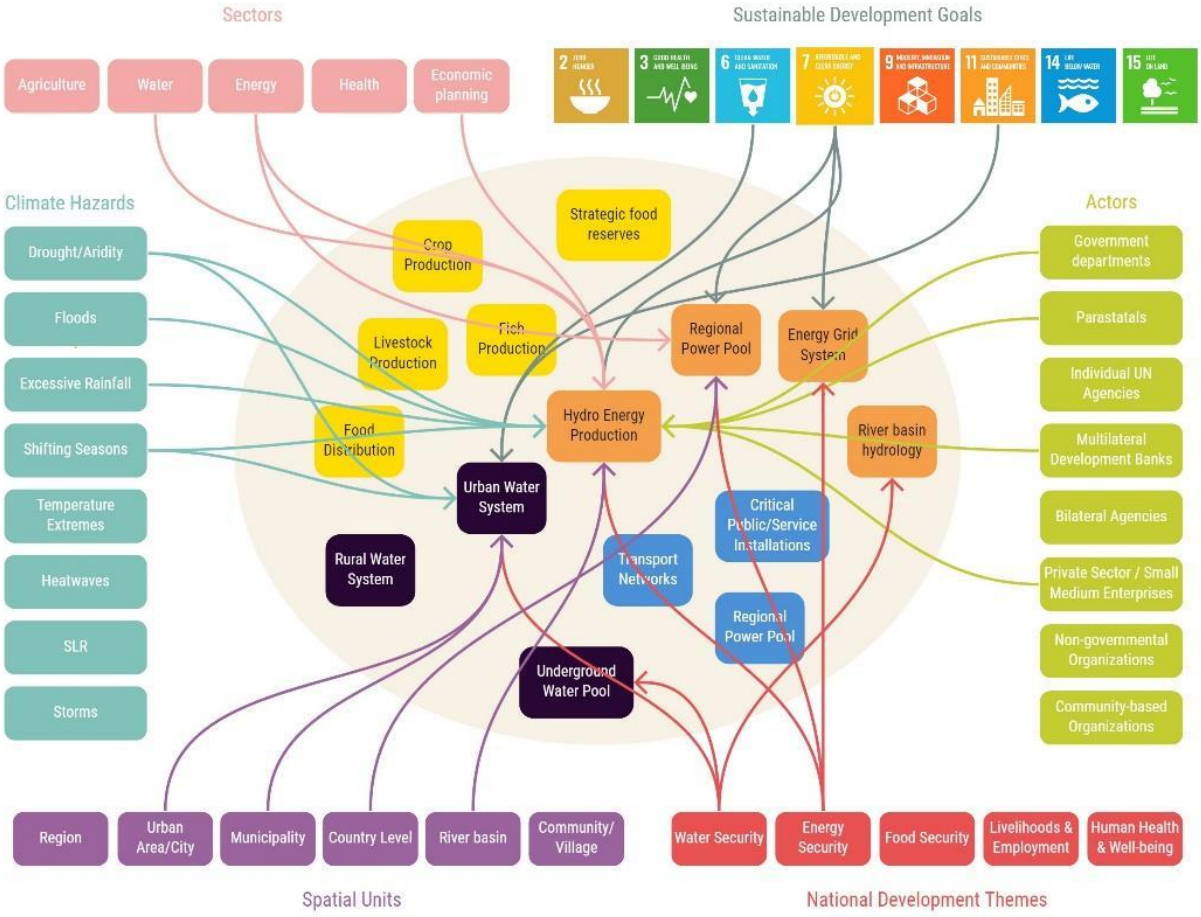

Figure 7. Integrative framework for NAPs and SDGs – example on selected systems. Source: UNFCCC Least Developed Countries Expert Group (2022)

6.2 How to implement the NAP

Implementing the NAP involves translating the national-level strategies and actions into specific measures that address the unique vulnerabilities and adaptation needs at different levels (provinces, districts, wards). This will entail aligning the adaptation actions proposed in the NAP with the Integrated Development Plans (IDPs) at district level and the provincial plans that would have been developed from the National Development Plan. In order to optimize the implementation of the NAP at district and sub-district level, there is need to take into consideration the following context:

- *Understand the district's context as provided in the IDPs*: Conduct a thorough assessment of the district's climate risks, vulnerabilities, and adaptation needs. Consider factors such as geographic location, topography,

socio-economic characteristics, natural resources, and existing development plans and priorities. These aspects may have been identified in other strategic documents developed by the local authorities such as the IDPs.

- *Align local plans with the NAP and NDP*: stakeholders at local level, should be familiar with the NAP and NDP as the identified adaptation priorities in the NAP will relate to the abridged activities identified in the NDP at local level. Further, the district-level adaptation efforts should align with the overall goals, objectives, and strategies outlined in the national and local plans (NDP and IDPs). Using these, documents the relevant priorities and actions in the NAP that relate to the local needs, can then be implemented at the district level.

- *Adaptation planning*: The district-level adaptation plan can be integrated in the IDPs and develop a local plan that outlines the specific strategies, actions, and targets for building resilience to climate change. The plan should consider the unique characteristics, adaptation priorities and needs, and resources of the district and should address sectors such as agriculture, water, infrastructure, health, and livelihoods, among others. It should also integrate with existing district-level development plans, policies, and programmes.

- *Mainstream adaptation into district planning processes*: mainstream adaptation considerations in the NAP into district development planning processes, policies, and programmes to ensure it becomes a crosscutting issue. Some of the plans in which adaptation should be mainstream include land-use planning, infrastructure development, disaster risk reduction, and other relevant policies and programmes.

- *Implement adaptation actions*: Implementation of the identified adaptation actions at district-level include infrastructure upgrades, ecosystem-based approaches, awareness campaigns, early warning systems, livelihood diversification, and capacity-building initiatives. Engage local communities and stakeholders in the implementation process to ensure their ownership and participation.

6.3 Resource mobilization strategy

To successfully implement the NAP, Zambia requires substantial local and international support in form of finance, investments, technical, and technology development and transfer. Resource mobilisation will therefore be imperative in securing the requisite resources to enable its effective implementation. The process will involve identifying, securing and allocation of financial, technical and other resources to implement the identified adaptation actions.

Resource mobilisation will require collaboration among stakeholders including government, civil society, private sector and development partners. Other funding sources will include bilateral and multilateral climate funds. Additionally, as one of the 46 LDCs, Zambia will use its resources under the Least Developed Countries Fund to implement relevant priorities from the NAP. The GCF National Designated Authority and the GEF Operational Focal Points and related entities will be critical in this regard to ensure success. Zambia will also use the NAP to inform the GCF country programme, which prioritises climate investment areas.

To effectively mobilise resources, the NAP resource mobilisation strategy will be formulated. The Strategy will guide financing of identified adaptation priorities from various innovative sources such as green bonds, Public-Private Partnerships (PPP), blended financing, nature debt swaps and credit enhancement.

To ensure transparency, accountability and performance measurement, a tracking and reporting mechanism on resources mobilised and utilised will be developed.

6.4 Institutional Arrangements for Coordinating NAP Implementation

Climate change affects all sectors of the economy, demanding a multi-sectoral, well-coordinated mechanism in order to achieve adaptation and mitigation targets. The Ministry responsible for climate change, being the focal point for the UNFCCC, will provide overall coordination of implementation of the NAP.

Coordination of the implementation of the NAP will be undertaken at national and sub-national levels and will make use of the existing mechanisms outlined in the National Policy on Climate Change. At national level, focal point ministries/departments will coordinate the implementation of the NAP within their respective sectors and will feed into the Technical Committee of Permanent Secretaries and the Council of Ministers on climate change through the ministry responsible for climate change. Below is the description of the roles of Council of Ministers and Technical Committee in the coordination of the implementation of the NAP.

The Council of Ministers

The Council of Ministers, chaired by the Vice President of the Republic of Zambia, will i) provide overall policy direction on adaptation in the country; ii) the mainstreaming and integration of adaptation activities in national and sector plans and policies; iii) mobilize resources for adaptation programmes and projects; iv) promote adaptation programmes that positively impact the

economy and the livelihoods of people; and v) monitor the implementation of climate change adaptation programmes and projects.

The Technical Committee on Climate Change

The Technical Committee of Permanent Secretaries is the main advisory body that feeds in the Council of Ministers on all matters relating to climate change programmes. Some of the key roles of the Technical Committee include; i) approve climate change adaptation programmes and projects; ii) oversee the development, revision and implementation of appropriate policies, legislation, programmes and projects, plans and strategies on adaptation; iii) oversee the monitoring and evaluation of the implementation of climate change adaptation programmes and projects; iv) facilitate the implementation of international adaptation obligations under the Convention; and v) provide technical direction on adaptation and means of implementation to the various sectors.

