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ZIMBABWE

World Bank Group

COUNTRY CLIMATE AND DEVELOPMENT REPORT

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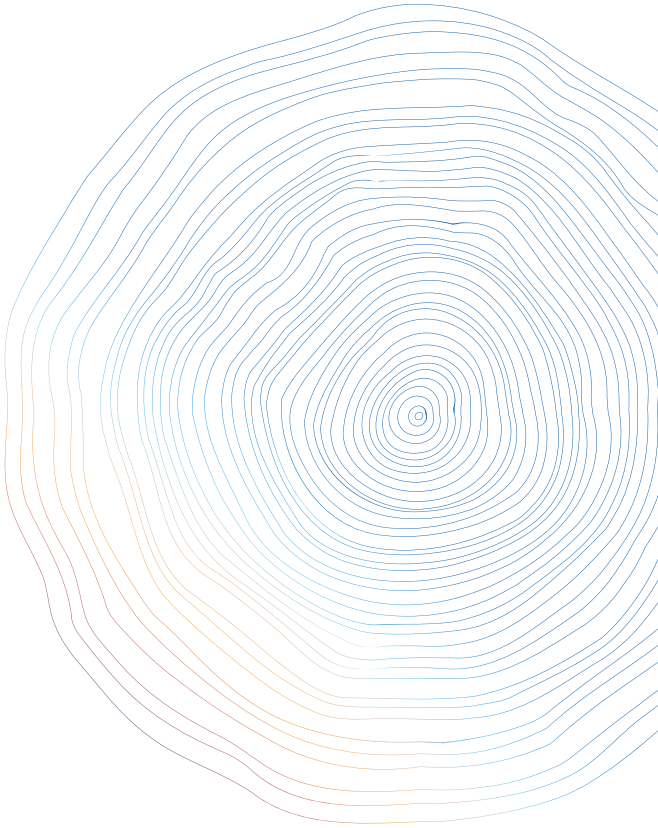

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TABLE OF Contents

List of Tables

List of Figures

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Abbreviations and Acronyms

AFOLU	Agriculture, Forestry and Other Land Uses
ARC	African Risk Capacity
ASP	Aspirational
BAU	Business-As-Usual
BBR	Beitbridge Bulawayo Railway
BEAM	Basic Education Assistance Module
BESS	Battery Energy Storage System
BOT	Build Operate Transfer
CapEx	Capital Expenditure
CCD	Climate Change Directorate
CCDR	Country Climate and Development Report
CCGT	Combined-Cycle Gas Turbine
CFF	Climate Finance Facility
CLIRUN	Climate Runoff Model
CMD	Climate Change Management Department
CMIP6	Coupled Model Intercomparison Project 6
CO_2	Carbon Dioxide
COMESA	Common Market for Eastern and Southern Africa
COVID	Coronavirus Disease
CPI	Consumer Price Index
CSA	Climate Smart Agriculture
CSAIP	Climate-Smart Agricultural Investment Plan
CSOs	Civil Society Organizations
DDs	Deep Dives
DRC	Democratic Republic of Congo
DT	Drought Tolerant
EMA	Environmental Management Agency
ESG	Environmental, social and governance
ETMs	Energy Transition Minerals
EU	European Union
EWS	Early Warning System
FDI	Foreign Direct Investment
FDM	Food Deficit Mitigation

FDMP	Food Deficit Mitigation Programme
FLID	Farmer-Led Irrigation Development
FTLRP	Fast Track Land Reform Programme
FY23	Financial Year 2023
GCF	Green Climate Fund
GCM	Global Climate Models
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GMB	Grain Marketing Board
GNI	Gross National Income
GoZ	Government of Zimbabwe
GWh	Gigawatt Hours
HCI	Human Capital Index
HSCT	Harmonized Social Cash Transfers
ICAT	Initiative for Climate Action Transparency
ICT	Information, Communication and Technology
IDBZ	Infrastructure Development Bank of Zimbabwe
IEC	International Electrotechnical Commission
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
ILO	International Labour Organization
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IPEC	Insurance and Pension of Commission of Zimbabwe
IPPs	Independent Power Producers
IPPU	Industrial Processes and Product Use
ITCZ	Inter Tropical Convergence Zone
KHM	Kuvimba Mining House
LEDS	Low-Emissions Development Strategy
LLUCF	land-use, land-use change and forestry
LMIC	Lower Middle-Income Country
LSA	Lean Season Assistance
MDAs	Ministries, Departments and Agencies
MDB	Multilateral Development Bank
MECTHI	Ministry of Environment, Climate, Tourism and Hospitality Industry

MIGA	Multilateral Investment Guarantee Agency
MIS	Monitoring and Information System
MMCZ	Minerals Marketing Corporation of Zimbabwe
MOUs	Memorandum of Understandings
MPSLSW	Ministry of Public Service, Labor and Social Welfare
MRV	Monitoring, Reporting and Verification
NO_2	Nitrogen Dioxide
NAP	National Adaption Plan
NCCRS	National Climate Change Response Strategy
NCP	National Climate Policy
ND-GAIN	Notre Dame Global Adaptation Initiative
NDA	National Designated Agency
NDC	Nationally Determined Contribution
NDS	National Development Strategy
NPV	Net Present Value
NRZ	National Railways of Zimbabwe
ODA	Overseas Development Assistance
OECD	Organisation for Economic Co-operation and Development
OpEx	Operating Expenses
PFM	Public Financial Management
PGMs	Platinum Group Metals
PPP	Public-Private Partnerships
PV	Photovoltaics
RBZ	Reserve Bank of Zimbabwe
RE	Renewable Energy
RCP	Representative Concentration Pathway
REDD+	Reduce Emissions from Deforestation and Forest Degradation
ROI	Return on Investment
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SECZ	Securities and Exchange Commission of Zimbabwe
STEM	Science, Technology, Engineering and Mathematics
SOE	State-owned enterprise
SRSP	Shock Responsive Social Protection
UMIC	Upper Middle-Income Country

UN	United Nations
UNCBD	United Nations Convention for Biodiversity
UNCCD	United Nations Convention for Combatting Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention of Climate Change
UNOPS	United Nations Office for Project Services
VCM	Voluntary Carbon Markets
WSS	Water Supply and Sanitation
WBG	World Bank Group
WFP	World Food Programme
ZCM	Zimbabwe Chamber Mines
ZESA	Zimbabwe Electricity Supply Authority
ZIA	Zimbabwe Investment Authority
ZIDA	Zimbabwe Investment and Development Agency
ZIMASCO	Zimbabwe Mining and Smelting Company
ZISCO	Zimbabwe Iron and Steel Company
ZMDC	Zimbabwe Mining Development Cooperation

Executive Summary

Executive Summary

Zimbabwe is a lower middle-income country with abundant natural capital and growth potential, but is highly exposed to climate change, with its immediate ability to address climate challenges severely constrained. While Zimbabwe is rich in natural capital, both mineral and renewable, existing public sector resources to address climate change challenges are limited by weak domestic revenue mobilization and limited access to development finance due to arrears to multilateral development banks (MDBs). Private sector investment is one of the lowest in the world as a share of GDP, hindered by recurring macroeconomic instability characterized by high inflation, exchange rate distortions, and unsustainable public debt levels with high external arrears. Volatile prices and restrictive exchange rate policies have kept foreign direct investment (FDI) low, despite a highly skilled labor force and the country's high-quality and high-value mineral resources. These macroeconomic challenges and slow structural transformation have exacerbated the impacts of existing climate variability, exacting a heavy burden on the poor particularly in rural areas. As a result, extreme poverty has doubled over the past decade, reaching levels typically found in low-income countries.

People in Zimbabwe are increasingly reliant on successive rounds of emergency relief rather than a formal government safety net. The country has experienced at least nine episodes of drought since 1980, interspersed with occasional but severe storms. In 2011, the national food poverty rate was 23 percent and this more than doubled by the end of the decade. In rural areas over half of the population (55 percent) was below the national food poverty line, despite the good maize harvest in the 2020/21 season. Due to the absence of adequate shock-responsive safety nets, over 80 percent of the food poor are not covered by any social assistance. Responding to Zimbabwe's cyclical droughts and chronic food insecurity is mainly through humanitarian agencies funded by yearly emergency appeals, as opposed to through a more sustainable government-led safety net. Existing risk financing mechanisms are inadequate to mitigate the impact of disaster and cover potential losses faced by the country.

Macroeconomic constraints, deindustrialization, and land reform have combined to increase dependency on agricultural livelihoods and push up emissions from land use change. With deindustrialization depleting opportunities in urban areas and the Fast-Track Land Reform Programme (FTLRP) opening up opportunities in rural areas, the structure of employment in the first decade of the 2000s shifted toward agriculture. This combination of factors pushed up emissions from Agriculture, Forestry and Other Land Uses (AFOLU). While deindustrialization since the early 1990s has halved non-AFOLU emissions to 1 tCO_2e per capita, the AFOLU emissions have increased rapidly to 2 tCO_2e per capita. This rise in AFOLU emissions has been driven mainly by the conversion of forest land to grassland and cropland. While some of this shift is driven by climate change itself, the larger share of it is driven by unsustainable rural livelihoods, and exacerbated by wood fuel and other biomass accounting for over two-thirds of Zimbabwe's energy mix. With these changes in land cover Zimbabwe has shifted from being a net carbon sink in 1990 to a small net emitter in 2017.[1] In the process, this is eroding ecosystem services (e.g. regulating water and sediment flows) critical to both development and climate adaptation.

The macroeconomic constraints pose a double bind in which the inability to finance development, climate adaptation, and mitigation is leading to increased land degradation, higher net emissions, and less resilience. This CCDR identifies a path out of this double bind by linking demand from global green value chains to Zimbabwe's significant reserves of energy transition minerals (ETMs), such as lithium needed for electric vehicles, in a way that: (i) enables public and private sectors to invest in resilient low-carbon development; (ii) finances capital accumulation that could be deployed to support at-scale land restoration and increases agricultural productivity; and (iii) expands resilience-building social safety nets to protect the most vulnerable, helping them adapt to the expected increase in cyclical weather shocks.

1 Government of Zimbabwe. 2022. *Zimbabwe fourth national communication to the UNFCCC.*

Zimbabwe is at a crossroads and the path that it takes will have consequences for both its development and climate action. Key sovereign decisions on macroeconomic policy, debt, mining sector governance, agricultural policy, and social protection will either keep the country on an LMIC path or open the door to an Upper Middle-Income Country (UMIC) path. The path that the country takes will have very real consequences for development and its resilience to climate variability and climate change, especially for the poor in rural areas. The path that it takes will also influence its carbon footprint, with higher emissions being associated with the LMIC path than its UMIC path. Unlocking the UMIC path would unleash FDI in export sectors and enable investment in human capital, agriculture, infrastructure and land restoration that would set Zimbabwe on a resilient low-carbon development path.

Reflecting this path-determining decision point, this report examines two separate growth scenarios and how these will be impacted by a range of climate scenarios out to 2050. The report proposes ways that the two growth scenarios could be made greener and more resilient and ways to transition towards the aspiration scenario. The growth scenarios are: (i) a business-as-usual (BAU) scenario, which projects past economic trends into the future; and (ii) an aspirational (ASP) scenario, based on the full implementation of Zimbabwe's Vision 2030.

The **BAU scenario** envisages that the macroeconomic environment remains volatile and reengagement with the MDBs stalls, resulting in: (i) continued constraints to private and public investment in key economic sectors such as mining, agriculture, manufacturing, transport (particularly rail), and renewable energy (RE); and (ii) further deterioration in public services such as health, education, electricity, water supply and sanitation (WSS), agricultural extension, and safety nets. Under this scenario, Zimbabwe remains an LMIC, economic growth continues to be modest (3 percent a year), and tax revenues remain low due to continued informality in the economy. Mining exports reach US$ 5.5 billion a year but the structure of the economy changes little all the way to 2050, and the urban share of the population increases modestly to just over 40 percent of the population. This growth scenario is also vulnerable to global economic shocks and further policy-missteps in macro-economic management so should not be considered a worst-case scenario.

The **aspirational (ASP) scenario** envisages that the macroeconomic environment significantly improves, prices and exchange rates stabilize, and there is full re-engagement with the MDBs. Under this scenario, Zimbabwe becomes a UMIC economy by 2030, achieving the Vision 2030 goal. This growth scenario: (i) enables at-scale FDI in key economic sectors such as mining, agriculture, manufacturing, transport and RE (solar, wind and hydro); (ii) boosts revenues needed for improvements in public services such as health, education, and WSS, agricultural extension, and safety nets; and (iii) generates the finance for public investment in scaling the electricity grid, roads, water supply, irrigation and large-scale landscape restoration. To achieve UMIC status by 2030, the economy will need to grow rapidly (10 percent a year) in the first decade, followed by sustained GDP growth in the 2030s and 40s. Tax revenues rise, facilitated by a formalization of the economy. By 2050, mining output reaches US$ 10.2 billion a year, agricultural output would be five times that of 2021, while industry and services would grow ten times, shifting the structure of the economy further toward industry and services, with the urban share of the population increasing to just over 60 percent of the population.