The Ministry responsible for climate change is the secretariat of the Technical Committee and the Council of Ministers. In this regard, it will receive M&E reports from sectors, and will compile and submit reports to the Technical Committee of Permanent Secretaries and Council of Ministers. Additionally, it will coordinate the preparation and submission of country reports on adaptation to the UNFCCC.

Coordination at sub-national level will be undertaken by WDCs at community level, DDCCs at district level and PDCCs at provincial level. Below is the description of the roles of WDCs, DDCCs and PDCCs.

Ward Development Committees

Coordination of implementation adaptation actions at community level will be undertaken by the WDCs. This will involve mainstreaming of adaptation in the ward and constituency development plans and budgets, and will report to the DDCCs.

District Development Coordinating Committees

The DDCCs will coordinate implementation of adaptation actions at district level and will ensure that state and non-state actors operating in the district collaborate on the implementation of adaptation actions. They will mainstream adaptation in the Integrated Development Plans (IDPs) and will report to the PDCCs. Additionally, the DDCCs will provide oversight to the WDCs regarding the execution of adaptation actions at that level.

Provincial Development Coordinating Committees

The PDCCs will facilitate the participation of state and non-state actors in the implementation, monitoring and reporting on progress made in the implementation of the NAP at provincial level. They will mainstream adaptation in provincial level plans. The PDCCs will also provide oversight to the DDCCs regarding the execution of NAP. In addition, the PDCCs will feed into the Cluster Advisory Groups (CAGs) at sectoral level as well as the NDCC at national level.

Table 9 below provides a list of stakeholders and their responsibilities in the implementation of the NAP.

Table 9. Roles and responsibilities of key stakeholders

Stakeholder	Role
Public	
Finance and National Planning	Responsible for resource mobilization
Agriculture	Collaborate in the implementation climate smart agriculture and provision of training for farmers in climate smart agriculture.
Justice	Drafting of legislation related to green economy and climate change
Infrastructure, Housing and Urban Development	Promote green and climate resilient infrastructure
Energy	Responsible for the development and promotion of green and climate resilient energy sources
Technology and Science	Develop affordable and appropriate green growth, adaptation and mitigation technologies.
Health	Mainstreaming and strengthening of the climate resilience of the healthy systems
Education	Promote the mainstreaming and training of the public in green growth and climate change
Gender	Engendering implementation of the NAP
Green Economy and Environment	Provision of climate and early warning information and services The Ministry also hosts the National Designated Authority to the GCF, serving as the interface between the Government of Zambia and the GCF The ministry also host the Forestry Department that will coordinate the implementation of adaptation actions in the forestry sector.
Disaster Management and Mitigation Unit	Disaster risk reduction (DRR) and management
Local Government and Rural Development	Promote green and climate resilient practices and interventions in all local development sectors of the district
Tourism	Promote green and climate resilient tourism
Fisheries and Livestock	Facilitate and support the development and implementation of climate smart fisheries and livestock practices
Mines and Mineral Development	Promote green and climate resilient mining and mineral explorations practices
Water Development and Sanitation	Responsible for management and provision water to enhance climate change adaptation and mitigation
Commerce, Trade and Industry	Enhance the coordination of public and private sectors to facilitate their participation in green and climate resilient trade
Lands and Natural Resources	Promote conservation of natural resources and ecosystems
Small and Medium Enterprises	Responsible for creating and promotion of green and climate resilient business opportunities
Community and Social Services	Mobilization of local communities in green and climate resilient programmes
Youth, Sports and Arts	Mobilization of youths in green and climate resilient programmes
Non-state actors	
Academia and Research	Conduct Research and development to inform green growth, adaptation and mitigation

Stakeholder	Role
Institutions	interventions
Private sector	Promote and enhance private sector participation in green and climate resilient business practices; Provision and mobilization of financial and other resources, technical assistance as well as capacity building for green and climate change interventions; Promote the accessibility and provision of climate finance and insurance to stakeholders for green and climate change interventions
Private Media	Facilitate disseminating of the policy to the general public.
Civil society	Promote awareness, campaigns, advocacy and adoption of green and climate change interventions; Implementation of adaptation actions, monitoring, evaluation and reporting
Traditional and Indigenous Leadership	Enhance community participation including traditional, local and indigenous, and preservation of indigenous technical knowledge to facilitate the implementation of green growth and climate resilient interventions
Faith-based organizations	Awareness creation, lobbying and advocacy; Implementation of adaptation actions, monitoring, evaluation and reporting
Cooperating partners	
Donors, multilateral and bilateral partners	Providing technical, technology and financial support

6.5 Capacity building

The capacity gaps for planning, coordination and implementation of adaptation actions were identified at national and sub-national levels. The assessment of capacity gaps for adaptations was undertaken at three levels, namely (a) individual level- skills/expertise and/or (b) institutions and organizations level, (c) system level. The capacity gaps identified were categorised according to the following main themes; Leadership; Information, Data and Analysis; Resource Mobilization; Knowledge Management; Implementation and management; Monitoring, Learning and Accountability; Research and Technical Capacities; Social and Cultural; and Multi-Stakeholder Dialogue Processes.

Refer to Table 10 presenting capacity gaps identified and proposed capacity-building actions.

*Table 10. Capacity gaps and actions**

Capacity Gaps	• **Capacity building action**
Knowledge Management	• Training in data collection, analysis and information dissemination • Training in the generation and interpretation of climate information services and products including climate data rescue and archives • Expansion of the hydro-met network for collection and timely disseminating weather and climate information • Training of sector leads, WDC, PDCC, DDCC and civil society on climate change, NAPs and Nature-based Solution (NBS) • Strengthen disease control in crops production, livestock and fisheries • Training of Extension staff in climate smart agriculture, climate finance, small scale organic fertilizer production, postharvest handling, preservation, utilization, value addition, food processing and marketing • Training of Extension staff in integrated water resource management, water harvesting technics and irrigation technologies • Exchange visits to appreciate best practices in different AERs • Development and disseminate of guidelines for NBS activities (e.g., beehives, small ruminants, seedlings for agro-forestry, development of infrastructure for disease control, purchase of fisheries materials) • Training media houses and other relevant stakeholders in documenting and communicating (in an understandable manner) the climate science in the NAP • Information exchange between producers (climate science experts) and users of climate information • Orientation of civil society, NAIS and media houses on capturing and dissemination NAP implementation progress and impacts • Enhance in-service trainings
Leadership	• Strengthen coordination for the implementation NAP for HQ, WDC, PDCC, DDCC and civil society • Training planners in resources mobilization and tracking • Recruit a NAP Champion to help with dissemination of the NAP actions
Information, Data and Analysis	• Orienting key stakeholders to the platform for information sharing system for monitoring NAP implementation
Resource mobilization	• Training planners and stakeholders in accessing climate finance and resource mobilization and project development for NAP

Capacity Gaps	• Capacity building action
	implementation • Develop systems and tools and undertake training of stakeholders in tracking and reporting climate finance for adaptation
Implementation and management	• Training of planners in strategic planning and policy reviews • Training the DDCC in project management • Develop and train stakeholders in the application of climate smart construction codes for infrastructure and roads • Enhanced provision of early warning systems, surveillance, climate services • Strengthen the institutional and human resource capacity in order to effectively and efficiently address all aspects of climate change at national, provincial, district and local levels • Mainstream climate change issues, including finance, into national and sub-national budgets and plans • Support capacity strengthening of SMEs to adopt green technologies along various value chains • Support mechanization and irrigation with increased access to financing
Monitoring, Learning and Accountability	• Training of stakeholders in data capturing, monitoring and reporting on MEL and MRV systems at national and sub-national levels
Research and Technical Capacities	• Re-characterization of AERs • Organize a national symposium for disseminating evidence-based research from pilots for upscaling • Strengthen capacity in development climate resilient crop, fish and livestock varieties/breeds • Strengthen the technical capacity of relevant Government personnel in Carbon Markets • Strengthen the capacity of local technological innovation centers to help strengthen institutional technology generation and transfer through a learning-by-doing approach
Gender, Social and Cultural	• Organize training for the implementation of the climate change Gender Action Plan (ccGAP, 2018) • NAP orientation workshop for Gender Focal Points (GFP) in ministries and leaders in non-state actors • Training workshop of GFP in setting monitoring gender and social inclusion NAP indictors and gender budgeting • Training of planners in gender transformative methodologies and approaches
Multi-stakeholder Dialogue Processes	• Strengthen coordination for multi-stakeholder engagement at all levels using existing structure; i.e., WDC, PDCC, DDCC, and NDCC • Strengthen the participation of women, children, youth and persons with disability in the negotiation process • Encourage/Promote stakeholder's participation and partnerships in climate actions;

*Details of the capacity gaps and actions are in the NAP Capacity Needs Assessment Report, 2023

7.0 MONITORING AND REVIEW OF THE NAP IMPLEMENTATION

Monitoring and reviewing of the NAP implementation at national and sub-national levels will involve tracking and reporting progress of adaptation actions using key performance indicators derived from the NAP MEL framework[3] in Appendix 1. This framework contains adaptation actions, key performance indicators, baseline, targets, frequency of monitoring and reporting, and responsible institutions.