The climate dangers ahead: more climate variability, more droughts, and periodic storm damage. Though there are both risks of wet and dry shocks, Zimbabwe faces greater downside risk from dry shocks than from wet shocks. The natural climate variability that Zimbabwe has always been exposed to in the form of highly variable rainfall patterns will continue and may well be exacerbated by climate change. Projected climate change impacts on the distribution of precipitation trend toward lower levels, as global average temperatures increase.[2] Moreover, the effect of these negative trends in precipitation, when combined with higher temperatures, will increase the risk of agricultural drought even under the optimistic scenario, where average temperature increases are kept within 1.5°C. There are also specific threats from storm systems coming from the Mozambique channel over the Eastern Highlands, such as was observed during

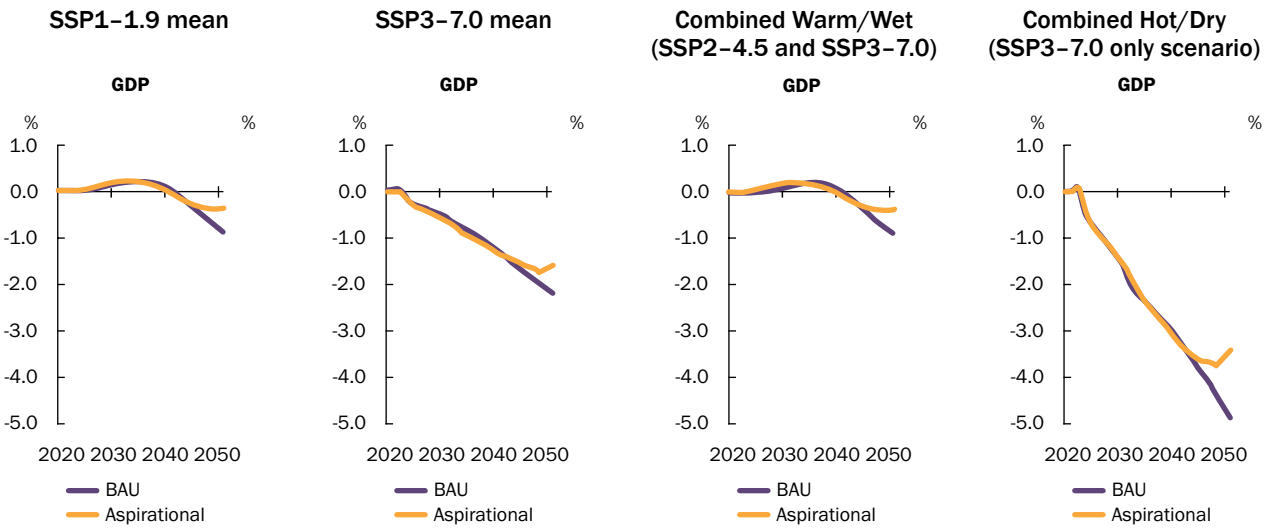
2 World bank Climate Change Portal https://climateknowledgeportal.worldbank.org/country/zimbabwe

Cyclone Idai, and these will continue to intensify with increases in higher global average temperatures. These projected changes in climate are evident even in the multi-model ensembles for different levels of global warming. However, this report goes further by also examining the vulnerability of the economy and the performance of sectors (e.g., agriculture and transport infrastructure) under both dry/hot and wet/warm futures. This is done to better understand the potential range of climate impacts that Zimbabwe will need to plan and be prepared for.

Overlaying climate change projections onto Zimbabwe's possible growth trajectories reveals just how critical development is to poverty reduction, particularly in rural areas. Under the BAU growth path, only very modest reductions in poverty rates are projected all the way out to 2050, with the relative impact of climate change scenarios contributing to the spread of poverty rate outcomes—the dry/hot scenario leading to 4 percent higher poverty rate than the wet/warm scenario. In contrast, under the ASP scenario, poverty rates are reduced substantially (to under 10 percent in 2050), with the impact of climate change being very muted—just 1 percent between the dry/hot and the wet/warm scenario. These results highlight that poverty reduction in Zimbabwe will be highly dependent on the country getting onto the aspirational UMIC path and much less determined by climate change.

However, development alone will not be enough to avoid the macroeconomic impacts of climate change. The analysis in the report shows that climate change will impose large costs on the economy for both the BAU and ASP scenarios – getting progressively larger over time. The climate impacts on these two growth scenarios (BAU and ASP) under a range of climate scenarios are relatively similar, both in terms of trend and the magnitude of the reduction until the 2040s. In the Paris-aligned world scenario (SSP1–1.9 mean), the climate impacts are under 1 percent of GDP (for both BAU and ASP) while, in a world on course for an average 3.6 °C of warming (SSP3–7.0 mean), this rises to over 2 percent of GDP for the BAU scenario.[3] Most relevant to drought-prone Zimbabwe, though, is that, under a combined cluster of SSP3–7.0 hot/dry global climate models (GCMs), this rises further to just under 5 percent GDP loss for the BAU scenario *versus* 3.5 percent for the ASP scenario. Thereafter, the development interventions set out in the ASP scenario provide a basis for strengthening resilience in the outer years, particularly under the combined hot/dry climate scenario. However, the development interventions assumed under the ASP growth path are, on their own, insufficient to adapt to the impact of climate change (Figure E1).

Figure E1: Climate impacts on GDP across policy and climate scenarios



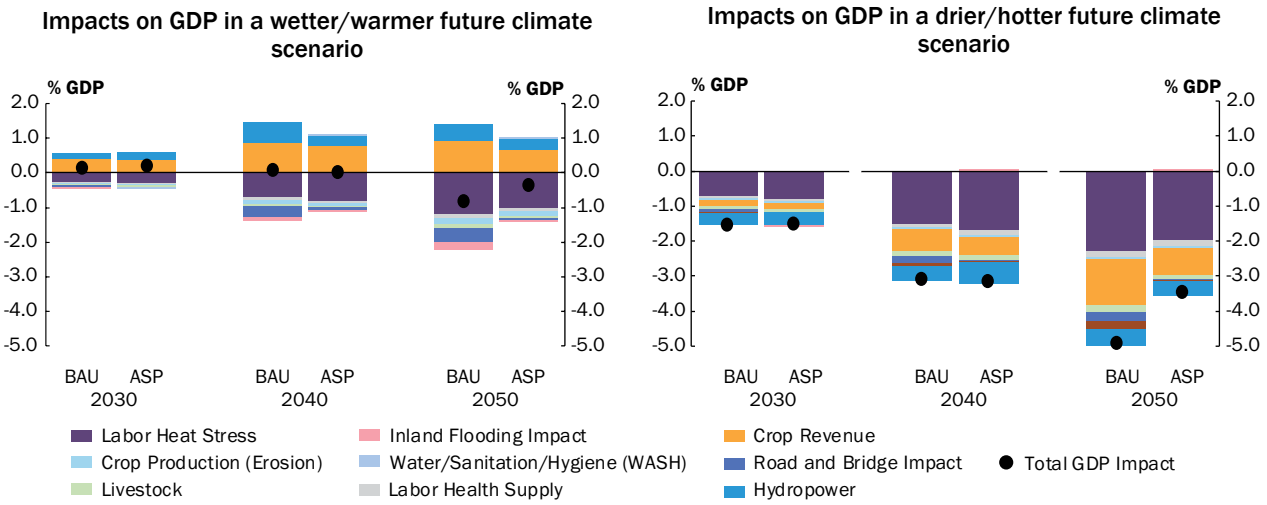
Source: World Bank staff calculations using CC-MFMOD.[4]

3 World bank Climate Change Portal https://climateknowledgeportal.worldbank.org/overview

4 Some minor climate impact channels are not uniformly included across climate scenarios, e.g., inland flooding is only in combined scenarios.

Further adaptation measures are needed to dampen climate change impacts on GDP growth, requiring an examination of climate impact channels. This report examines a range of climate impact channels across both wetter/warmer and drier/hotter climate futures (Figure E2). The largest negative impacts to GDP arise from labor heat stress across all climate futures. Though labor heat stress will reduce labor productivity in industry and services, its impact on agriculture will be greater due to the high level of outdoor manual activity. In hot/dry scenarios GDP losses are further driven by crop revenue losses (up to 2 percent of GDP).[5] In wet/warm scenarios, GDP losses are driven by flood damage, including to roads and bridges (up to 0.7 percent of GDP).[6] The difference between climate impacts on GDP in the BAU and ASP scenarios in the outer years is driven by the greater structural exposure of the BAU growth path to agriculture in the 2050s, driving up labor heat stress and crop losses.

Figure E2: Climate impacts on GDP by growth and climate scenarios disaggregated by channel of impact



Source: World Bank staff calculations using CC-MFMOD.

Though the projected impacts of climate change are significant, there is limited scope to build more resilience or reduce emissions growth under the BAU scenario. The costs of climate action in Zimbabwe are estimated at US$ 10 billion for adaptation and US$ 4.8 billion for mitigation in the run up to 2030. Under the current (BAU) levels of public investment on climate action this would leave around US$ 11 billion to be financed between now and 2030 by the private sector, existing development partners, climate and carbon finance. This is equivalent to a near doubling of private investment flows[7] under the BAU growth scenario in an environment where private investment, both internal and FDI, is held back by the macroeconomic factors, including parallel exchange rates and restrictions on repatriation of profits to foreign investors. Flows of climate finance from global funds and other existing donors to Zimbabwe have also been low, a mere US$ 121 million between 2014 and 2018. In this environment, investment will be held back in key livelihood resilience measures such as irrigation and large-scale land restoration, let alone investment in building resilient and low-carbon transport and energy systems. The limited recurrent budget resources available under the BAU scenario also severely constrain spending on protecting and growing human capital, such as climate-smart social safety nets, education and health. The very real risk of further macro-economic shocks or missteps could jeopardize even these modest levels of public and private investment.

However, a set of 'no-regrets' actions can be prioritized even under the BAU scenario that would build some resilience and stem emissions growth. These 'no-regrets' adaptation measures are low-cost and

5 Based on the GCM CNRM-ESM2-1.
6 Based on the GCM EC-EARTH3-VEG.
7 Gross fixed capital formation, private sector https://data.worldbank.org/indicator/NE.GDI.FPRV.ZS?locations=ZW

make sense to pursue whichever of the growth paths that Zimbabwe eventually follows. Due to the very limited financing available, a guiding principle for these no-regrets priority actions is that the role of the state is catalytic, leveraging individual and private sector investment wherever possible, rather than being driven by public sector investment. The priority actions include both those development actions with climate co-benefits already being implemented by the GoZ, as articulated in the budget, as well as additional actions that could be financed by individuals, the private sector and development partners (even without full reengagement). There is also scope to scale up the climate finance drawn down by domestic institutions accredited by global climate funds such as the Environmental Management Agency (EMA, Adaptation Fund) and the Infrastructure Development Bank of Zimbabwe (IDBZ, Green Climate Fund) and further financing could be drawn down from voluntary carbon markets.

By contrast, there is far greater scope for resilient and low-carbon development under the ASP scenario. Under the ASP scenario, the burden of financing climate action can be shared across public and private sector as well as the MDBs. Climate tagging of the first National Development Strategy (NDS1) that underpins Vision 2030, reveals US$ 0.8 billion in mitigation expenditure and US$ 4 billion in adaptation expenditure in the run up to 2030.[8] These would leave US$ 8.5 billion of climate actions to be financed in the remainder of this decade. Though this would still require a substantial increase in both private and MDB investment, it is within the expected parameters of the ASP scenario driven by a revitalized partnership between the state and the private sector, and benefit from full re-engagement of development partners and the MDBs as well as continued utilization of climate and carbon finance. To this end, catalyzing the development of green and sustainable finance through strengthened policies and market incentives will be critical.

Integrating climate action into the BAU growth path could lay the foundations for transitioning to the ASP growth path. Though the scope and scale for climate action under the BAU and ASP growth paths are different, the 'no-regrets' actions identified under the BAU scenario could facilitate Zimbabwe's transition to the ASP growth path. The proposed climate actions, for both the BAU and the ASP scenarios are, therefore, clustered around the following three key areas:

- **Greening the mining industry and supporting low emissions, resilient infrastructure:** creating an enabling governance environment that links revenues from mining to economy-wide green and resilient industrial and infrastructure development;
- **Supporting conservation agriculture, landscape restoration, food and water security:** enabling millions of farmers to adapt to climate change and reduce emissions from land use change;
- **Protecting and growing human capital:** supporting the poorest with social safety nets and basic services that equip them to cope and proactively adapt to a warming world.

Under each of these key action areas climate positive adjustments to the BAU growth path are discussed showing how these are foundational to scaling-up climate and development action under the ASP growth path.

Action Area 1: Greening the Mining Industry and Supporting Low Emissions, Resilient Infrastructure

Along with tough decisions on macroeconomic management, the governance of the mining sector is a key lever in determining whether Zimbabwe follows the BAU or ASP growth path. Zimbabwe is at a crossroads. Key sovereign decisions on macroeconomic policy, debt, mining sector governance, agricultural policy, and social protection will either keep Zimbabwe on a BAU (LMIC) growth path or open the door to the ASP (UMIC) growth path. High on this list are foundational decisions on the governance of the mining

8 This includes the assumption NDS1 levels of expenditure would continue in the NDS2 covering the second half of the 2020s,

sector, itself comprising one of Zimbabwe's comparative advantages, and a driver of foreign exchange, foreign direct investment tax. Together with addressing macroeconomic aspects of the investment climate, putting in place a robust governance framework for mining that meets international best practices is critical for Zimbabwe to balance risk and reward for investors, and to attract high-quality investors to its mining sector and downstream value-addition opportunities. The mining laws need to be modernized, to introduce a competitive licensing regime offering improved security of tenure and sanctity of contract. Uncertainty and discretion in, for example, regularly re-setting royalty rates should be avoided. In parallel there needs to be a shift away from state ownership of mining interests toward a transparent and competitive allocation of mining concessions with green mining standards. Along with dropping retention requirements for export revenues (enforced conversion to local currency), this would enable the free flow of capital into the mining sector, and associated energy and transport infrastructure. This transition could also improve working conditions in the mining sector, encouraging partnerships between large-scale and artisanal miners, and providing a path to formalization of the industry that would reduce artisanal miners' vulnerability to heat stress and flooding.

The policy certainty and transparency of these priority mining sector governance reforms could catalyze investment in associated low-carbon infrastructure, particularly in renewable energy (RE) and rail. With electricity being the single-biggest brake on mining sector growth and mineral processing, these proposed reforms would encourage mining companies to be more likely to enter into partnerships with independent power producers (IPPs) willing to invest in RE, particularly solar PV and large-scale battery energy storage systems (BESS), which are on the least-cost electricity generation path. Along with GoZ targets for increasing the modal share in favor of railways, these reforms could also catalyze rehabilitation of the rail network.

In the absence of these mining sector governance reforms, options for low-carbon development of infrastructure are limited, relying heavily on enabling investment in off-grid RE and building the resilience of road infrastructure. Firms across Zimbabwe are investing in energy efficiency but only one-quarter of them are investing in RE. In 2022, GoZ did introduce legislative changes supporting grid-connected independent power purchase agreements, but this legislation did not include similar incentives for off-grid investments. Reforms to incentivize off-grid RE, including lifting exchange restrictions, import taxes on RE equipment, and allowing the off-setting of RE investments against tax liabilities, would be an important interim step to resolving the current crippling electricity shortages. In the medium term, providing assurances that these investments can be connected to the grid on a net-metering basis would further incentivize investment.

Under the BAU scenario in the transport sector, the priority would be to keep mining revenues moving through a continuation of the PPPs being put in place on key transport corridors. In addition, low cost, 'no-regrets' actions include: (i) carrying out climate vulnerability assessments in transport; (ii) adopting climate-smart design standards; and (iii) building capacity to maintain the network and to respond to emergencies. Given the expanding mining sector and the share of road transport projected under the BAU scenario, putting in place targets to improve the efficiency of trucks would help abate growth of emissions anticipated.

Under the ASP scenario, PPPs to expand the railways system would be a key way to create synergies between mining development, climate mitigation and adaptation. Linking rail PPPs to mining concessions would increase commercial viability and provide a path to modernizing and greening the rail system. In time this would facilitate a modal shift of freight to rail and electrifying the rail network.

Action Area 2: Supporting Conservation Agriculture, Landscape Restoration, Food and Water Security

Zimbabwe's most pressing climate-related priority is managing food security. Maize accounts for more than half of the average calorie consumption for the majority of Zimbabweans. However, the climate modeling for this report indicates that, under dry/hot scenarios, maize yield losses could be up to 20 percent by the

2040s. In the lower-lying south of the country, these losses increase to over 30 percent by the 2040s. To address both the challenge of disrupted agricultural development and the future threat of climate change impacts, Zimbabwe needs to re-engineer its agricultural knowledge innovation system.

Observed climate change indicates that the frequency of droughts has risen from 1 in 10 growing seasons within the period 1902–1979 to 1 in 4 growing seasons within the period 1980–2011. Together with the downturn in the macroeconomic context and the disruption to modes of agricultural production following land reforms, many Zimbabweans have become more vulnerable to variability in rainfall patterns.

Under the BAU scenario, re-vitalizing the agricultural knowledge innovation system can build on the Government's conservation agriculture program to bolster smallholder resilience. No-regrets and low-cost actions include re-prioritized public spending toward: (i) participatory research and extension to rigorously test and promote conservation agriculture technology packages adapted to the newly defined agroecological zones; (ii) improving smallholder farmers' access to finance and irrigation technology that enable them to tap into the existing 10,000+ dams, as well as existing ground and surface water sources; (iii) sub-catchment management land and water use planning to map land degradation and establish agreements on water abstraction rights; and (iv) scaling-up access to agricultural insurance markets.

Deforestation can be slowed by harnessing voluntary carbon markets to promote efficient cook stoves. Though public finance for land restoration would be very constrained under the BAU scenario, GoZ has included funding to promote efficient cookstoves in recent budgets.[9] Rather than funding clean cooking from public resources, access to efficient cook-stoves could be promoted widely through the newly adopted Carbon Credit Framework (2023) at a lower-cost to the public purse by working with private sector and voluntary carbon markets.

In the medium term there may be new agricultural export opportunities for Zimbabwe, as other parts of the world face water resource availability constraints. With other parts of the world facing chronic water scarcity due to a combination of population growth and climate change (e.g., countries around the Mediterranean), Zimbabwe could take advantage of opportunities to revitalize its agricultural export industry, particularly in high-value horticulture, to the other parts of Africa, as well as to Europe and East Asia. Under the ASP scenario, the greater flows of mining revenues accruing to the public sector could accelerate investment in agricultural development and expanding irrigation. Zimbabwe plans to develop underutilized ground and surface water resources to expand irrigation by 130,000 hectares. There would also be much greater scope for investment in the agricultural research and extension system to drive forward: (i) crop-switching to drought- and heat-tolerant crop varieties; (ii) improved rangeland and pasture management practices; and (iii) breeding programs for climate-resilient livestock. Improving incentives for investment in mechanization and precision agriculture, including for smallholders (e.g. two-wheel tractors), would raise productivity levels. Pursuing these climate and agricultural development investments under the ASP scenario would lead to import substitution, both of staples and in the dairy industry, which is currently importing powdered milk.

At-scale landscape restoration could make the ASP scenario more resilient and reduce GHG emissions. The benefits of investing in large-scale landscape restoration were estimated to be over US$ 400 million a year to Zimbabweans. This would further enhance the resilience of the ASP scenario aligned with Vision 2030. These benefits are based on investments in restoring degraded natural habitats, riparian buffers, conservation agriculture as well as expanding community conservancies and improved management of tourism facilities in state protected areas. The mitigation benefits of this large-scale land restoration are estimated to reduce emissions by an average 11 million tCO_2e per year up to 2050 as compared to the BAU scenario with continued land degradation. This is equivalent to around a quarter of Zimbabwe's current annual emissions. Using a relatively low estimate of US$ 4.5 per tCO_2e, landscape restoration could

9 2023 Blue Book

generate around US$ 50 million a year in carbon credits. Valuing these emissions reductions at the social value of carbon would generate around US$ 686 million a year in global benefits.

Action Area 3: Protecting and Growing Human Capital

Social protection is a critical pillar of climate change adaptation, particularly for a drought-prone country such as Zimbabwe, with a chronic caseload of food insecure people. Over the past decade poverty rates doubled. In 2022, over half of the rural population was living in extreme poverty. With 80 percent of food-poor households not covered by any social assistance, putting in place a social-safety net mechanism that protects people from dry shocks is a key priority. The best option for developing a shock-responsive safety net program would be to focus on scaling up the Harmonized Social Cash Transfers (HSCT) program. However, the HSCT has very low coverage, currently reaching only 0.4 percent of the population, and needs to be scaled-up and complemented with livelihoods support to improve beneficiaries' resilience.

Under the BAU scenario, reforms to the HSCT can focus on beneficiary registration and targeting, links to early warning systems, regional benchmarking of transfer amounts and digital payments. The newly developed beneficiary registry of vulnerable people in Zimbabwe and can be used to target support in the event of a shock. This will involve entering data on beneficiaries of all social assistance programs onto the registry, and ensuring districts are trained and supported in data management. Alongside this, low-cost reforms – such as benchmarking of amounts to be transferred against international comparators, strengthening of targeting mechanisms and digital payments – would make more efficient use of scarce government resources and could be used to direct development partner emergency response resources more effectively.

The ASP scenario offers more opportunity to scale-up HSCT and to build in support for productive livelihoods. NDS1 places social protection as one of the integral crosscutting pillars for reducing poverty and vulnerability, aiming to increase the reach of social protection interventions. The priority would be to cover 70 percent of the extreme poor, improving the adequacy of benefits and creating a flagship safety net. A dynamic safety net could also provide existing and additional beneficiaries with top-up benefits in times of shock, triggered by early warning systems, through agreed standard operating procedures. These shock-responsive mechanisms could also be complemented with support to productive livelihoods through well tested mechanisms such as small grants, life and business skills training, financial literacy, savings groups as well as climate-smart public works which create short-term employment including: soil and water conservation, afforestation/reforestation, small-scale irrigation and flood protection.

Complementing these social protection reforms, increasing investment in water and health services would further protect human capital from climate change. Investment in WSS is needed to halt the current decline in services and the expected up-tick in water-borne disease driven by climate change. Under the BAU scenario key sector priorities that could be pursued to stem decline and increase resilience of WSS services, include: (i) finalizing and adopting the water sector master plan; (ii) supporting LGA investment planning; (iii) setting up a regulatory function; and (iv) introducing RE for urban and small towns' WSS systems. In the health sector a priority would be to modify the targeting of malaria prevention measures, as malaria is set to increase in the Eastern Highlands. Under the ASP scenario, the aim would be large-scale rehabilitation and climate-proofing of WSS systems to achieve universal access to WSS by 2030 along with a strengthening of health systems to address the other climate related health issues impacting labor supply and labor heat stress.

The education system in Zimbabwe has been key to facilitating social mobility and is a core climate adaption strategy. Education has been foundational to social mobility in Zimbabwe, providing a well-trodden path to higher incomes and women's empowerment. Climate risks and opportunities highlight the demand for STEM skills. In agriculture, STEM skills will be key in managing risk though the application of conservation

and precision agriculture. Growth of the mining sector will also create demand for STEM skills across blue and white-collar job types from mining technicians to engineers both in the private and public sectors. Policies to retain teachers generally, and specifically STEM faculty members, are needed and could, even under the BAU scenario, be facilitated through partnerships with agriculture and mining sectors.

'No-regrets' Climate Actions are Low-cost and Could Help Shift Zimbabwe to an Upper Middle Income Growth Path

Though the opportunity for pursuing climate action under the BAU scenario is highly constrained, implementing the 'no-regrets' measures dampens climate impacts and could help the country to transition to the ASP growth path. The 'no-regrets' measures identified by this report are based on the state enabling climate-smart investments by individuals and the private sector, with only very modest public sector investments. The catalytic public finance needed to enable these measures should be prioritized by the GoZ and its development partners, along with increasing the country's capacity to tap into climate funds and voluntary carbon markets.

Once on the ASP growth path, there is far greater scope for resilient and low-carbon development that could set Zimbabwe on a path to net-zero in the second half of the century. This resilient and low-carbon growth path would be driven by a revitalized partnership between the state and the private sector, and benefit from full re-engagement of development partners, the MDBs, climate funds, and voluntary carbon markets. Though the transition to the ASP scenario is aligned with becoming a UMIC it is still vulnerable to climate change. The additional climate measures set out in this report offer a way to further dampen the effects of climate change and improve the country's competitive advantage in key sectors such as mining and agriculture. Moreover, these additional climate measures can be taken without losing proposed development gains set out in Vision 2030. This more resilient ASP growth path could also return Zimbabwe to a net zero pathway in the second half of the century.

1

Zimbabwe's Development in a Changing Climate

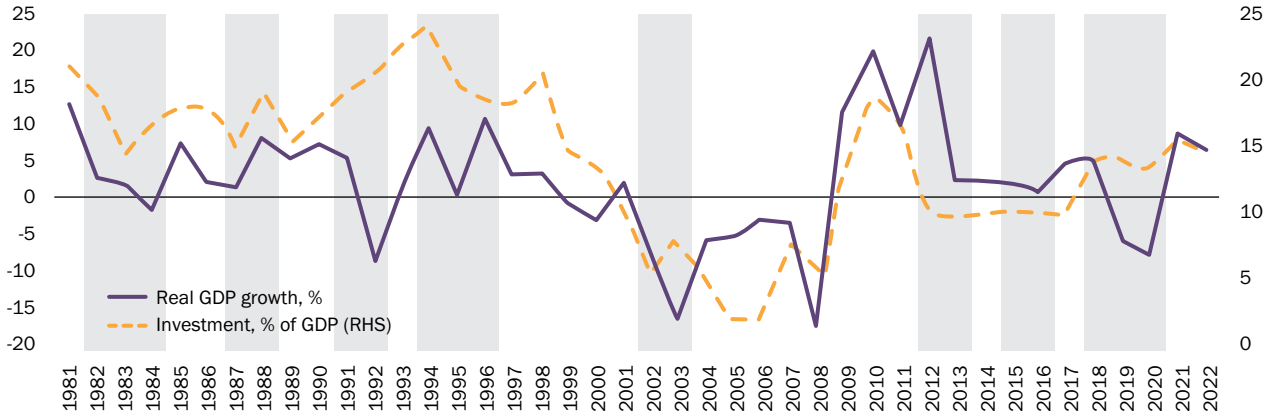
1. Zimbabwe's Development in a Changing Climate

1.1. Current Context and Development Priorities

Zimbabwe is a lower middle-income country (LMIC) striving to join the club of upper middle-income countries (UMICs) by 2030. Zimbabwe's economy benefits from a highly skilled labor force, and rich and diverse natural resources, including minerals such as lithium, that are currently in high demand. However, its development path has been characterized by major volatility, low growth, and high poverty, forcing many Zimbabweans to leave the country. In 2022, gross national income (GNI) per capita was US$ 1,500, well below peers in the Sub-Saharan Africa (SSA) region and LMICs. Nearly 7 million people, mostly in rural areas, live in extreme poverty, with limited access to basic service delivery.

Once one of the most prosperous countries in Africa, Zimbabwe's development over the past three decades has been constrained by recurring macroeconomic instability, exogenous shocks, and structural challenges (Figure 1.1.1). Volatile growth and a decade-long recession due to weak macroeconomic management led to accumulation of arrears on external debt since 2000 and hyperinflation in 2008. A broad shift in economic policy after 2008 temporarily spurred a recovery from the economic turmoil, with per capita GDP growth averaging over 15 percent a year over 2009–2012. Since then, however, per capita income growth has been negative, averaging close to -1 percent a year over 2013–2022. Price and exchange rate distortions, frequent policy changes to address these distortions (dollarization and credit ban, re-dollarization, restrictions on forex), and unsustainable debt have limited investment and economic activity. Amplified by persistent droughts, Cyclone Idai (2019) and the COVID-19 pandemic, the decade ended with two consecutive years of deep recession in 2019 and 2020, and a return to triple-digit inflation (World Bank 2022a). While economic growth returned following the COVID-19 pandemic, multiple global and domestic shocks have reduced the resilience of households and firms, constraining recovery. Structural challenges, such as a high reliance on agriculture and commodity exports, pervasive informality, and inadequate infrastructure, have amplified the economic instability and prevented the economy from reaching its potential.

Figure 1.1.1: GDP Growth, investment, and droughts



Source: MoFED, Zimstat, WDI, World Bank.