At national level, the lead institutions will be responsible for monitoring progress on the implementation of the NAP within their respective sectors. At sub-national level, implementation of the NAP will monitored through the PDCCs, DDCCs and WDCs structures. These monitoring reports will be submitted to the ministry responsible for climate change for consolidation and submission to the Technical Committee of Permanent Secretaries and the Council of Ministers on Climate Change. The approved reports from the Council of Ministers will be shared with state and non-state actors at national and international levels.

3 For more details, please refer to the NAP MEL framework, 2023

8.0 COMMUNICATING AND REPORTING ON THE NAP

8.1 Communicating the NAP

Communicating the NAP is guided by the already existing communication strategy for NAP (2022) which augments the National Climate Change Communication Strategy. Successful implementation of the National Adaptation Plan requires a proactive communications strategy, aimed at promoting ownership of the National Adaptation Plan among the public and development partners. The NAP Communication Strategy is based on a development communications approach, with key principles geared toward creating awareness; Inspiring behaviour change; encouraging practice; disseminating information and knowledge and ensuring inclusiveness and involvement (specific emphasis on gender equity, equality and parity); and promoting transparency and accountability.

8.2 Reporting on the NAP

This NAP communicates identified adaptation priorities, implementation and support needs, plans and actions, key performance indicators and their reporting systems established through a robust MEL framework. It serves as the first Adaptation Communication for Zambia pursuant to Article 7.10 of the Paris Agreement.

Reporting on adaptation actions for Zambia will follow a two-tier-reporting system at national and international levels and follow existing mechanisms and guidelines.

At national level, reporting will be through the NAP Monitoring and Evaluation framework from the WDCs, DDCCs and PDCCs. The PDCCs will in turn submit reports to the Ministry responsible for climate change. The Ministry responsible for climate change will receive and consolidate sectoral reports on the implementation of the NAP for submission to the Technical Committee of Permanent Secretaries and the Council of Ministers on Climate Change. Reports on the NAP will be shared with stakeholders including civil society organizations and the private sector to ensure transparency and accountability.

At international level, reporting on adaptation actions will be in accordance with the reporting obligations as outlined in the Convention and the Paris Agreement. This will be through the Biennial Transparency Report (BTR), the NDC reporting mechanisms and the National Communication.

The subsequent reporting of the NAP will be at two indicator levels, the first based on the outputs in the NAP MEL framework while the second based on outcome aggregate indicators listed below as provided for in the NDC (2021):

i) The level of resilience of natural or physical systems achieved;
ii) The level of adaptive capacity of human system attained;
iii) The level of knowledge base for adaptation planning and response; and
iv) The level of capacity of human resource-base for addressing climate change.

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Appendix 1: Implementation schedules in Monitoring, Evaluation and Learning (MEL)

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
SECTOR NAME: AGRICULTURE									
Livestock & crop failure.	Promotion of irrigation and efficient use of water resources.			#. of farmers using efficient irrigation systems disaggregated by sex.	50,000	80,000	MoA Reports, ZNFU Reports	Annually	MoA
	Irrigation schemes operationalized			#. of irrigation schemes fully operational	2	7	MoA Reports	Annually	MoA
	Irrigation infrastructure constructed and rehabilitated			#. of dams constructed.	1	6	MoA Reports	Annually	MoA
				#. of dams rehabilitated	0	20	MoA Reports	Annually	MoA
	Strengthen research in climate change and windstorm-based climate indices								
	New irrigation farming developed			Hectarage of area under irrigation	1,053	2,453	MoA Reports	Annually	MoA
	Income diversification				TBA				
	Agriculture insurance				TBA				
	Strengthening disease surveillance and control activities				TBA				
Reduced interest in agriculture	Providing financial incentives to the agriculture sector			# of GRZ policy measures that contain incentives for adaptation.	2	7	FISP Implementation Manual, National Budget Presentation. (Yellow Book)	Annually	MoA/ MoF
				# of matching grants awarded and disbursed to agro-based SMEs	66	76	CEEC Reports	Quarterly	MoA/ MoF

Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
	Introduction of climate resilient and drought tolerant crop types and varieties.			# of farmers adopting drought tolerant crops disaggregated by sex.	600,000	2,100,000	MoA Reports & Seed companies	Quarterly	MoA
				#. of drought-resilient crop varieties developed	42	53	MoA Reports	Annually	MoA
Reduced livelihood income & diversification	Agro-processing & value addition			# of agro-processing plants established and operationalized.	0	1	MCTI Reports, MoA Reports, MSMED Reports	Annually	MoA
				# of value chains established	9	29	IAPRI (Rural Agricultural	Annually	MoA
							Livelihood Survey Reports)		
Reduced agricultural productivity	Promotion of Climate-Smart Agriculture			Hectarage of area brought under CSA	300,000	310,000	CSAAZ, MoA Reports,	Quarterly	MoA/ CFU/
									IAPRI
				Maize average yield under CSA (tons /Ha)	3.5	8.5	Conservation Farming	Annually	MoA/ CFU/
							Unit & RALS.		IAPRI
				# of farmers adopting CSA practices disaggregated by sex.	1,000,000	3,500,000	Conservation Farming, Unit & RALS.	Annually	MoA/ CFU/
									IAPRI
	Increased extension services			Camp Extension Officer (CEO) / farmer ratio	0.666666667	0.25	MoA Reports	Quarterly	MoA
				# of extension visits made by a CEO in a month	2	6	MoA Reports	Quarterly	MoA
				# of farmer training activities conducted by a CEO	1	3	MoA Reports	Quarterly	MoA
				# of farmer field days made in a year.	1	3	MoA Reports	Annually	MoA

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
	Encouraging precision agriculture/ use of ICTs			# of extension officers using ICTs disaggregated by sex	400	26,620	MoA Reports	Quarterly	MoA
	Up-scaling on dissemination of climate services			% farmers accessing information on CSA disaggregated by sex.	30	80	MoA / NAIS Reports	Quarterly	MoA
	Planting of trees and vegetation to minimize dust				TBA				
	Strengthen soil and water conservation technologies				TBA				
	Plant trees and allow vegetation (grass included) to regenerate in areas that are not utilised				TBA				
	Promote tree planting				TBA				
	Promote sustainable land management				TBA				
	Promote Integrated Pest Management (IPM)			Amount of pest control chemicals procured (ltrs)	110,000	985,000	Forecast & Post-Harvest	Annually	MoA
							Surveys		
	Planting of grass, & trees as hedges and wind breaks				TBA				
	Encouraging crop diversification to drought-tolerant crops and varieties				TBA				
	Promote conservation agriculture (CA)				TBA				
	Promote agroforestry			Hectarage of area brought under agroforestry	15,000	40,000	MoA Reports, REDD+ Project Reports.	Annually	MoA & FD

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
				# of agroforestry seedlings planted.	7,000,000	19,500,000	MoA Reports, REDD+ Project Reports.	Quarterly	MoA & FD
				# of farmers adopting climate-smart agroforestry disaggregated by sex.	3,000	15,000	MoA Reports, REDD+ Project Reports.	Annually	MoA & FD
Crop failure & food insecurity	Diversification in agriculture			% farmers practicing mixed farming disaggregated by sex.	40	100	MoA Reports,	Quarterly &	MoA
								Annual	
	Promote alternative livelihoods such as rice farming, beekeeping, etc.				TBA				
	Enhancing market linkages for the produce			# of provincial bulking/ aggregation centers.	0	10	MoA Reports	Annually	MoA
				# of businesses linked to value-chains	0	4,000	MoA Reports	Quarterly	MoA
	Access to mechanization			# of farmers using mechanized agriculture disaggregated by sex	1,300	35,013,000	MoA Reports	Annually	MoA
				Hectarage of area under mechanized farming	2,275	8,875	MoA Reports	Annually	MoA
	Enhance food production and post-harvest and preservation techniques			Post-harvest losses of crops (%)	30	45	Post-Harvest Survey Reports	Annually	MoA/ Zamstats
	Promote seed conservation of indigenous crop varieties				TBA				

Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
	Improved storage facilities for produce at the national level.			Grain storage capacity (MT)	966,000	2,466,000	FRA Reports	Annually	MoA/ FRA
	Promote application of climate smart resilient codes in for roads development (including roads in National Parks and Game Management Areas and in high potential agricultural areas)			Km of all-weather gravel feeder roads rehabilitated	TBA	1,400	MoA Reports (Zamgrow project)	Annually	MoA/ RDA
Poor Nutrition	Health education on how to prepare and use available foods			# of health facilities offering health education on food nutrition	TBA	TBA	MoA Reports	Quarterly	MoA
	Promote food fortification			# of foods fortified	2	5	MoA Reports	Annually	MoA
	Promote health education on how to prepare and use available foods				TBA				
	Promote cultivation of fortified food crops (orange-fleshed sweet potatoes and maize)				TBA				
	Promoting the preparation and preservation of foods				TBA				
	Promotion of production of crops enhancing balanced diets				TBA				