Fiscal space to address the consequences of exogenous shocks and invest in climate-smart public infrastructure is severely limited. Domestic revenue mobilization is constrained by high informality of the economy and governance challenges. A big chunk of the public expenditure is allocated to the compensation of employees, leaving little room for quality improvements in basic service delivery and scaling up social protection in times of economic downturn. Due to external arrears, external borrowing is very limited and

costly, preventing the upgrading and expansion of infrastructure, and increasing reliance on humanitarian aid to mitigate the impact of the poor from climate and other external shocks.

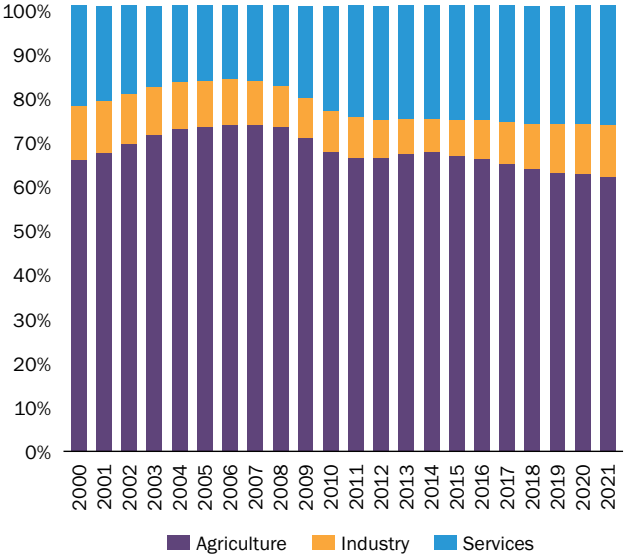
Trade integration has declined and foreign direct investment (FDI) has remained low, limiting the transfer of new technologies and investment in modernizing the economy. Zimbabwe's trade openness has declined from over 89 percent of gross domestic product (GDP) in 2011 to just 56 percent in 2021, trailing neighboring countries and regional LMIC averages. Zimbabwe is the only country among its immediate peers that has seen negative export growth over the past two decades, which has exacerbated shortages of foreign currency. Historically, the economy's trade flows have been underpinned by low value-added primary products, such as tobacco, gold, diamonds, and platinum. The export basket of Zimbabwe has narrowed, with fewer products exported every year (World Bank 2022a) and a declining economic complexity index (OEC 2021).

Inconsistent macroeconomic policies and a difficult business environment have led to an expansion of informal and agricultural employment, increasing structural economic vulnerabilities. Around 80 percent of employment is in the informal sector, concentrated in agriculture, wholesale and retail trade, and mining. More than 60 percent of the economy is employed in the agriculture sector (Figure 1.1.2), primarily subsistence agriculture, with a sizable number of small commercial producers. In the past two decades, Zimbabwe has had a unique development trajectory, with labor moving back to agriculture and rural areas, although this has been starting to reverse in recent years. Commercial producers have faced financing challenges, distortive prices, and land tenure issues, limiting their productive potential. Agriculture is predominantly rainfed and output per worker is low, highly vulnerable to increasing climate variability—rainfall amounts and patterns and temperatures. The mining sector, which officially generates around 14 percent of GDP, is dependent on the production of gold, mostly by the large number of small artisanal miners who are unregulated. Exports of gold averaged US$ 1.5 billion in 2020–2022, with a similar amount estimated to leave the country illegally each year (International Crisis Group 2020). Growth in the more productive manufacturing and service sectors has been limited and insufficient to boost economic growth, while still being affected by changes to the external environment. Despite the shift of employment back to agriculture and deindustrialization, in 2022 agriculture generated 12 percent of GDP, industry 31 percent, and services 52 percent.

Extreme poverty and inequality have increased over the past decade, making Zimbabwe one of the most unequal countries in Sub-Saharan Africa. The decade started with a national food poverty rate of 23 percent in 2011, which increased to 30 percent in 2017 (Sharma et al. 2022). By 2019, the poverty rate had risen yet again, when almost two-fifths of the population was found to be in extreme poverty. The situation deteriorated further during the COVID-19 pandemic in 2020, when almost half the population was below the extreme poverty line (Figure 1.1.3). With the gradual opening of the economy and a good maize harvest in the 2020/21 season, the situation improved slightly in late 2021, with 43 percent of the population in extreme poverty. Likewise, inequality also increased during this period, reaching a Gini coefficient of 50 in 2019, making Zimbabwe highly unequal. The Gini coefficient in rural and urban areas, and the provinces was lower than the national level, suggesting that much of the inequality is between locations rather than within locations. Extreme poverty is much higher in rural than in urban areas. Over half of the rural population (55 percent) was below the national food poverty line in 2021, despite the good maize harvest in the 2020/21 season.

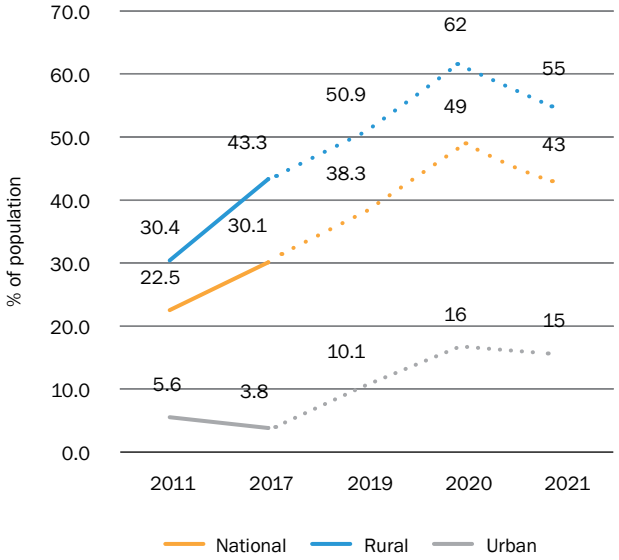
Due to the absence of adequate safety nets, over 80 percent of the food poor are not covered by any social assistance. Yet there is a good basis from which to scale up, given that, despite their limited coverage, social assistance programs in Zimbabwe were generally progressive, meaning that the distribution of benefits was concentrated in the poorer quintiles of the population. Responding to Zimbabwe's cyclical droughts and chronic food insecurity is primarily through humanitarian agencies funded by emergency appeals, as opposed to through a more sustainable government-led safety net.

Figure 1.1.2: Structure of employment by economic sector (percent of total)



Source: World Bank (2022) Zimbabwe Country Economic Memorandum.

Figure 1.1.3: Poverty headcount ratio, national food poverty line, 2011–2021



Source: World Bank (2023). Reversing the Tide: Reducing Poverty and Boosting Resilience in Zimbabwe.

Zimbabwe's Vision 2030 aims to foster inclusive economic growth, reduce poverty, and transform the country into an industrialized, knowledge-based UMIC. Vision 2030, published in September 2018, is the Government of Zimbabwe's (GoZ) overarching planning framework for the Second Republic, following the transition of November 2017. The goal of Vision 2030 is to achieve a prosperous upper middle-income economy by 2030. The first five-year National Development Strategy (NDS1, 2021–2025) underpins Vision 2030, targeting an annual GDP growth rate of above 5 percent[10] and the creation of at least 760,000 formal jobs over the five-year period. NDS1 includes a detailed costed capital investment plan, costed at US$ 40 billion, with breakdowns by financing source, including US$ 12 billion from the private sector, three-quarters of which is for energy investments.

The analysis for this report examines two separate growth scenarios (or development trajectories) and how these will be impacted by a range of climate scenarios out to 2050. The report then proposes ways that the two growth scenarios could be made greener and more resilient. The growth scenarios are: (i) a business-as-usual (BAU) scenario, which projects past economic trends into the future; and (ii) an aspirational (ASP) scenario based on the full implementation of Zimbabwe's Vision 2030. The parameters for the 2021 baseline and these growth scenarios are presented in Annex A.

The **BAU scenario** envisages that the macroeconomic environment remains volatile and reengagement stalls resulting in: (i) constrained investment in key economic sectors such as mining, agriculture, manufacturing, transport (particularly rail), and renewable energy (RE), instead relying on limited rehabilitation of coal-fired power plants (Bulawayo 87MW an Munyati 97MW); (ii) limited modernization in public services such as health, education, WSS, agricultural extension and safety nets etc.; and, (iii) inadequate public investment to scale up the electricity grid, water supply and irrigation with negative impact on productivity. Under this scenario, Zimbabwe remains an LMIC, economic growth continues to be modest (3 percent a year), and insufficient to eradicate poverty. This would result in over one-third of households living in extreme poverty all the way to 2050, and high informality continuing to keep tax

10 The NDS1 growth scenario was based on projected growth in 2019 and 2020 and did not take into the deep recession in these two years. The ASP scenario is based on GDP estimates for 2021.

revenues low. Mining exports reach US$ 5.5 billion a year (9.3 million tonnes a year), but the structure of the economy changes little all the way to 2050 (agriculture 10.7 percent, industry 32.5 percent, services 56.8 percent), and the urban share of the population increases modestly to just over 40 percent of the population.

The **aspirational Vision 2030 growth scenario (ASP)** envisages that the macroeconomic environment significantly improves, prices and exchange rates stabilize, and that there is full re-engagement with the multilateral development banks (MDBs). This ASP growth scenario: (i) enables at-scale foreign direct and domestic investment in key economic sectors such as mining, agriculture, manufacturing, transport (rail), and RE (Batoka hydroelectric dam 1,200MW, solar 770MW, wind 80MW), as well as rehabilitation and expansion of coal-fired power plants; (ii) boosts public revenues for needed improvements in public services such as health, education, WSS, agricultural extension and safety nets, etc.: and (iii) generates the finance for public investment, including scaling the electricity grid, roads, water supply and irrigation. Under this scenario, Zimbabwe becomes an UMIC economy, growing rapidly (10 percent a year) in the first decade followed by sustained GDP growth thereafter. As such, poverty is reduced to near zero and tax revenues rise, with the revenue effort reaching 25 percent of GDP facilitated by a re-formalization of the economy. By 2050, mining output reaches US$ 10.2 billion a year (13.3 million tonnes a year), agricultural output would be five times that of 2021, while industry and services would grow ten times, shifting the structure of the economy further toward industry and services, with the urban share of the population increasing to just over 60 percent of the population.

A necessary condition for the ASP scenario is clearance of arrears, which will unlock resources for modernizing the economy, mitigating the impacts of external shocks, and adapting to climate change. Following the adoption of its Arrears Clearance and Debt Resolution Strategy, the GoZ initiated a Structured Dialogue Platform in late 2022. With the Platform, the GoZ aims to reach an agreement with creditors, development partners, and other stakeholders on a roadmap for arrears clearance and reengagement. Implementation of critical macroeconomic stability, governance, and land tenure reforms is the cornerstone of the roadmap, maximizing the gains from other NDS1 reforms and ensuring the achievement of Vision 2030 goals. Resolving the unsustainable debt situation will mean access to concessional borrowing and global grants for modernizing and adapting public infrastructure to climate change. It will also mean a lower cost of private financing, which will boost private sector activity and investment, and ensure higher private sector participation.

1.2. Risks from Climate Change and Natural Hazards

Zimbabwe's vulnerability to natural hazards and the broader climate change impacts is high, necessitating a focus on climate adaptation. Previous Intergovernmental Panel on Climate Change (IPCC) assessments highlight Zimbabwe as a climate change hotspot, alongside other Southern African countries. Zimbabwe ranks 174 out of 182 countries on the Notre Dame Global Adaptation Index (ND-GAIN),[11] which ranks vulnerability to, and ability to adapt to, climate change.[12] Natural hazards, particularly drought, have a significant impact on people and the economy. The 1991/92 drought was dubbed as one of the worst in living memory, which resulted in a 25 percent reduction in manufacturing output and a 6 percent reduction in foreign exchange earnings (SARDC-UNEP 2009). The drought in 2007 affected 6 million individuals and the drought in 2013 affected over 4 million people, with estimated economic damage of up to US$ 500 million (EM-DAT 2015). The country is also prone to riverine floods and storms; Cyclone Idai affected more than 270,000 people, with estimated direct damage estimated at US$ 622 million.

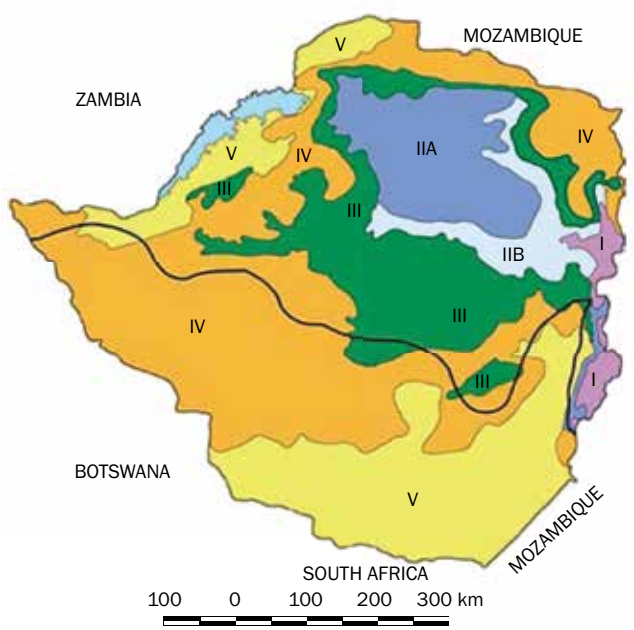
11 The ND-GAIN Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience.

12 Countries that are lower in the index are considered to be more vulnerable and less ready to handle climate risks.

Observed climate change indicates that annual mean surface temperatures have increased and precipitation decreased over the period 1900–2018. Annual mean surface temperature warmed by about 0.9°C from 1900 to 2018, and average annual rainfall declined by about 5 percent across the country over the same period (GoZ 2022). While the impact on rainfall has been relatively muted, Zimbabwe has experienced a high frequency of mid-season dry spells and a contraction of the rainy season through late-onset, and early cessation of the rainy season in the recent decades since 1960. The number of rainy days has reduced while the number of dry days has increased. One exception is in the mid-Zambezi region, which has seen a reduction in the length of dry spells by up to 10 days for the period 1980–2016, while most regions have witnessed an increase in the length of dry spells by 4 to more than 20 days. Increasing temperatures have raised evapotranspiration rates and reduced soil moisture, further worsening the severity of droughts and mid-season dry spells, particularly in the southern and western regions of the countries. In Southern Africa as a whole, river flows have mostly decreased (Dallas and Rivers-Moore 2014).

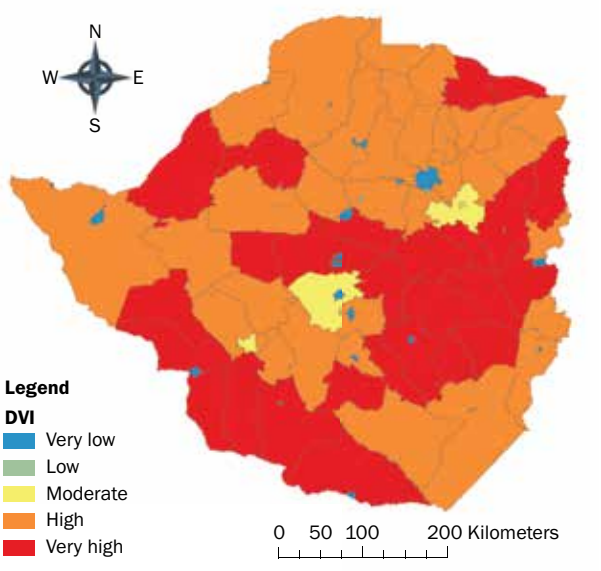
Drought is a particularly high risk owing to the large share of employment in agriculture and the rural concentration of the food poor. The frequency of droughts rose from 1-in-10 growing seasons in the period 1902–1979 to 1-in-4 growing seasons in the period 1980–2011 (ZMSD 2020). This jump in the frequency distribution of droughts suggests the onset of climate change over and above normal climate variability in rainfall patterns. Agriculture in Zimbabwe is primarily rainfed, so poor rains have an immediate bearing on many people, especially those in rural areas, who depend directly on farming for food consumption and income. Late-onset and early season cessation of the rain has been observed for all the main five agro-ecological regions. This is already reshaping Zimbabwe's agro-ecological regions, with drought-prone regions (IV and V) having become drier and having increased in area, while major food-producing regions (II and III) have shrunk (Figure 1.2.1). A large part of the country has high to very high levels of vulnerability to drought (Figure 1.2.2), dependency on rainfed farming for livelihood, poverty, household head characteristics and prevalence of chronic illness.

Figure 1.2.1: Zimbabwe's natural (or agroecological) regions



Source: World Bank. 2022.

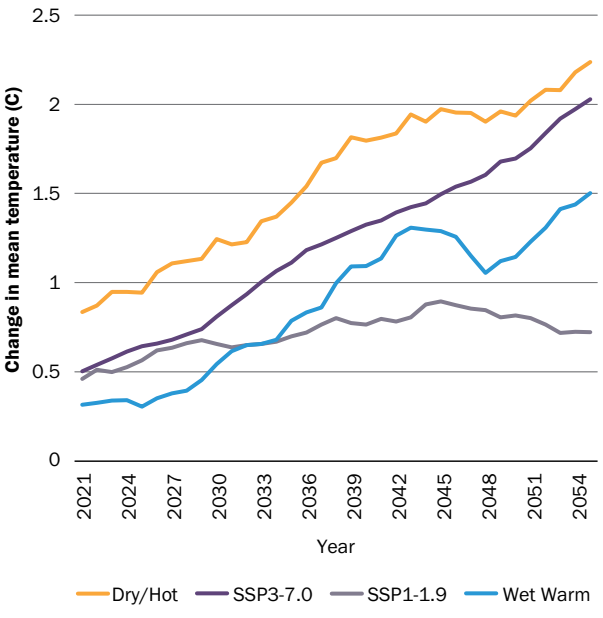
Figure 1.2.2: Spatial variation of vulnerability to drought in Zimbabwe



Source: World Bank (2021) A Technical Assessment for Updating Drought Risk Mapping in Zimbabwe.

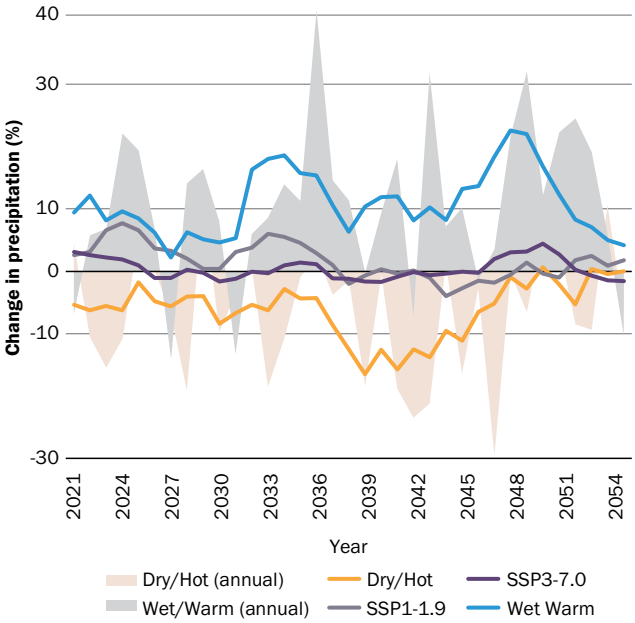
These observed changes in climate indicate that Zimbabwe is trending toward more arid conditions, but there is wide variation across climate projections, with some global climate models (GCMs) projecting a wetter climate (World Bank 2021a). To reflect climate uncertainty in the analysis, a total of 4 climate scenarios were selected from among a larger set of available scenarios. The inclusion of multiple climate scenarios is critical to account for uncertainty in both future greenhouse gas (GHG) emissions trajectories, as well as uncertainty across different climate model projections. Two of the 4 scenarios included were selected to allow for comparisons across emissions scenarios. These are referred to as mitigation scenarios, as follows: (i) an optimistic case (ensemble average of SSP1–1.9 GCMs), which represents reductions in GHG emissions in line with limited 1.5°C of warming by 2100; and (ii) a pessimistic case ensemble average of SSP3–7.0 GCMs, in which warming reaches 3.6°C by 2100, due to lax climate policies or a reduction in ecosystems and the ability of oceans to capture carbon. In addition, to enable analysis of economic performance and potential adaptation, options across a range of possible climate futures, the means of three dry/hot and three wet/warm climate scenarios were selected. These dry/hot and wet/warm mean scenarios represent a cluster of GCMs around the 90th percentile out of 50 SSP2 and SSP3 GCMs. Together, the four mean scenarios (SSP1–1.9 mean; SSP3–7.0 mean; hot/dry mean; and wet/warm mean) represent a broad band of temperature and rainfall deviations (Figures 1.2.3 and 1.2.4).

Figure 1.2.3: Zimbabwe change in mean temperature



Source: World Bank. 2023a.

Figure 1.2.4: Zimbabwe change in mean precipitation (lines 5-year moving average, shaded area annual variation)



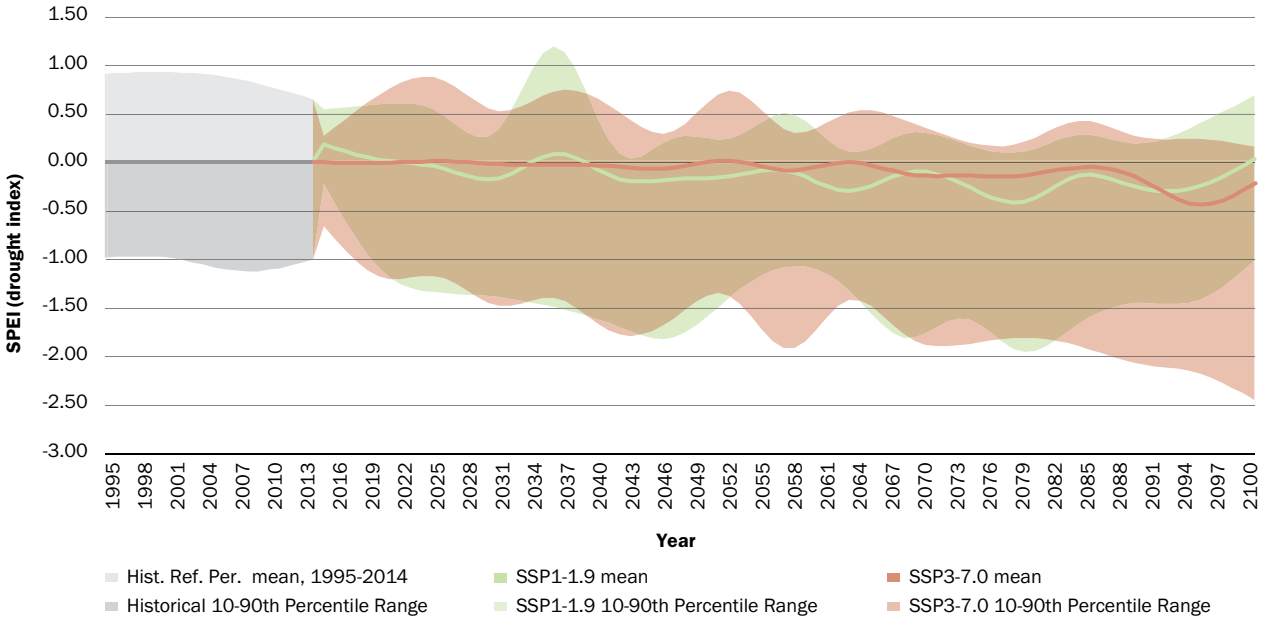
Source: World Bank. 2023a.

Though there are both risks of wet and dry shocks, Zimbabwe faces greater downside risk from dry shocks than from wet shocks. The evidence from existing climate variability, observed climate change, and projected climate change suggests that the risks of droughts will continue to be higher than the risk from floods and storms, but that both dry and wet shocks will persist. This frames Zimbabwe's adaptation challenge in that no-regrets climate actions need to build resilience to both wet and dry shocks—even if greater emphasis needs to be put on managing dry shocks.

The combination of higher temperatures and lower precipitation will increase the risk of drought. The combined effect of higher temperatures and lower precipitation is projected using the Standardized

Precipitation Evapotranspiration Index (SPEI) (Figure 1.2.5). The magnitude of the deviation in the SPEI indicates the severity of the wet or dry conditions. Positive values indicate a surplus of water, while negative values indicate a deficit of water, with values below -2 considered extremely dry. The 1991/92 drought that led to a 6 percent drop in GDP registered a SPEI of -2 for a sustained period. More recent dry shocks, such as the drought in 2015/16, have registered even lower SPEI readings, but not for such a sustained period as in the 1991/92 drought.[13] Analysis for the Southern Africa Drought Resilience Initiative showed that Zimbabwe has high drought hazard and weak coping strategies, leaving it with high residual risk and pointing to the need to build institutional mechanisms for resilience (World Bank 2021b). Riverine and inland flooding are a lesser climate risks, as most of the country's water runoff flows across moderate inclines from the Highvelt, which stretches diagonally across from Plumtree in the southwest of Zimbabwe to Harare. However, there are specific threats from storm systems coming from the Mozambique channel over the Eastern Highlands, such as was observed during Cyclone Idai. These will continue to intensify with increases in higher global average temperatures.

Figure 1.2.5: Annual SPEI drought index projections for SSP1–1.9 and SSP3–7.0 multi-model ensembles (reference period 1995-2015)



Source: World Bank CCKP.

1.3. Risks and Opportunities for a Low-carbon Growth Path

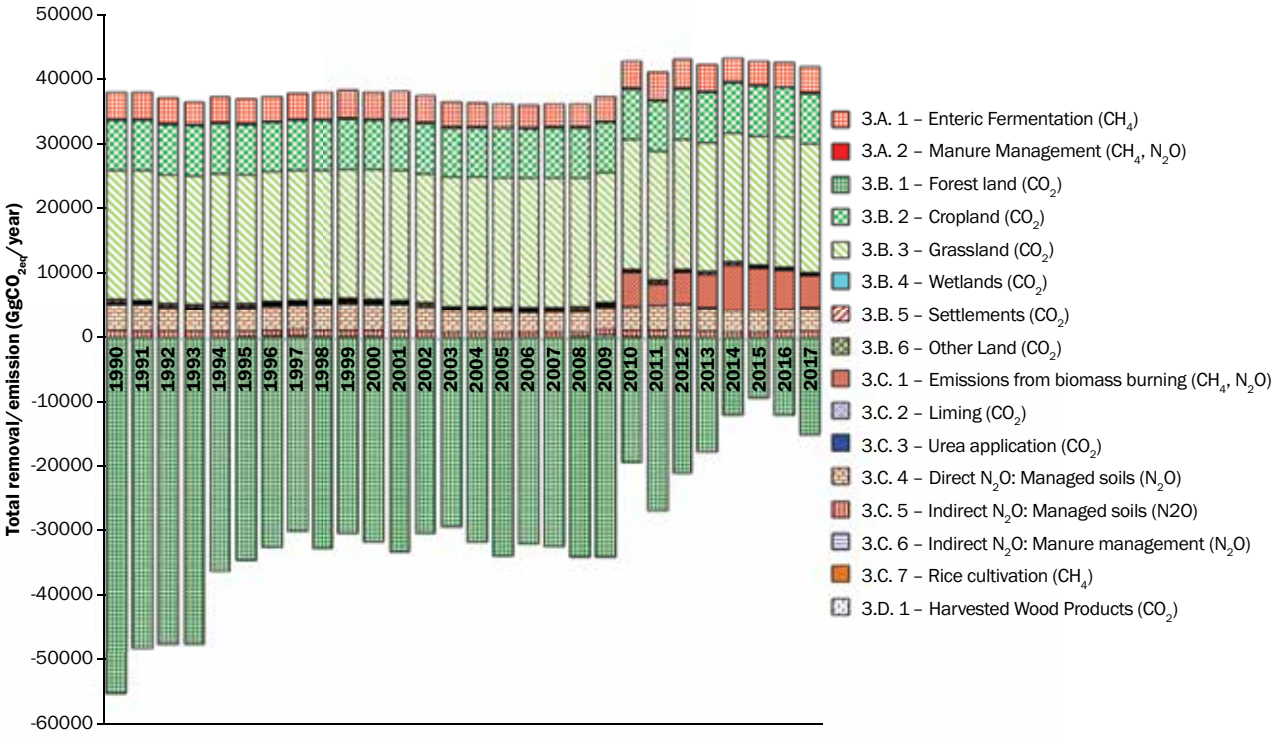
Zimbabwe is a small net emitter of GHGs—accounting for just 0.05 percent of global emissions since 1750—but has gone from being a GHG sink to a source since the 1990s, driven by land degradation (Ritchie, Roser and Rosado 2020). Faced with macroeconomic constraints and despite relatively diversified economy, Zimbabweans are increasingly dependent on agricultural livelihoods, which have pushed up emissions from Agriculture, Forestry and Other Land Uses (AFOLU). While deindustrialization since the early 1990s halved non-AFOLU emissions to 1 tCO_2e per capita, AFOLU emissions increased to 2 tCO_2e per capita. In 2017, GHG emissions from the AFOLU sector were estimated at 42 $MtCO_2e$, while removals were estimated at 14.9 $MtCO_2e$, giving a net positive flux of AFOLU emissions of 27.1 $MtCO_2e$ (Figures 1.3.1).