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
	Promoting use of indigenous food and crop varieties which are tolerant to droughts				TBA				
	Promotion use of indigenous and local knowledge in food production systems				TBA				
	Promote supplementation of feed for wildlife during drought periods				TBA				
	Diversifying foods and enhanced diet supplement				TBA				
	Diversifying growing of indigenous plants, roots, tubers and fruits				TBA				
	Infant and child feeding at under-five clinics and School Health Nutrition in schools				TBA				
	Enhancing alternative livelihoods in low-rainfall regions				TBA				
	Promoting the preservation of indigenous foods			% of households practicing dry food preservation disaggregated by sex of the head of household	60	140	MoA Reports	Annually	MoA
				# of health facilities promoting best practices in food preservation methods.	No data	TBA	MoA Reports	Annually	MoA

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
SECTOR NAME: FISHERIES									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Changes in fish species distribution	Adoption of alternative livelihoods by households in fish dependent communities			# households with alternative livelihoods disaggregated by sex of household head	400	750	MFL Reports & Zamstats	Annually	MFL
				Type of climate-resilient fish species	30	40	MFL Reports	Quarterly	MFL
	Promote utilization of fishponds and fish cages			# of farmers utilizing fishponds and cages disaggregated by sex.	15,354	16,204	MFL Reports	Quarterly	MFL
				# of cooperatives utilizing fishponds and cages	50	110	MFL Reports	Quarterly	MFL
Declining fish stock in natural water bodies	Strengthen community sensitization and enforcement of fisheries regulations including fish bans			# of arrests during fish bans per year	70	125	MFL Annual Reports	Annually	MFL
				# of patrols conducted around fishing water bodies	350	794	MFL Annual Reports	Annually	MFL
	Promote aquaculture development and other forms of alternative livelihood in fishing communities (utilization of fish cages and pens)			# of fishing communities utilizing fish cages and pens	110	190	MFL Reports	Annually	MFL

Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
				Number of people trained in basic aquaculture development disaggregated by sex.	TBA	TBA	MFL Reports	Annually	MFL
	Conservation of habitats to support healthy fish stocks				TBA				
Possibility to flood ponds and loss of farmed fish	Improve pond site selection and design processes			# of pond sites meeting the prescribed standard and design	500	800	MFL Reports	Quarterly	MFL
	Sustainable fisheries Management				TBA				
	Strengthening of the early floods warning systems and preparedness				TBA				
	Strengthen aquaculture regulations			Aquaculture regulations enforced	TBA	TBA	MFL Reports	Annually	MFL
Habitat destruction and water quality deterioration	Protection and restoration of critical habitats (Fish breeding areas)			# of fish breeding areas protected	40	90	MFL Reports	Quarterly	MFL
				# of fish breeding areas restored	TBA	TBA	MFL Reports	Annually	MFL
Increased possibility of fish diseases and outbreaks	Control the spread of fish disease to other natural water bodies			# of fish disease studies conducted	TBA	TBA	MFL Reports	Annually	MFL
				# of fish monitoring and surveillance visits conducted.	TBA	TBA	MFL Reports	Annually	MFL
	Strengthen monitoring among fishers and fish farmers			# of fish farms monitored for optimal growth	578	978	MFL Reports	Quarterly	MFL
	Adoption of				TBA				

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
	alternative livelihoods such as rice farming, beekeeping, etc.								
	Strengthening research in climate sensitive diseases				TBA				
	Engaging communities in alternative income generating activities outside of crop farming				TBA				
Run-offs in hilly areas cause soil erosion and affecting habitats around river mouths	Sensitize communities towards sustainable fish farming practices			# of communities sensitized about sustainable fish farming practices	650	1,100	MFL Reports	Quarterly	MFL
	Rehabilitate aquatic environments around river mouths			Kilometer of aquatic environments rehabilitated around river mouths	100	150	MFL Reports	Annually	MFL
SECTOR NAME: FISHERIES									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Changes in fish species distribution	Adoption of alternative livelihoods by households in fish dependent communities			# households with alternative livelihoods disaggregated by sex of household head	400	750	MFL Reports & Zamstats	Annually	MFL
				Type of climate-resilient fish species	30	40	MFL Reports	Quarterly	MFL
	Promote utilization of fishponds and fish cages			# of farmers utilizing fishponds and cages	15,354	16,204	MFL Reports	Quarterly	MFL

Impact of Climate Change	Adaptation Measure	Medium term (2023-2025)	Long term (2026-2035)	Key Performance Indicators	Baseline	Target *(See note above)*	Data source/ Means of Verification	Frequency	Responsibility
				disaggregated by sex.					
				# of cooperatives utilizing fishponds and cages	50	110	MFL Reports	Quarterly	MFL
Declining fish stock in natural water bodies	Strengthen community sensitization and enforcement of fisheries regulations including fish bans			# of arrests during fish bans per year	70	125	MFL Annual Reports	Annually	MFL
				# of patrols conducted around fishing water bodies	350	794	MFL Annual Reports	Annually	MFL
	Promote aquaculture development and other forms of alternative livelihood in fishing communities (utilization of fish cages and pens)			# of fishing communities utilizing fish cages and pens	110	190	MFL Reports	Annually	MFL
				Number of people trained in basic aquaculture development disaggregated by sex.	TBA	TBA	MFL Reports	Annually	MFL
	Conservation of habitats to support healthy fish stocks				TBA				
Possibility to flood ponds and loss of farmed fish	Improve pond site selection and design processes			# of pond sites meeting the prescribed standard and design	500	800	MFL Reports	Quarterly	MFL
	Sustainable fisheries Management				TBA				

Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
	Strengthening of the early floods warning systems and preparedness				TBA				
	Strengthen aquaculture regulations			Aquaculture regulations enforced	TBA	TBA	MFL Reports	Annually	MFL
Habitat destruction and water quality deterioration	Protection and restoration of critical habitats (Fish breeding areas)			# of fish breeding areas protected	40	90	MFL Reports	Quarterly	MFL
				# of fish breeding areas restored	TBA	TBA	MFL Reports	Annually	MFL
Increased possibility of fish diseases and outbreaks	Control the spread of fish disease to other natural water bodies			# of fish disease studies conducted	TBA	TBA	MFL Reports	Annually	MFL
				# of fish monitoring and surveillance visits conducted.	TBA	TBA	MFL Reports	Annually	MFL
	Strengthen monitoring among fishers and fish farmers			# of fish farms monitored for optimal growth	578	978	MFL Reports	Quarterly	MFL
	Adoption of alternative livelihoods such as rice farming, beekeeping, etc.				TBA				
	Strengthening research in climate sensitive diseases				TBA				
	Engaging communities in alternative income generating activities outside of crop farming				TBA				

Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Run-offs in hilly areas cause soil erosion and affecting habitats around river mouths	Sensitize communities towards sustainable fish farming practices			# of communities sensitized about sustainable fish farming practices	650	1,100	MFL Reports	Quarterly	MFL
	Rehabilitate aquatic environments around river mouths			Kilometer of aquatic environments rehabilitated around river mouths	100	150	MFL Reports	Annually	MFL

SECTOR NAME: WILDLIFE									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2025-2035)**	**Key Performance Indicators**	**Baseline**	**Target***(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Reduced socioeconomic benefits from wildlife resources	Adoption of alternative livelihoods by households that are dependent on natural resources				TBA				
	Provision of water points in national				TBA				
	Awareness of animal behaviour and how to interact with wildlife.				TBA				
	Training community members as blasters aimed at scaring animals from human settlements				TBA				
	Protection of wildlife breeding grounds				TBA				
	Conservation of habitats to support wildlife in protected and open areas				TBA				
	Strengthen the operational capacity of Community Resource Boards (CRB) including knowledge of climate				TBA				
	Promote non-water based tourism products and packages				TBA				
	Promote public private community partnerships in the sustainable management of wildlife resources.			# of collaborative public private community partnerships developed in sustainable management of wildlife	7	12	MOT Reports	Quarterly	Ministry of Tourism
	Improve planning and management of wildlife estates			# of general management plans for National Parks developed	8	20	MOT Reports	Quarterly	Ministry of Tourism