13 SPEI time series over region [-22.25, 26.25], [-15.75, 33.25] SPEI time series 9 months. Accessed on June 2 2023.

Leading up to 2010, Zimbabwe had some of the world's highest rates of deforestation (for canopy cover exceeding 10 percent), with a forest loss rate of 3,090 km² a year (World Resources Institute 2021). Conversion of forest land to grassland had the highest emission contribution (41 percent) of the AFOLU emissions, followed by emissions from conversion of forest land to cropland (18 percent), biomass burning (12 percent), enteric fermentation (10 percent), and direct NO_2 emissions from managed soils (9 percent). Over two-thirds of Zimbabwe's total energy supply is from wood and other forms of biomass (IRENA 2022). In addition, climate change will shift the spatial distribution of forest ecosystems, with expected impacts in the provision of environmental services, biodiversity conservation, and mitigation potential through carbon sequestration. The reduction of the area covered by Miombo and Baikiaea ecosystems is likely to have a negative impact on people's livelihoods, as they generate lower levels of income from timber and non-timber products than Mopane ecosystems (Zimref 2019).

Land degradation, in addition to being a risk to low-carbon growth, is making Zimbabwe less resilient to existing climate variability, as well as to the future impacts of climate change. In addition to driving up AFOLU-related emissions, this land use change has eroded critical ecosystem services, diminishing the availability of wild resources, ecosystem capacity for water regulation (baseflow and groundwater) and sediment regulation, as well as carbon retention. This erosion of ecosystem services makes both landscape and livelihoods more vulnerable to climate change impacts. Moreover, this erosion increases vulnerability to both warmer/wetter futures, as well as to hotter/drier futures. A detailed study in the Mazowe catchment (one of Zimbabwe's seven water catchments) showed that a range of provisioning, regulating, and cultural ecosystem services that provide current and potential benefits to local farmers and villagers, to the tourism sector, water utilities, and to Zimbabwean society as a whole, were worth over US$ 464 million annually (US$ 65 million livestock; US$ 106 million wild resource harvesting; US$ 43 million tourism; US$ 250 million water flow and sediment regulation) (World Bank 2022d).

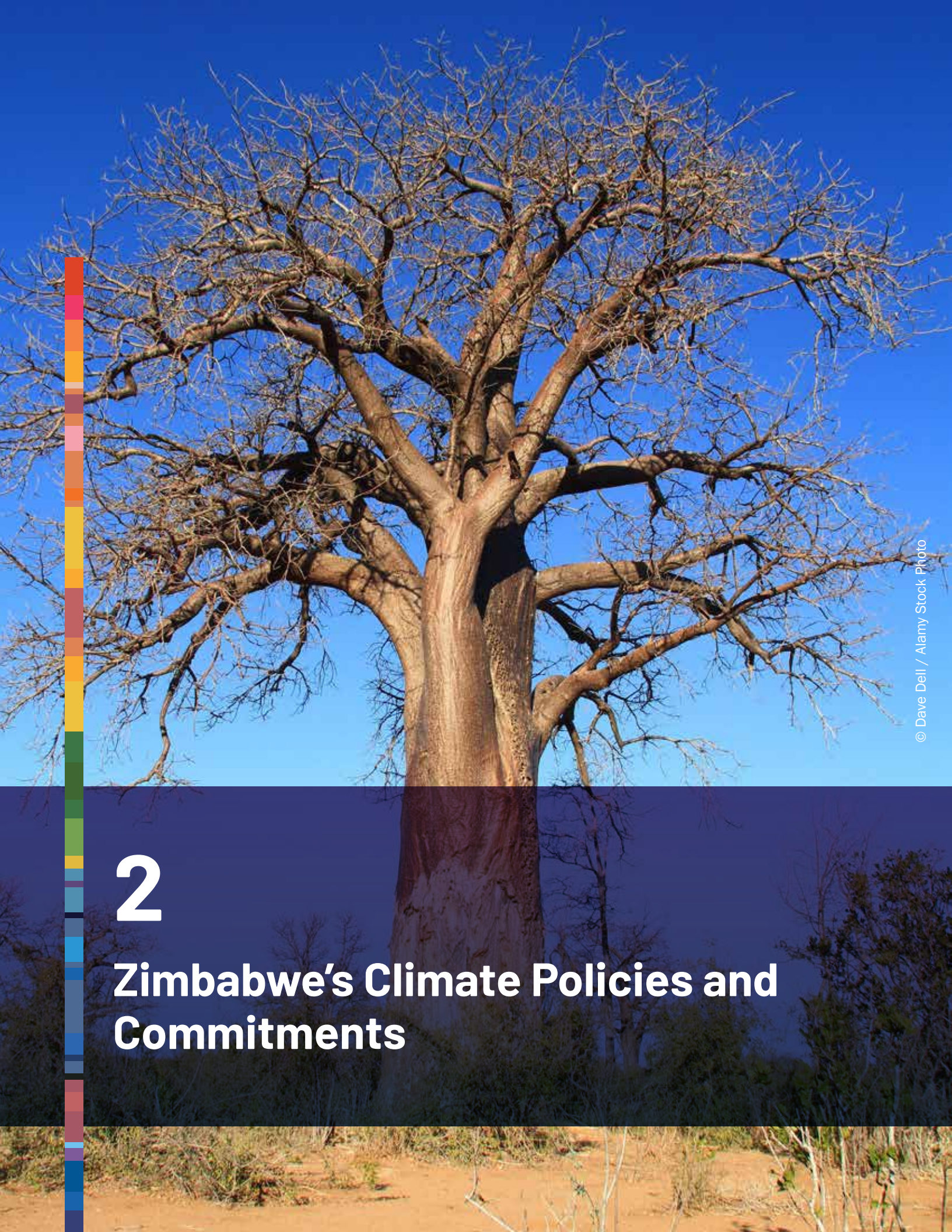
Figure 1.3.1: AFOLU emission and sequestration, 1990 to 2017



Source: GoZ 2022 4th National Communication to UNFCCC.

While Zimbabwe faces risks to low-carbon growth from trends in land degradation, it also faces a clear opportunity to support low-carbon growth, driven by global demand for its stock of green transition minerals. Zimbabwe has large reserves of precious and transition metals (gold, platinum, lithium, nickel, etc.), as well as diamonds. It contains the second-largest platinum and fifth-largest lithium reserves globally. In 2022, the mining sector generated three-quarters of Zimbabwe's exports (see Chapter 3). The GoZ aims to grow mining revenues to US$ 12 billion a year by 2030, including expansion in lithium and a five-fold increase in diamond production from 2020 levels. Zimbabwe's ambition to add value to its lithium deposits through domestic battery production will further increase energy demand, pushing up emissions from the increased use of coal-fired energy generation plants. Though Zimbabwe has a skilled workforce in the mining sector relative to SSA, infrastructure deficits in the energy and transport sectors are a severe constraint to growth of the mining sector. Along with regulatory barriers and macroeconomic challenges, this infrastructure deficit is a key reason for Zimbabwe being at the bottom of the Fitch Solutions Mining Risk/Reward Index. This lack of infrastructure raises the key climate change mitigation question of whether the plans to expand the mining sector, and all the associated energy and transport infrastructure, will be fueled by brown or green energy.

The big climate policy question for Zimbabwe is whether it can transform its rich mineral reserves into: (i) building green and resilient infrastructure; (ii) restoring its renewable natural capital; and (iii) protecting and growing its human capital. Doing so could put it on a low-carbon growth path to becoming a UMIC. This key climate policy question is discussed further in Chapter 3 following a review of the country's climate policies in the next chapter.



2

Zimbabwe's Climate Policies and Commitments

2. Zimbabwe's Climate Policies and Commitments

2.1. Commitments to Adaptation and Low Emissions Development

Zimbabwe's Revised Nationally Determined Contribution (NDC 2021) aims to reduce emissions by 40 percent by 2030 at a cost of US$ 4.8 billion and, for the first time, balances adaptation and mitigation. The Revised NDC tackled both climate change adaptation and mitigation to fully address Zimbabwe's climate change profile as a small net-emitting country highly vulnerable to climate change. The NDC states that the US$ 4.8 billion needed to reduce GHG emissions by 30.65 $MtCO_2e$/year is fully conditional on appropriate international support, albeit on analysis that some investments are being already included in NDS1. Over four-fifths of the emission reductions by 2030 is meant to come from the AFOLU sector (25.35 $MtCO_2e$). The remaining emissions reductions come mainly from the energy sector (4.2 $MtCO_2e$), with smaller reductions from industry and waste. Parallel work on costing mitigation actions was also carried out in the Long-term Low Greenhouse Gas Emission Development Strategy 2020-2050 (LEDS). The LEDS, the drafting of which started before but was published in 2022 after the Revised NDC, prioritizes 38 costed sectoral mitigation measures with an abatement potential of 33.2 $MtCO_2e$ by 2050 at a cost of US$ 7.8 billion. Importantly the LEDS shows that many of these investments have a positive net present value (see Chapter 4).

The NDC also sets out four high-level adaptation measures, namely:

1. Develop, implement and scale up climate-smart agriculture solutions and strengthen the resilience of agricultural value chains and markets;
2. Enhance early warning and climate-related disaster risk reduction systems (including information management systems);
3. Ensure climate-resilient infrastructure and design; and
4. Develop and promote resilient water resources management.

The Revised NDC defers to the **National Adaptation Plan** (NAP) for further elaboration, costing, and financial and institutional arrangements for adaptation. The draft NAP, pending Cabinet review and before publication, is costed at US$ 10.3 billion in the period up to 2030.

The Zimbabwe Renewable Energy Policy was ratified in 2020 to provide for net-metering and other incentives for investment in RE. While the Revised NDC lists improving energy efficiency as one of the mitigation options, this cause is hampered by decaying transmission infrastructure on an extensive scale, owing to sustained underinvestment in the power sector. Moreover, net-metering will be hampered by grid inefficiencies and pervasive load-shedding.

Proposals for investing in efficient cook-stoves were dropped from the Revised NDC for not appearing aspirational vis-à-vis Vision 2030 to become an UMIC status by 2030. The Revised NDC does not address energy efficiency for the rural population (70 percent of the total) that depends on biomass for energy. The omission of a wood fuel efficiency mitigation option was a missed opportunity in Zimbabwe's Revised NDC for a country with extensive reliance on wood fuel energy which, together with tobacco curing, drives one of the highest forest deforestation rates in the world.

Decarbonization plans may also need to be updated to reflect the uptick in mining and steelmaking investments that are coming onstream in Zimbabwe and a fall in the costs of RE. In the wake of discoveries of significant deposits of energy transition metals that are projected to see significant global demand in the outlook period, some reassessment of energy supply may be required and better matched with opportunities to introduce variable renewable energy sources whose cost has fallen significantly in the last decade.

2.2. Institutional Arrangements for Climate Change Management

The Climate Change Management Department (CCMD) is the lead government agency for coordinating climate action in a whole-of-government and whole-of-society approach. The CCMD, founded in 2015, coordinates the operational, institutional and governance framework linking the international-national-provincial-and-local realms. The High-Level Committee in the Office of the President and Cabinet (OPC) is responsible for oversight of all climate change activities at the national level. National coordination seeks to foster a united international engagement for climate change negotiations, resource mobilization, knowledge management, and technology transfer for implementing climate change mitigation and adaptation. However, the CCMD remains too understaffed to effectively coordinate climate change-related activities and expenditure across government and non-government actors (World Bank (2022e).

Zimbabwe is party to the United Nations Framework Convention on Climate Change (UNFCCC) and its attendant protocols. The CCMD is the National Designated Agency (NDA) for coordinating and providing technical leadership for Zimbabwe's international engagement to the UNFCCC and related international climate change networks, as well as participation in MRV frameworks to respective Conference of Parties (COP), with set schedules for national reporting. The NDA also serves as the clearing house for the review and endorsement of national projects, and structures for participating in international climate change processes, networks and financing mechanisms, as well as undertaking national readiness assessments.

Zimbabwe has articulated a stakeholder consultative framework for climate change management. The Cabinet Committee on Climate Change, the National Climate Change Platform, and Local Authorities Urban and Rural District Councils Authority coordinate consultation on climate change mitigation and adaptation across government at both central and local government levels, with the private sector and civil society, including with women and youth groups. These structures were consulted in the drafting and approval of key climate change policies, as well as during government-initiated stakeholder consultations ahead of participation in international climate change forums and negotiations, together with the revision of Zimbabwe's NDC and the drafting of the LEDS.

The National Climate Change Response Strategy (NCCRS 2015) highlights Zimbabwe's economic and societal vulnerability to climate change, and outlines a national approach for mainstreaming climate action at national and sectoral levels through a multi-stakeholder engagement process. The NCCRS outlines key sectors of focus and is premised on seven pillars for climate action, namely: (i) adaptation and disaster risk management; (ii) low-carbon development; (iii) capacity development; (iv) governance and transparency frameworks; (v) finance and investment; (vi) technology generation and transfer; and (vii) communication and advocacy. Budgeted for US$ 9 billion, the NCCRS elaborates sector-specific actions, covering both the natural environment and ecosystems, economic sectors, physical and social infrastructure, and crosscutting enablers.

Unlike the NCCRS, which is sector specific, the National Climate Policy (NCP 2017) demonstrates preference for cross-sectoral and economy-wide approaches to climate action. The NCP forms the backbone of Zimbabwe's climate change response and seeks to coordinate the country toward a climate resilient and low-carbon economy. The policy sets high-level goals and institutional frameworks for climate change governance, the establishment of the National Climate Fund (NCF), and economy-wide climate change mitigation and adaptation. The NCF targets funding from the existing fuel carbon tax and tobacco levy, plus an additional 10 percent allocation from the national budget and 0.005 percent corporate profit tax for green development.

The NCP reflected the state of international thinking at the time and made provision for the country to participate in international carbon markets and other results-based mechanisms such as REDD+.[14]

14 'REDD' stands for 'Reducing emissions from deforestation and forest degradation in developing countries. The '+' stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks.

The NCP provides implementation framework of the NCCRS, and outlines the institutional and legal basis for regulating climate-related business and supporting low-carbon development. The NCP provides for the prospective development of key pillars of the national climate change management architecture, including the LEDS (completed 2022), the National Adaptation Plan (NAP, draft, in line for submission to Cabinet), and the Climate Change Bill (draft, in line for submission to Cabinet). A Climate Change Law (Act) would strengthen the climate change mandate of government and lend legal weight and capacity for enforcement to the NCP.

In 2023 GoZ published a Carbon Credit Framework (CCF) for Zimbabwe April 2023. Given its developing country and small-net emissions profile, Zimbabwe should be able to benefit from participation in international carbon markets. The goal of the CCF is to promote, institutionalize and regulate the trade in carbon on both the compliance markets under the 2015 Paris Agreement and the voluntary carbon market governed by independent bodies. The CCF is applicable to all carbon trading projects that include new as well as existing projects being implemented in Zimbabwe before adoption of the CCF by Cabinet. The carbon income generated will be distributed across the investor, communities and GoZ. Project developers will be eligible to recover half of the gross income whilst the other half will go into the Treasury's Consolidated Revenue Fund pending the establishment of the National Climate Change Fund (NCCF). Resources flowing into the fund will support local climate change adaptation and mitigation programs, expenses by government in administering this framework and local authority levies.

Public financing for climate change actions remains limited, but there have been recent efforts to mainstream climate change into the budgeting process. For the first time, the 2022 budget incorporated a section on climate change management, detailing the critical set of projects and programs linked to the revised NDC. The public investment management (PIM) guidance was amended in 2021 to incorporate climate risk assessment into infrastructure planning. However, the efficient design and execution of projects is constrained by limited capacity across government agencies to design proactive measures to address climate change risk, combined with fiscal risks from inflation and exchange rate distortions.

An emergent climate finance ecosystem is beginning to take shape in Zimbabwe. The successful accreditation of the Infrastructure Development Bank of Zimbabwe (IDBZ) for direct access to the GCF in July 2021 for mid-sized projects for green infrastructure development was a first step. The FBC Bank—a mortgage lender—is also advanced in its accreditation process to the GCF. If successful, this could unlock resources for green infrastructure projects, particularly housing. GCF projects will favor blended finance arrangements that de-risk markets and crowd in disparate sources of finance for promoting low-carbon development, including domestic, bilateral and multilateral, private sector, Official Development Assistance (ODA) and philanthropic resources for green infrastructure development. A Climate Finance Facility (CFF) under preparation at IDBZ could play a dynamic role in mobilizing and blending disparate sources of climate finance for low-carbon development in the emergent climate finance ecosystem. The Environmental Management Agency (EMA) is also accredited to the Adaptation Fund, while the aforementioned NCF seeks to drive domestic resource mobilization and deployment for implementing climate change mitigation and adaptation.

2.3. Ways to Strengthen Institutions, Policies and Markets in Order to Deliver More Ambitious Commitments

While progress has been made since 2015 under the guidance of UNFCCC, further strengthening of the institutional architecture for driving the climate change response in Zimbabwe will be needed. Options to do this include (World Bank 2022e): (i) setting up a National Climate Change Commission to tackle power asymmetries and enable vertical and horizontal coordination; (ii) incentivizing ministries, departments and agencies (MDAs) to promote mainstreaming of climate change, comply with climate policies, and produce financial records of climate expenditures; (iii) encouraging relevant MDAs to join the Paris Committee on Capacity Building to identify and address country specific capacity gaps; (iv) providing more detail on the mechanisms for community benefit sharing in the CCF.

The draft Climate Change Bill seeks to consolidate disparate policy gains into the country's body of laws in the hope of spurring private-sector investment and PPPs for climate action. Most of the climate change policies and strategies outlined in this chapter were drafted from 2015 onward, which coincided with increased government investment in technical capacity and international engagement to act on climate change under the auspices of UNFCCC and attendant protocols.

The draft Climate Change Bill could also seize the opportunity to prepare Zimbabwe to trade with the EU under the European Union Carbon Border Adjustment Mechanism (EU CBAM) and similar upcoming carbon-trade protocols. The EU CBAM requires that goods imported into the EU are taxed for embedded carbon to compete with EU firms that are themselves charged for carbon emissions under the European Emissions Trading System (ETS). The commodity coverage of the first phase of EU CBAM includes aluminum, cement, iron and steel, fertilizer, hydrogen and electricity. Though Zimbabwe would likely not be competitive exporting to the EU at present, iron and steel is an increasing prospect for Zimbabwe, with reported progress on the Manhize Iron and Steel Plant that is proceeding with Chinese investment. With other jurisdictions likely to bring in CBAMs, competition with neighboring countries will intensify, as for example firms in the region transition heavy industry to green hydrogen. Subsequent phases of EU-CBAM could impact Zimbabwe's trading prospects with the EU in the medium to the long term in sectors such as horticulture, where Zimbabwe may have a competitive advantage.

Limited public sector and development partner funding remains a key constraint to realizing Zimbabwe's low-emissions development projects. Slow and volatile economic growth, combined with international isolation, has resulted in low savings rates, high interest rates, and a very tight fiscal space. This in turn is hampering private sector investment throughout the economy, not least for new and emergent low-carbon and green industries. The proposition of the RE policy and its enactment into national law through the draft Climate Change Bill may improve the investment climate and private sector participation for low-carbon technologies. Between 2014 and 2018, OECD reports that total allocations of climate finance to Zimbabwe were a mere US$ 121 million, around half of which was for adaptation (IPCC 2023: 1306). The volume and project pipeline for climate finance has increased little over the past five years, though two development partner-funded climate change adaptation projects have recently been agreed for financing by the Green Climate Fund (GCF), for a total of US$ 35.1 million, and an IFAD project in partnership with the GoZ for US$ 395.89 million to co-finance smallholder irrigation revitalization projects covering over 1.2 million households.

Public sector spending on adaptation could increase by a further US$ 36 million a year if revenues from the carbon tax levied on fuel were efficiently collected and reallocated. Currently, proceeds from the carbon tax on fuel are channeled into the Consolidated Revenue Fund, which is allocated for general government expenditures. The draft Climate Change Bill envisions broadening the carbon tax beyond fuel to include other key point-source pollution industries, such as manufacturing, iron and steel, ferro-chrome, cement, transport, and thermal power generation, which would greatly boost carbon tax revenues to fund both climate change adaptation and mitigation projects.

Improvements in climate change planning, budgeting, and implementation of climate-related projects will improve the effectiveness of public spending. Such improvements include: (i) undertaking climate budget tagging to provide data on climate-related spending and enable public scrutiny of such spending; (ii) designing a climate change financing framework and factoring in climate financing at the subnational level; (iii) greening PFM to ensure that climate objectives are incorporated in PIM, enabling Zimbabwe to operationalize the Paris Agreement's enhanced transparency framework and prepare a biennial transparency report (BTR) ahead of December 31, 2024; and (iv) strengthening the NDC investment plan to ensure public expenditure is aligned to the NDC. This will involve the prioritizing public investment projects, identifying external financing sources, and engaging private sector investors (World Bank 2022e).

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3

Sector Development Priorities for a Resilient and Low-carbon Future

3. Sector Development Priorities for a Resilient and Low-carbon Future

This chapter identifies policies and investment priorities that can be implemented over the next five years that advance Zimbabwe's development goals, and contribute to the transition toward a low-emissions and resilient economy that is aligned with the objectives of the Paris Agreement.

The chapter first sets out a case for using the mining sector as a catalyst for accelerating investment in RE, as well as to drive modernization in low-carbon and resilient transport infrastructure. Second, it proposes ways that agricultural development can make the recent land reforms more resilient to existing climate variability and outlines additional investment options for adapting to further climate change. Third, the chapter proposes a path to building a national social protection system to shield the poor and vulnerable from climate shocks, as well as complementary investments that will grow human capital and skills for a climate resilient economy. As one of the few sources of foreign exchange, mining will be critical not only in drawing investment into green infrastructure such as RE, but also funding for other development and climate needs, such as social protection and land restoration.

3.1. Greening the Mining Industry and Supporting Low Emissions, Resilient Infrastructure

Zimbabwe is mineral-rich and its economic infrastructure has been shaped by its mineral wealth. The country's history of minerals extraction, processing and transportation has shaped the location of its centers of economic activity, which are concentrated in mineral-rich areas, and along transport corridors where backward and forward linkages and other agglomeration affects were strongest.

The mining sector is already a major contributor to Zimbabwe's economy and could drive further growth by supplying green minerals to the transitioning global energy system. Mining industry output in 2022 was estimated at US$ 5.5 billion, accounting for 14 percent of GDP, three-quarters of all exports, three-quarters of all FDI, 20 percent of state revenues, and 11 percent of formal employment payroll (World Bank 2024a). Over the past five years, mining's role in the economy has grown relative to that of manufacturing and agriculture. Global demand projections associated with net zero pledges have improved the long-term fortunes of several minerals that Zimbabwe is endowed with, notably lithium, nickel and copper that are needed to support RE supplies, and platinum group metals that are needed for the emerging hydrogen economy. Although cyclicality of mineral prices will remain, energy transition minerals (ETMs) are needed to drive a longer-term structural shift in re-engineering of the global energy system. Future demand for ETMs is likely to outpace supply and presents a major opportunity for Zimbabwe both to increase mining exports and in value addition through midstream (e.g., refining) and downstream (e.g., battery production) processing.

Growth of mining in the national economy has occurred in the context of poor macroeconomic operating conditions and opaque mining sector governance over the past two decades. Among incumbent mining firms, considerable resilience is needed to overcome impediments to investment that include harsh currency surrender requirements, limited access to bank finance, and regulatory inconsistency. Starved of investment, existing operations must often cope with outdated equipment and technology and several, facing financial challenges, are either on care-and-maintenance or have been mothballed. Viewed from abroad, Zimbabwe fairs very poorly in assessments of the investment climate. It has ranked last among countries in one widely referenced global survey in the past two years (Fraser Institute 2023). In the 2022 annual Chamber of Mines survey, major domestic factors impacting business confidence were ranked as follows: (i) power outages; (ii) high operating costs; (iii) shortages of foreign exchange; (iv) difficulties accessing capital; and (v) reliance

on obsolete machinery and equipment. The Zimbabwe Chamber of Mines' membership sees a mounting gap between the level of output that can be realistically achieved compared with potential, particularly in lithium output where members project only 9 percent growth compared with 100 percent growth as the potential (Zimbabwe Chamber of Mines 2022).

A prominent role is played by state-owned mineral enterprises in seeking to spur mineral development, since they hold a significant number of mineral assets. Some of these are a legacy of public ownership of mining and mineral processing assets assumed post-Independence, such as steelmaker ZISCO, coal miner Hwange Colliery, and ferrochrome maker ZIMASCO, and others are the mineral properties ceded to the GoZ either under the indigenization policies of the previous government or the "use it or lose it" measures taken periodically to free up mining claims that were being held but not developed. In 2020, Kuvimba Mining House (KHM) was established to directly control several mothballed gold mines whose previous owners had divested their interests and, in turn, had transferred to it many of the assets. KMH is understood to be owned 65 percent by the GoZ through ZMDC, with another 35 percent held by various private parties. While KMH has a diversified mining asset base, several of these assets have been loss-making and carry large unsettled debts, both to creditors and, reportedly, to workers.

Artisanal mining, which is presently under-regulated, has proliferated due to a dearth of livelihood options in rural communities and the low-quality governance environment. Indeed, more gold is produced by artisanal mining than by industrial mines and, at times, Zimbabwe has experienced uncontrolled booms in artisanal extraction of diamonds, chromite, and lithium-bearing ores.