				# of general management plans for Game Management Areas developed	19	37	MOT Reports	Quarterly	Ministry of Tourism
	Enforce equitable benefit sharing arrangements among government, communities and the private sector in the management of wildlife resources.			# of protected areas with equitable benefit sharing arrangements being enforced	29	33	MOT Reports	Annually	Ministry of Tourism
	Promote the development and implementation of forest fire management (plans) in PFAs and open forests			# of National Parks with fire management plans	4	5	MOT Reports	Annually	Ministry of Tourism
	Development of participatory village land use plans			# of Game Management Areas with integrated land use plans	TBA	TBA	MOT Reports	Annually	Ministry of Tourism
	Creating community wildlife ranches and reserves as an additional conservation effort for the conservation of endangered species as well as biodiversity enhancement			# of private game ranches established	43	168	MOT Reports	Quarterly	Ministry of Tourism
	Strengthening research in climate sensitive diseases				TBA				
	Strengthening disease surveillance and control activities				TBA				
	Establish community game ranches/ community parks for the conservation of wildlife species			# of community game ranches/ community parks established	2	12	MOT Reports	Quarterly	Ministry of Tourism
Increased wildlife habitat loss due to increased incidences of fire	Develop and implement fire management plans for national parks and game management			# of National Parks with fire management plans in addition	4	5	MOT Reports	Annual	Ministry of Tourism

	areas			to GMP					
	Encouraging participatory approach to rangeland management involving communities living in or around wildlife-protected areas, and who depend on rangeland resources for their livelihoods.				TBA				
	Provision of water points in water stressed areas including national parks (weirs, dams and reservoirs.				TBA				
Increased Human wildlife conflicts	Relocating humans from wildlife corridors			# of mapped wildlife corridors and refuges	2	7	MOT Reports	Annual	Ministry of Tourism
	Protection of wildlife habitats and corridors								
	Intensive Management programs such as drilling water points for wildlife				TBA				
	Protection of wildlife breeding grounds								
	Relocating humans from wildlife corridors				TBA				
Increased incidence of wildlife diseases due to increased rainfall and/or flooding	Establish a mechanism for surveillance of the well-being of wildlife			Existence of a strategy for surveillance and control of wildlife diseases	5	10	MOT Reports	Annual	Ministry of Tourism
	Supplementary feeding and water provision for wildlife				TBA				

SECTOR NAME: INFRASTRUCTURE & TRANSPORT									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2025-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Increased deterioration of road infrastructure	Increase funding for regular maintenance of existing road infrastructure and buildings			Kilometers maintained in compliance to climate-sensitive national construction codes and standards	250	2,250	RDA Annual Report	Every 5 years	RDA/ DID-MLGRD
	Increased investments in the development of new climate resilient infrastructure i.e. roads, bridges, etc.			# of climate resilient infrastructure constructed *Include roads, bridges etc.*	1	11 average 200km each	RDA Annual Report	Annually	RDA/ DID-MLGRD
	Development and implementation of enhanced windstorm-resilient standards and building codes			# of roads which meet the revised climate resilience road codes and standards	No data	TDA	RDA Annual Report	Annually	RDA/ DID-MLGRD
	Promotion of climate resilient infrastructures				TBA				
	Designing climate proof infrastructure				TBA				
	Promotion of climate resilient infrastructures				TBA				
	Utilization of alternative forms of transport such as rail and air in accordance with climate smart codes				TBA				
	Enhanced verification and enforcement of revised road codes and standards				TBA				
Compromised quality and strength of buildings	Enforcement of building codes			Existence of Integrated Development Frameworks (IDFs) which incorporate climate change issues	0	1	Inspection reports	By 2026	DPI- MIHUD

	Revision of building codes and standards			Existence of building codes and standards	0	1	Building Codes and Standard document	By 2028	MIHUD
	Enforcement of construction codes			% of budget amounts allocated to enforcement of building codes and standards	0	10	Ministry Annual Report	Annually	MIHUD
	Revision of building codes and standards to include provision for fire resistant material			# of institutions with installed fire control measures and equipment	No data	All	Ministry Annual Report	Annually	MIHUD
	Construction of climate smart infrastructure				TBA				
	Develop access roads to social amenities such as clinics and schools based on climate resilient infrastructure codes and standards				TBA				
	Promote Insurance of property against loss to fires and other climatic hazards			# of infrastructure insured against climate induced loses	No data	TBA	Inspection Reports	Annually	MIHUD
Increased demand for green and climate resilient buildings	Increase investment in the construction of climate-smart buildings			% of climate resilient and green buildings established	0	30%	Ministry Annual Report	Annually Starting 2029	MIHUD
	Build the capacity by training stakeholders on the principles for green and climate resilient building designs			% of stakeholders trained in green and climate resilient building designs	10%	60%	Ministry Annual Report	Annually	MIHUD
	Enhance revision of building codes and standards				TBA				

	Promote insurance for agriculture, infrastructure and buildings				TBA				
	Shift to more cost-effective measures such as use of green energies to power in buildings			# of buildings powered with green energies	No data	TBA	Ministry Annual Report	Annually	MIHUD
	Enhance climate proofing of water infrastructure				TBA				
	Undertake training for climate proofing of infrastructure				TBA				
	Establishing fire management infrastructure in and around protected forest areas				TBA				
	Development of fire risk maps which specifies high and low risks				TBA				
	Installation of fire control measures infrastructure in tourism sites				TBA				
	Investing in climate resilient water infrastructure				TBA				
	Increased investments in the development of new climate resilient infrastructure i.e. roads, bridges, etc.				TBA				
	Design and construct climate proofed infrastructure for health services				TBA				
	Promotion of best practices of waste management			% of institutions/households subscribing to waste disposal	10%	40%	Ministry Annual Report	Annually	MLGRD
	Revision of building				TBA				

	codes and standards								
	Enhance designing and construction of climate proofed infrastructure				TBA				
	Promotion of climate resilient infrastructures				TBA				
Increased infrastructure maintenance costs	Develop maintenance schedule for every infrastructure			# of infrastructure with maintenance schedule	No data	TBA	Ministry Annual Report	Annually	MIHUD
	Development of climate resilient building codes and standards				TBA				
	Promote insurance of infrastructure and buildings				TBA				
	Revision of building codes and standards				TBA				
	Revision of building codes and standards to include provision for fire resistant material				TBA				
	Regular maintenance of existing road infrastructure				TBA				
SECTOR NAME: TRANSPORT									
Impact of climate change	*Adaptation Measure*			*Key Performance Indicators*	*Baseline*	*Target*	*Data source/ Means of Verification (MoV)*	*Frequency*	*Responsibility*
Loss of access to social amenities	Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water, lodges, etc.			# of climate-resilient access roads to social amenities constructed	TBA	TBA	Ministry Annual Report	Annually	DID- MLGRD
	Develop				TBA				

	maintenance schedule for every infrastructure								
	Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water, lodges, etc.				TBA				
	Promotion of climate resilient infrastructures				TBA				
Difficulty in transporting goods and services to different parts of Zambia	Development of alternative transport infrastructure i.e., airports and railways based on climate resilient infrastructure codes and standards			# of provincial airports upgraded.	0	5	Ministerial Reports	Annually	MTL
				# of airports constructed	0	3	Ministerial Reports	Annually	MTL
	Promotion of climate resilient infrastructures				TBA				
	Utilization of alternative forms of transport such as rail and air				TBA				
	Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water, lodges, etc.			# of railway lines constructed	0	7	Ministerial Reports	Annually	MTL
	Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water,			# of harbours constructed	0	23	Ministerial Reports	Annually	MTL
				# of pontoon landing bays constructed	0	13	Ministerial Reports	Annually	MTL
				# of passengers using air transport disaggregated by sex	1,653,077 (2022)	1,828,132	Passenger Manifest	Annually	MTL

	lodges, etc.			Volume of cargo transported by air	1,657,022 (2022)	17,239,605	Cargo Manifest	Semi Annually	MTL-Zambia Airport Corporation Limited
				# of passengers using rail transport disaggregated by sex	649,620 (2022)	642,202	Passenger Manifest	Semi Annually	MTL-Zambia Railways Limited
				Volume of cargo transported by rail	894,124 (2022)	1,406,404	Cargo Manifest	Semi Annually	MTL-Zambia Railways Limited
				Volume of cargo transported using water transport	185,801.92 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-Mpulungu Harbour
				# of passengers using road transport disaggregated by sex	65,122,740 (2022)	TBA	Passenger Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA
				Volume of cargo transported by road	34,308,418.58 (2022)	TBA	Cargo Manifest	Semi Annually	MTL-RTSA

SECTOR NAME: FORESTRY									
Impact of Climate Change	**Adaptation Actions**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key performance indicators**	**Baseline**	**Target *(See note above)***	**Data source/ Means of Verification**	**Frequency**	Responsibility
Increased forest loss/tree mortality	Promote afforestation and reforestation			Hectarage replanted segregated by species	4,737	14,737	**FD/ZAFFICO**	Every 5 years	Forestry Dept.
				# of forests nurseries established	116	316	**FD/ZAFFICO**	Quarterly	Forestry Dept.
				# of seedlings raised segregated by species	12,500,000	TBA	FD/ZAFFICO	Quarterly	Forestry Dept.
	Protection of water catchments located in forests			TBA					
	Sustainable Forest Management			TBA					
	Reforestation along river channels			TBA					
	Manage species and habitats to protect ecosystem functions			TBA					
	Promote tree planting to increase tree cover/hedges and windbreaks			TBA					
Moisture stress/ changes in phenology start and end of growing season	Promote Assisted Natural Regeneration (ANR) in indigenous forests / Restoration of degraded areas			Hectarage of forests regenerated/ restored (forest gain)	27,000	1,027,000	FD Annual Report	Annually	Forestry Dept.
	Promote participatory forestry management (CFMGs)			# of CFMGs	165	465	FD Quarterly Report	Quarterly	Forest Dept
				Hectarage under community management	2,369,501	8,369,501	FD Annual Report	Annually	Forest Dept
				# of households participating in CFMGs disaggregated by sex of head of household	Male: TBA Female: TBA	FD Quarterly Report	Quarterly	Forestry Dept.	FD Quarterly Report

Reduced Non-Wood Forest Products	Promote alternative sources of livelihoods for forest dependent communities			Types of alternative livelihoods initiatives promoted (beekeeping, livestock rearing, collection of mushroom/caterpillars, carbon, mushroom production etc.) collection of mushroom/caterpillars, carbon, mushroom production etc.)	4	12	Annual/Reports	Yearly	Forestry Dept.
				# of female and male headed households taking up alternative livelihoods disaggregated by sex of head of household	2,000,000	TBA	FD Annual Report	Quarterly	Forestry Dept.
	Development and implementation of participatory forests management plans (CFMG)			TBA	TBA	TBA	TBA	TBA	TBA
	Creation of awareness on the importance of forest conservation			# of awareness meetings conducted on forest conservation	255	1,755	FD Quarterly Report	Quarterly	Forestry Dept.
				# of households sensitized on forest conservation disaggregated by sex of head of household	M: 4,502	24,502	FD Annual Report	FD Annual Report	Forestry Dept.
					F: 4,348	24,348	FD Annual Report	FD Annual Report	Forestry Dept.
	Promote utilization of alternative non-wood fuel sources of energy			% of households utilizing alternative non-wood fuel sources of energy disaggregated by sex of household head	M:TBA	TBA	FD Annual Report	FD Annual Report	FD/ MoE
					F:TBA	TBA	FD Annual Report	FD Annual Report	FD/ MoE

				Types of alternative non-wood fuel sources of energy promoted (biogas, gas stoves etc.)	TBA	TBA	FD Annual Report	Annually	Forestry Dept.
	Promote forest management anchored on ecosystem and /or landscape approaches			Hectarage of forests under landscape approach	6,000,000	15,500,000	FD Annual Report	Every 5 years	Forestry Dept.
				National Forest Landscape Restoration Strategy developed	0	1	Progress Reports	Every 5 years	Forestry Dept.
				Sub-national Restoration Opportunity Assessment Methodology (ROAM) implemented	0	1	Progress Reports	Every 5 years	Forestry Dept.
	Reduce deforestation and forest degradation			Hectarage of forests under selective cutting/# of forest concession issued	100	300	FD Annual Report	Annually	Forestry Dept.
				Rate of forest loss deforestation (Ha)	170,000	290,000	Survey Reports	Annually	Forestry Dept.
				Rate of forest degradation (Ha)	38,600	65,600	Survey Reports	Annually	Forestry Dept.
				# of Forest Patrols undertaken	4,265	24,265	FD Annual Report	Annually	Forestry Dept.
				# of districts linked to the Timber Traceability System	0	60	FD Annual Report	Annually	Forestry Dept.
	Promote the development and implementation of forest fire management (plans) in PFAs and open forests			# of fire management plans developed for PFAs	20	491	FD Annual Report	Annually	Forestry Dept.
				# of fire/ mgt plans developed for open forests (CFMGs and other customary areas)	165	465	FD Annual Report	Annually	Forestry Dept.
				Hectarage of prescribed fire (early burning)	397,798	2,397,798	FD Annual Report	Annually	FD/DNPW/ ZEMA

				# of incidences of late fire /fire alerts	28,000	46,000	FD Annual Report	Annually	FD/ ZEMA
Increased temperatures and drought conditions leading to frequent risks of forest fires	Establishing fire management infrastructure in and around protected forest areas (PFAs)			Kilometer of fire breaks opened/maintained in the PFAs	120	TBA	FD Annual Report	Annually	Forestry Dept.
				Kilometer of forest boundary cleared or maintained (PFA)	500.9	5500.9	FD Annual Report	Annually	Forestry Dept.
	Development of fire risk maps which specify high and low risk			TBA					
	Establishment of forest fire early warning and rapid response system			# of early warning system established	0	5	FD Annual Report	Annually	FD/ZEMA
	Early burning of forests and rangelands			TBA					
Shift in forest species distribution /loss or reduced forest biodiversity due to increased temperatures and/or flooding	Undertake regular or periodic forest inventories to assess species composition, stocking levels and distribution			# of forest inventories undertaken	2	3	FD Annual Report	Every 5 years	Forestry Dept.
				# of forest tree species [outlined in the inventory report	282	782	FD Annual Report	Every 5 years	Forestry Dept.
				Species distribution/vegetation types mapped	1	2	Survey Reports	Every 5 years	Forestry Dept.
				Stocking levels (stems/ha)	231	TBA	Survey Reports	Every 5 years	Forestry Dept.
SECTOR NAME: TOURISM									
Impact of Climate Change	**Adaptation Actions**	**Medium term (2023-2025)**	**Long term (2026-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Reduced tourist visits due to lower water levels at Mosi-Oa-Tunya/ Victoria Falls and other waterfalls.	Develop new innovative tourism products to promote indoor and non-water-based tourist activities			# of adrenaline tourism products developed	1	2	MoT Reports	Quarterly	Ministry of Tourism
				# of adventure tourism products developed	2	8	MoT Reports	Quarterly	Ministry of Tourism
				# of wildlife-based tourism products developed	3	18	MoT Reports	Quarterly	Ministry of Tourism
				# of ethno tourism products developed	2	6	MoT Reports	Quarterly	Ministry of Tourism
				# of theme parks developed	TBA	5	MoT Reports	Annually	Ministry of Tourism

				# of heritage sites developed	10	25	MoT Reports	Annually	Ministry of Tourism
				# of cultural villages rehabilitated and upgraded	TBA	7	MoT Reports	Annually	Ministry of Tourism
				# of museums rehabilitated	TBA	4	MoT Reports	Annually	Ministry of Tourism
				# of MICE facilities developed	TBA	10	MoT Reports	Quarterly	Ministry of Tourism
				# of fish angling sites	TBA	TBA	MoT Reports	Annually	Ministry of Tourism
	Develop tourism activities at other waterfalls in high rainfall areas			TBA					
Reduced sighting of Wildlife in Parks due to droughts/increased temperatures	Provision of water points in water-stressed national parks and GMAs (weirs, dams, reservoirs)			TBA					
	Supplementary feeding and water provision for wildlife			TBA					
	Provision of water points in water stressed areas including national parks (weirs, dams and reservoirs								
	Improve resource management around water points and boreholes								
	Intensive Management programs such as drilling water points for wildlife								
	Provision of water points in national parks								
	Restock depleted national parks			# of depleted national parks restocked	4	12	MoT Reports	Annually	Ministry of Tourism
Increased heat stress for tourists	Provision of climate smart cooling facilities			# of tourism sites with heat-relieving amenities	TBA	TBA	MoT Reports	Annually	Ministry of Tourism

	Plant of trees around tourist camps and facilities			TBA					
	Reforestation around tourist camps and facilities			TBA					
Reduced water availability for wildlife	Provision of water points in water-stressed national parks and GMAs (weirs, dams, reservoirs)			# of national parks provided with water points for wildlife	6	21	MoT Reports	Annually	Ministry of Tourism
Disruption of tourism activities due to extreme weather events (wind on water]	Provision of early warming information, and accurate weather information to enable improved			# of tourism operators with access to timely and accurate weather information services	TBA	1,000	MoT Reports	Annually	Ministry of Tourism
	Strengthening of the early floods warning systems and preparedness			TBA					
	Building of flood protection structure in tourist areas and ecosystems			TBA					
Increased threat of loss of tourism facilities due to wildfires	Installation of fire control measures infrastructure in tourism sites			# of tourism businesses with installed fire control measures and equipment	TBA	1,675	MoT Reports	Annually	Ministry of Tourism
	Development of fire risk maps which specifies high and low risks								
	Promote Insurance of property against loss to fires and other climatic hazards			# tourism businesses with insurance cover against loss	TBA	2,000	MoT Reports	Annually	Ministry of Tourism
Increased destruction of roads and communicatio n infrastructure in tourist	Enhance increased investment in the development of new climate resilient infrastructure i.e., roads, residential house, water, lodges,			Kilometres of access roads to tourist sites rehabilitated and maintained to grade D/E climate resilient standards	TBA	3,000	MoT Reports	Quarterly	Ministry of Tourism

destinations due to floods	etc.			Kilometres of access roads in National Parks and Game Management Areas rehabilitated and maintained to grade D/E climate resilient standards	1309	2,989	MoT Reports	Quarterly	Ministry of Tourism
	Promote insurance of infrastructure and buildings			TBA					
	Undertake training for climate proofing of infrastructure			TBA					
	Promote application of climate smart resilient codes in for roads development (including roads in National Parks and Game Management Areas and in high potential agricultural areas)			Promote application of climate smart resilient codes in for roads development (including roads in National Parks and Game Management Areas)					
				Kilometres of loop roads in National Parks and Game Management Areas rehabilitated and maintained to grade D/E climate resilient standards	316	732	MoT Reports	Quarterly	Ministry of Tourism
SECTOR NAME: MINING									
Impact of Climate Change	**Adaptation Measure**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**	**Impact of Climate Change**	**Adaptation Measure**
Increased flooding of mining pits	Formulate a disaster management framework to be used in the mines during flooding events to mitigate loss of life or damage to equipment.			National Master Framework for managing flooding events in all mines in Zambia developed.	TBA	TBA	Annual Report	By 2026	MMMD/WARMA/MWDS
				% of mines with disaster management frameworks	No data	90	Technical Reports	Annually	Mining Companies

	Design of climate resilient tailings dumps (flood responsive dewatering)			% of mines with mine plans and designs and effective dewatering plans that are responsive to the threat of flooding	TBA	100	Technical and Production Reports	Quarterly	Mining Companies
	Install pumps that can adequately pump out water from pits during flooding events			% of mining sites that installed adequate pumps to pump out water during flooding	TBA	100	Technical and Production Reports	Annually	Mining Companies
Flooding of tailings causing local environmental degradation such as bleaching	Improve pollution control around tailings storage facilities			% of tailings storage facilities with designs that are responsive to the threat of flooding	TBA	100	Technical Reports on tailings dam designs, geotechnical and risk management.	Monthly	Mining Companies/MMMD/ZEMA
	New tailings storage facilities should be located far from any human activity			Site location (Km) of tailings dams/dumps/storage facilities from human activity	0.5	2.5	Environmental, Health and Safety Monitoring and Inspection Reports	Annually	-Mining Companies -MMMD -ZEMA
	Neutralize tailings in all tailings dumps to avoid bleaching/breaching in case of floods			% of tailings storage sites neutralized	No data	100	Progress Reports	Monthly	Mining Companies/ZEMA
Increased dust levels in mining areas (from tailings dumps.)	Undertake regular dust suppression measures			% of mines adhering to required dust emission levels	TBA	100	Environmental, Health and Safety Monitoring and Inspection Reports	Monthly	Mining Companies/ZEMA
	Plant trees and allow vegetation to regenerate in areas that are not utilized			Hectarage regenerated planted trees in mining sites	No data	TBA	Environmental, Health and Safety Monitoring and Inspection Reports	Annually	Mining Companies
	Design of tailings storage facilities should be changed to response to the threats of windstorms								

Reduced power supply from hydro, resulting in low production	Install and utilize alternative power sources			% of mining sites with alternative power sources	TBA	50	Technical and Production Reports	Annually	Mining Companies
	Promote implementation of off-grid power supply for households so that there is more energy diverted to mineral production			# of off grid power supply policies developed	No data	TBA	Production and Technical Reports	By 2026	MoE/MMMD/CEC/Mining companies
	Investment in exploring alternative energy sources such as solar energy, thermal energy, and nuclear energy.			TBA					
Disruption of hydroelectric power supply to the mines	Promote use of alternative power that is locally accessible e.g., mini hydro power stations, setting up a solar power plant and geothermal utilization			# of alternative power sources established	TBA	TBA	Annual Report	By 2026	Mining Companies
Increased energy demand for underground cooling	Install adequate and energy efficient cooling facilities underground to protect the health and safety of workers			% of mines with installed energy efficient cooling facilities underground	TBA	TBA	Environmental, Health and Safety Monitoring and Inspection Reports	Quarterly	Mining Companies
				% of workers reporting health problems associated with high temperature disaggregated by sex	TBA	TBA	Inspection Reports	Quarterly	Mining Companies/MMMD
Reduction in the amount of water available for mining and mineral processing	Practice water recycling to minimize the pumping of water			% of mines that are practicing water recycling methods.	TBA	TBA	Inspection Reports	Quarterly	Mining Companies, ZEMA, WARMA
	Use water-efficient mining and mineral processes			% of mines using water efficient methods in mining and mineral processing.	TBA	TBA	Inspection Reports	Quarterly	Mining Companies, ZEMA, WARMA
	Recycle water in mining and mineral processes								

SECTOR NAME: WATER AND HYDROLOGY									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2025-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Reduced stream flow	Construction of new and rehabilitation of existing dams in accordance with climate-smart codes and standards			# of dams constructed to harvest water	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Strengthen compliance with environmental water flows			# of streams with sustained environmental flows	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Monitoring and management of water resources			Amount of water utilized disaggregated by use (domestic, commercial and industrial)	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Water catchment protection and conservation			TBA	TBA	TBA	TBA	TBA	TBA
	Climate-smart wastewater recycling system			Amount of wastewater recycled	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Improve resource management around water points and boreholes			TBA	TBA	TBA	TBA	TBA	TBA
Reduced availability of water supply and sanitation	Enhance water demand management			Amount of water utilized disaggregated by use (domestic, commercial and industrial)	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Promote ecological sanitation which uses less water			Percent of households using ecological sanitation systems disaggregated by sex of head of household	TBA	TBA	Statistical Bulletin	Annually	MWDS

	Improved water harvesting techniques			TBA	TBA	TBA	TBA	TBA	TBA
	Enhance water demand management			TBA	TBA	TBA	TBA	TBA	TBA
Reduced groundwater levels	Strengthen regulations for borehole drilling			# of boreholes drilled with permits	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Improve domestic water supply by utility companies			Non-revenue water (%)	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Protection of groundwater recharge zones			Development of Statutory Instrument to protect recharge zones	TBA	TBA	Statistical Bulletin	Annually	MWDS
	Develop groundwater resource utilization and efficient use for different sectors			TBA	TBA	TBA	TBA	TBA	TBA
	Improve domestic water supply by utility companies			TBA	TBA	TBA	TBA	TBA	TBA
	Promote artificial groundwater recharge			TBA	TBA	TBA	TBA	TBA	TBA
	Construction of artificial groundwater recharge infrastructure			# of water recharge zones with artificial infrastructure	TBA	TBA	Quarterly Reports	Quarterly	MWDS
	Investing in climate resilient water infrastructure			Kilometers of climate resilient water supply network system expanded	100 (2020)	1100	Quarterly Reports	Quarterly	MWDS
				# of households with retrofitted connections to water supply network disaggregated by sex of head of household	25000 (2020)	193,000	Quarterly Reports	Quarterly	MWDS

	Protection of wetlands and wetland resources based on the EbA approach			# of wetlands managed under the EBA approach	TBA	TBA	Annual Report	Annually	MWDS
Reduced water quality and quantity	Promote rainwater harvesting			Amount of rainwater harvested (m^3)	2007	2,032	Annual Report	Annually	MWDS
	Construction of new and rehabilitation of existing dams in accordance with climate-smart codes and standards			TBA	TBA	TBA	TBA	TBA	TBA
	Increase in volume of surface water impounded			Volume of surface water impounded	189.6km^3 (2020)	380.21 km^3	Annual Report	Annually	MWDS
				# of head waters protected	TBA	TBA	Annual Report	Annually	MWDS
				% HH accessing weather and climate information disaggregated by sex of the head of household	TBA	TBA	Annual Report	Annually	MWDS
	Construction of climate resilient dams			# of dams constructed	TBA	TBA	Annual Report	Annually	MWDS
	Improved water harvesting techniques			TBA	TBA	TBA	TBA	TBA	TBA
	Development of well fields			# of well fields developed	1 (2020)	42	Quarterly Reports	Quarterly	MWDS
	Promote recycling and use for domestic, agricultural and industrial use			TBA	TBA	TBA	TBA	TBA	TBA
	Water quality monitoring and control			% water samples that minimum quality standards	TBA	TBA	Quarterly Report	Quarterly	MWDS/MoH

				Percentage of commercial utilities whose water samples meet the national drinking water standard according to (ZBS/WHO) standards	54.4 (2020)	154.4	Quarterly Reports	Quarterly	MWDS/MoH
	Public education and sensitization on efficient water utilization			Number of households practicing efficient water utilization disaggregated by sex	TBA	TBA	Annual Report	Annually	MWDS
	Mapping and assessment of available groundwater resources			Area mapped km^2	TBA	TBA	Annual Report	Annually	MWDS
				# of areas mapped	TBA	TBA	Annual Report	Quarterly	MWDS
	Undertake Natural Capital Accounting for Water			Quantity of water in each watershed	TBA	TBA	Annual Report	Every 4 years	MWDS
				Economic value of water in each watershed (ZMW)	TBA	TBA	Annual Report	Every 4 years	MWDS
	Harmonize transboundary water diplomacy and benefit sharing			# of transboundary water investment programmes and projects implemented	0	10	Reports	Annually	MWDS
				# transboundary water management agreements which have mainstreamed changes issues	TBA	TBA	Reports	Annually	MWDS

	Improved international water cooperation			# of international water instruments domesticated	TBA	TBA	Reports	Annually	MWDS
	Improved water allocation system			# of ground water permits issued	318	1068	Quarterly Reports	Quarterly	MWDS
				# of surface water permits issued	988	1598	Quarterly Reports	Quarterly	MWDS
	Improve resource management around water points and boreholes			TBA	TBA	TBA	TBA	TBA	TBA
	Enhanced Water Catchment Management and Protection			# of Water Resources Protection Areas (WRPA) gazetted	0	5	Annual Report	Annually	MWDS
				# of Water Catchment Management Plans developed	0	2	Annual Report	Annually	MWDS
Increased damage to water infrastructure	Promote the establishment of water management groups			# of water management groups established	TBA	TBA	Annual Report	Annually	MWDS
	Undertake training or trainers for climate proofing of water infrastructure			# of trainers trained disaggregated by sex	TBA	TBA	Annual Report	Annually	MWDS
	Promote climate proofing of water infrastructure			# of water infrastructure climate proofed	TBA	TBA	Annual Report	Annually	MWDS
	Promote the application of climate-smart codes and standards			% of water infrastructure constructed with climate smart codes and standards	TBA	TBA	Annual Report	Annually	MWDS
				% of water infrastructure rehabilitated/upgraded with climate smart codes and standards	TBA	TBA	Annual Report	Annually	MWDS

SECTOR NAME: ENERGY SECTOR									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2025-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Reduced water inflows into the major hydro power reservoirs	Renewable energy mix diversified			Percentage of renewable energy to total national installed electricity generation	3 (2022)	13 (2026)	Ministry of Energy Annual Report	Annually	MoE/ERB
Reduced power supply to the mines and other sectors of the economy	Promotion of Renewable Energy Off grid solutions			# of commercial/industrial/ institution/facilities using alternative sources energy	TBA	TBA	Ministry of Energy Annual Report	Annually	ERB
				# of renewable energy off-grid projects developed	7 (2022)	22 (2026)	Ministry of Energy Annual Report	Annually	MoE
				Amount of energy generated	TBA	TBA	Ministry of Energy Annual Report	Annually	ZESCO/ERB
				% of mining sites with established internal power plants using RETs	TBA	TBA	Ministry of Energy Annual Report	Annually	ZESCO/ERB
Droughts causes a reduction in power supply generated from hydroelectric power (HEP) that is distributed to the mines and manufacturing industries	Use of clean power alternatives that are locally accessible, e.g. creating hydro-electric power from water that is pumped from the pit, setting up a solar power plant.			TBA	TBA	TBA	TBA	TBA	TBA
	Investment in exploring alternative energy sources such as solar energy, thermal energy, and nuclear energy.			TBA	TBA	TBA	TBA	TBA	TBA
Reduced hydropower supply to the households	Promote efficient use of alternative energy			# of energy efficiency programmes implemented	0 (2022)	5 (2026)	Ministerial Quarterly Report	Quarterly	MoE
				Percentage in the use of alternative technologies and/or fuels in households	16.5 (2022)	38.5 (2026)	Ministry of Energy Annual Report	Annually	MoE

	Promote installation and utilization of alternative power sources			TBA	TBA	TBA	TBA	TBA	TBA
	Promote implementation of off-grid power supply for households so that there is more energy diverted to mineral production			TBA	TBA	TBA	TBA	TBA	TBA
	Augment processes for transitioning to Renewable Energy Technologies (RETs)			TBA	TBA	TBA	TBA	TBA	TBA
	Conduct research and produce an atlas of Zambia's renewable energy hot spots			TBA	TBA	TBA	TBA	TBA	TBA
Reduced hydroelectric power generation	Augment processes for transitioning to RETs			# of power plants producing renewable energy	8 (2022)	TBA	Energy Sector Report	Annually	MoE/ERB/ZESCO
	Increased use of alternative energy			% use of alternative energy	No data	TBA	Energy Sector Report	Annually	MoE/ERB
				Amount of energy produced from hot spots (geo-thermal)	0	250Kw (MedT) 10 (LongT - 2030)	Energy Sector Report	Annually	MoE/ERB
	Conduct research and produce an atlas of Zambia's renewable energy hot spots			# of feasibility studies on renewable energy hot spots identified in the Atlas	1	89 (2026)	Energy Sector Report	Annually	MoE/ERB
Reduced power supply from hydro, resulting in low production by industries	Install and utilize alternative power sources			TBA	TBA	TBA	TBA	TBA	TBA
	Increased use of alternative energy			TBA	TBA	TBA	TBA	TBA	TBA

SECTOR NAME: HEALTH									
Impact of Climate Change	**Adaptation Measure**	**Medium term (2023-2025)**	**Long term (2025-2035)**	**Key Performance Indicators**	**Baseline**	**Target** *(See note above)*	**Data source/ Means of Verification**	**Frequency**	**Responsibility**
Increased incidence of climate sensitive diseases, water borne (diarrheas: cholera, dysentery and typhoid); vector borne (Malaria) and airborne respiratory conditions	Strengthening public health emergence preparedness and response for climate-sensitive diseases			# of districts with functional public health emergency preparedness and response systems for climate sensitive diseases	No data	116	Disease Surveillance Reports and Multi-sectorial Meeting Minutes	Quarterly	MoH
	Strengthening of surveillance activities (Tracking of diseases and trends related to climate change)			# of districts with functional surveillance systems for climate sensitive diseases	No data	116	Disease Surveillance Reports and Multi-sectorial Meeting Minutes	Annually	MoH
				# of environmental health surveys conducted	No data	116	Reports and Meeting minutes	Annually	MoH/MLGRD/ZEMA
	Integrate health services and protection measures into climate vulnerability assessments			TBA	TBA	TBA	TBA	TBA	TBA
	Strengthen surveillance for water quality at the sources			# of districts with access to water quality monitoring tools	48	116 Districts	Water Quality Monitoring Report	Annually	MoH / NWASCO
				# of water samples monitored in hot spots	16,850	TBA	MoH Annual Environmental Health Report	Annually	MoH
	Domestic (household) water purification in hotspots			% of households practicing some form of water treatment methods disaggregated by sex of head of household	34%	85%	ZDHS Reports	Every 4 years	MoH/ ZAMSTATS/ UNICEF

	Research in climate-sensitive diseases			Annual budget amount towards R&D for climate science research	No data	TBA	Annual Workplan & Budget	Annually	MoH
				# of research papers published	0	20	National Health Research Authority Annual Report	Annually	MoH
	Malaria control activities (vector control (i.e., IRS, ITN etc.)			% of households covered during IRS who had access to ITNs (Malaria prevention & control) disaggregated by sex of head of household	71%	90%	Malaria Bulletin	Annually	MoH
	Surveillance of malaria incidence			Incidence of malaria cases reported	340/1000	201/1000	Malaria Bulletin	Quarterly	MoH
	Surveillance of non-pneumonia disease incidence			Incidence of respiratory cases (non-pneumonia)	394.7/1000	315/1000	National Health Statistical Report	Quarterly	MoH
	Planning for curative services			Incident of people accessing hospital services for respiratory (non-pneumonia) treatment of the total OPD attendants	317.1/1000	353.6/1000	National Health Statistical Report	Annually	MoH
				% of people accessing hospital services for respiratory treatment (Asthma) of the total OPD attendants disaggregated by sex	13.4	10	National Health Statistical Report	Annually	MoH
	Implement Health promotion activities			# of health promotion programs developed and	No data	10	National Health Statistical Report	Annually	MoH

				disseminated for climate sensitive diseases					
Costs to the health sector increase during droughts because of outbreaks of diseases.	Promotion of health insurance			TBA	TBA	TBA	TBA	TBA	TBA
	Promotion of production of crops enhancing balanced diets			TBA	TBA	TBA	TBA	TBA	TBA
Damage to health sector infrastructure/ buildings	Designing climate proof infrastructure for health services			# GRZ owned health facilities conforming to climate resilience building standards and codes	No data	2834	National Health Statistical Report	Annually	MoH
	Healthcare waste management			% of GRZ owned health facilities with climate sensitive treatment and disposal facilities for health care waste	No data	2834	Environmental Health Report	Annually	MoH
				% of health facilities practicing tree planting and maintenance of a green environment	No data	100	National Health Statistical Report	Annually	MoH