In Zimbabwe, the relationship between large-scale mining corporations (LSM) and artisanal and small-scale miners (ASM) has been marked by conflict and violence. To address this, partnerships between mining corporations and ASM are being recognized as necessary for peaceful coexistence. These partnerships aim to find common ground and benefit all stakeholders involved. They can take various forms, such as sub-leasing agreements or financial assistance. The involvement of the Government is crucial for the success of these initiatives. The partnerships offer benefits such as increased revenue for the state, improved working conditions for ASM miners, and addressing climate impacts. Lastly, by promoting peaceful coexistence, the collaboration between LSM and ASM can collectively address climate impacts, such as reducing flooding and heat stress on ASM activities, and the alleviation of environmental impacts to land, water and air, which typically work through the following transmission mechanisms:

Land impacts	Water impacts	Air impacts
Deforestation and forest degradation	Destruction of fish and other water life, and their habitats	Diesel Pollution
Top soil removal	Blocking of riverways	Particle dust pollution
Sediments and erosion	Cyanide contamination	
Mercury use	Disturbance of riverbanks and the substrate	Mercury use
Soil contamination		

Vision 2030, which sets out ambitions for Zimbabwe to attain UMIC status by 2030, is predicated on rapid mining sector growth. Targets for mining sector output of US$ 12 billion in 2023 and US$ 20 billion in 2030, were set out in the Strategic Roadmap for Mining in October 2019, which was developed as part of Vision 2030. The Deep Dive on Mining section examines how investment and growth in the sector might attain government targets, up to 2030 and beyond under two sets of conditions. The first is in line with the BAU scenario in which prevailing domestic investment conditions persist. The second, aligned with the ASP scenario, projects mining sector growth in a reformed environment in which significant domestic barriers to investment are successfully addressed. External conditions in mineral markets and capital markets are

assumed to be the same and broadly supportive of mining investment in both scenarios. Given the lead times for greenfield mining projects to come into production and to assess the implications of mining growth on decarbonization goals, the analysis adopts a time horizon out to 2050.

Zimbabwe has a diverse mineral endowment but the potential to exploit known resources varies considerably from one mineral to another, with the likely evolution of investment being affected by factors specific to each. Those such as high-value gold, diamonds, and platinum group metals dominate the present mineral value mix and have attracted investment even during times of domestic economic instability and commodity market volatility. Resources of lower-value bulk minerals such as coal, chrome, and iron ore are substantial but investment flows have been heavily constrained by costly associated transportation infrastructure investments. Minerals critical to the low-carbon economy, such as copper, nickel, lithium, and graphite, face mixed fortunes. Lithium holds the greatest promise, as evidenced by a recent wave of acquisitions of lithium-bearing mineral concessions. The BAU and ASP scenarios are built taking into account the specificities of each mineral subsector.

The mining sector is projected to grow in value terms from 2022 levels by 30–50 percent in the BAU scenario, and by as much as 250–300 percent in the ASP scenario, by 2050 (Figures 3.1.1. and 3.1.2.) The outlooks for mining in Zimbabwe to 2050 under the BAU and ASP scenarios are quite different in each of the major mineral subsectors, even though many of the investment conditions faced by investors are common to all (Figures 3.1.3 and 3.1.4). This is due to a variety of factors, including the quality of the resource base, assets already in operation or needing to be built, the types of ownership among incumbents, and the scope for new players to enter, as well as market conditions for each of the minerals looked at. The aim of the mineral-by-mineral analysis is to identify the subsector-specific factors that will hinder or enable miners to overcome investment barriers in the BAU scenario and seize new investment opportunities in the ASP scenario (these data are available in the separate Deep Dive on Mining).

The aggregate sector outlook masks quite different fortunes among the main minerals. In the BAU scenario, there is a decline in output of nickel and only modest increases in most other minerals (including coal), but a significant increase in lithium output. In the ASP scenario, coal is the biggest loser, whereas all

Figure 3.1.1: Mining sector value (US$ million 2022 prices)

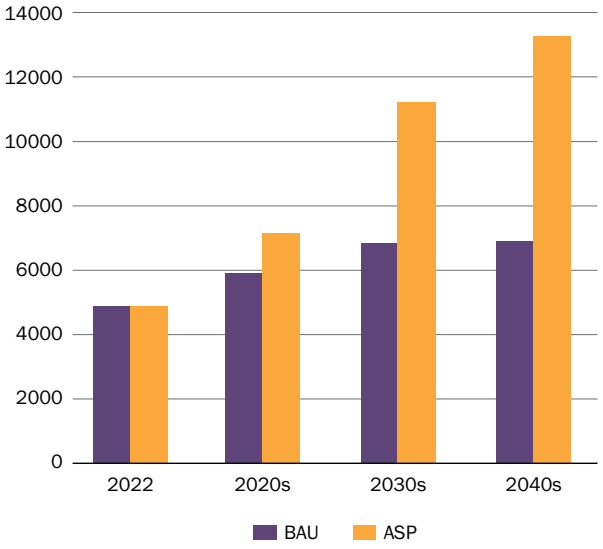
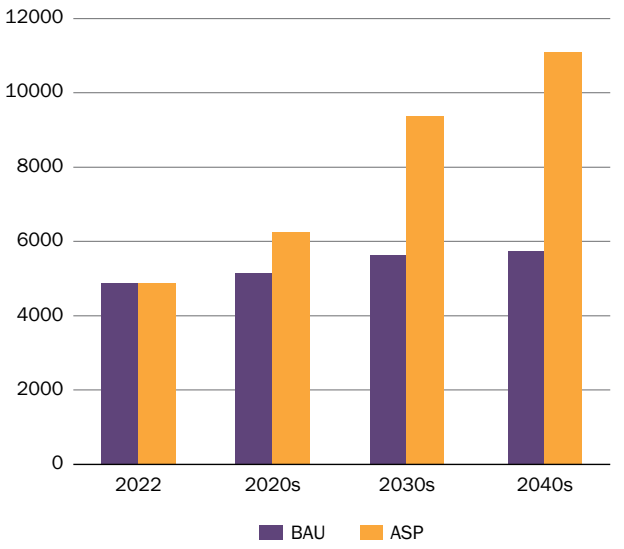


Figure 3.1.2: Mining sector value US$ million long-term price forecast



Source: World Bank. 2024a

Figure 3.1.3: BAU scenario: Average mineral shares by value 2040s

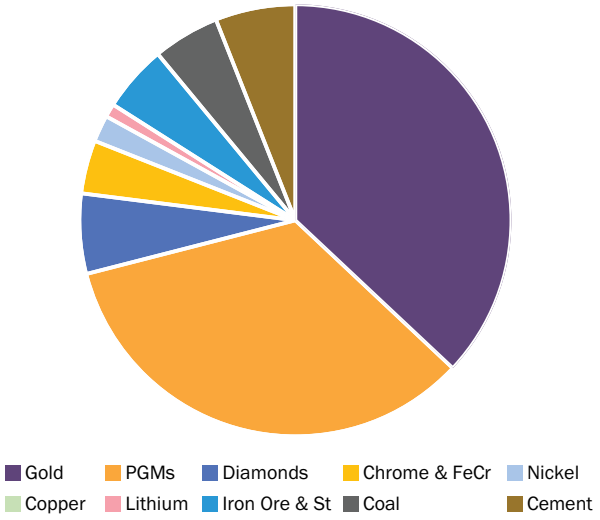
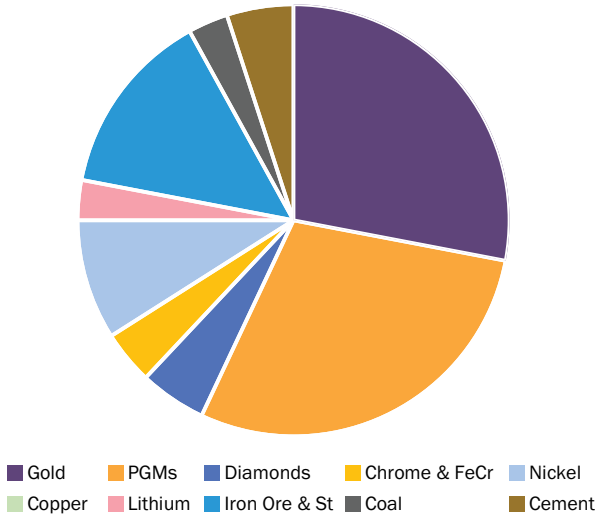


Figure 3.1.4: ASP scenario: Average mineral shares by value 2040s



Source: World Bank. 2024a

other minerals see rises, with nickel and lithium growing most strongly. Important changes are also expected in the portion of mine output that will be processed in Zimbabwe in the outlook period. In the BAU scenario, downstream processing is restricted to platinum group metals (PGMs) smelting and a limited amount of ferrochrome smelting, steel-making and coke conversion. In the ASP scenario, processing takes place both on a larger scale for these minerals and is extended to gold, nickel, and lithium. The higher sales values associated with refined mineral products provide a basis for mining sector growth in value terms in both scenarios, especially so in the ASP scenario.

The GoZ foresees many of the socio-economic benefits of mining sector growth to flow from increases in the degree of value retention in Zimbabwe. Policy interventions are intended to encourage investment in mineral processing located at the mine-site, or independently, which would otherwise take place outside Zimbabwe. In the BAU scenario, policy intervention is skewed toward compensating for other factors that inhibit such investment by using tax breaks, subsidies and even direct bans on exports of unprocessed minerals.[15] In the ASP scenario, however, policy intervention is skewed more toward removing the underlying factors that inhibit investment, and thereby being better able to mobilize finance for significant infrastructure investment, especially power generation and improved roads and rail, in partnership with the private sector.

The external investment environment is increasingly supportive of energy transition minerals (ETMs), but it is also increasingly supportive of investments that contribute toward greening the economies of host governments. Zimbabwe has an opportunity to take advantage of these two related global trends, as it seeks to realize bold ambitions to harness its mineral wealth, not only for the benefit of the nation but for the wider climate ambitions of the global community. While mining is currently constrained by the state of Zimbabwe's infrastructure, future mining investment could drive low-carbon development of rehabilitated and new infrastructure.[16] As a viable off-taker able to pay for services in hard currency, the mining sector—with the right incentives—could capitalize on legacy infrastructure and drive the expansion of RE and key transport services that would provide positive spillover effects for other industries and urban centers.

15 In December 2022, the GoZ introduced a blanket ban on the export of unprocessed minerals, with exemptions available only to investors building or committing to build local processing capacity. Prior to this, export bans had been imposed (and removed) only on specified minerals.

16 Low levels of maintenance and performance of road, rail and electricity supply services, and the hollowing out of much of the manufacturing sector have contributed to a difficult operating environment for mining companies and acted as significant barriers to investment.

Solutions need to strengthen the enabling environment for firms to invest in climate-smart mining and PPPs for supporting green and resilient infrastructure.

3.1.1. Energy and Mining

Existing sources of electricity—from Kariba hydropower and the Hwange coal-fired power plant—are insufficient to meet demand and are holding back investment in industry. Zimbabwe's per capita electricity consumption has almost halved in the past decade. Inefficiencies and subsidies in the power sector amount to US$ 1.6 billion or over 7 percent of GDP in financial (generation inefficiencies 2 percent, electricity subsidies 1.35 percent) and economic terms (lack of reliability 3.79 percent). Zimbabwe performs worse than regional comparators on the frequency and duration of outages, as well as distribution losses (World Bank 2022b).

In early 2023, mining companies were experiencing load-shedding of between 12 and 14 hours a day. Diesel generators are the default power backup mechanism, but if these have to run for more than 25 percent of the time many mining operations are no longer financially viable. Even with load-shedding, mining consumes one-quarter of the existing 10 TWh a year supplied by the grid. The carbon intensity and share of emissions of electricity generation have worsened over the past decade (1,000g KWh in 2022) (World Bank 2022b). The projected reduction in precipitation, increase in evaporation, and increase in water demand will reduce river runoff, and thus negatively impact hydropower generation (GoZ 2015).

Projections for energy consumption across mining and mineral processing are expected to rise sharply under the ASP scenario, reaching 21 TWh a year in the 2040s (Table 3.1.2). Meeting this demand would require massive investment, estimated at US$ 7 billion.[17] NDS1 plans for most of this investment to be made by the private sector, with Zimbabwe Electricity Supply Authority (ZESA) as the off-taker. However, an alternative would be to incentivize the mining sector to be the primary off-taker for IPPs and only sell surplus to ZESA. This would be an opportunity to transition mining to renewable and resilient energy through power-to-mine investments that could also support broader RE scale-up. The in turn the public sector

Table 3.1.1: Mining sector electricity demand: BAU scenario (GWh)

Product	2022	2020s	2030s	2040s
Gold	323	404	538	673
PGM	621	710	980	1,065
Diamonds	120	120	230	230
Chromite & FeCr	1,959	2,431	3,152	3,575
Nickel	23	34	34	0
Iron & Steel	0	778	1,179	1,568
Lithium	90	313	375	375
Coal	138	180	188	196
Cement	155	165	185	206
Total in GWH	3,427	5,134	6,861	7,888

Table 3.1.2: Mining sector electricity demand: ASP scenario (GWh)

Product	2022	2020s	2030s	2040s
Gold	323	538	1,036	1,332
PGM	621	840	1,295	1,510
Diamonds	120	144	384	384
Chromite & FeCr	1,959	3,575	5,814	7,207
Nickel	23	527	1,345	1,402
Iron & Steel	0	1,568	5,489	7,840
Lithium	90	500	805	1,073
Coal	138	186	200	220
Cement	155	206	258	309
Total in GWH	3,427	8,084	16,625	21,276

17 To catch up with existing demand and to meet the future needs of mining, industry and manufacturing.

could focus on key reforms, including: (i) improved power sector planning; (ii) utility tariff reform and debt clearance; (iii) rehabilitation and upgrading of the grid to meet current deficit and future demand; (iv) off-grid solutions, both as medium-term transition and a long-term solution to electrification (public CapEx and user OpEx); and (v) transitioning biomass (e.g., wood chip, charcoal, etc.) from a historically unsustainable energy source associated with deforestation and land degradation to a certified sustainable source of energy for rural livelihoods, and agri-processing and heavy industry (e.g., cement and steel production processes that cannot be run on electricity) would deliver adaptation co-benefits.

Mining sector growth in each scenario will imply growing GHG emissions unless emissions can be reduced, but this will be challenging for several reasons. First, mining output growth will increasingly rely on the extraction and processing of minerals that are of decreasing grade and/or located at greater depths, resulting in greater energy intensity of mining. Second, if mining operations move up the value chain to retain more value domestically through smelting and refining in Zimbabwe, which is a Vision 2030 goal, the energy intensity of the sector would increase even more sharply. Mining already represents close to one-quarter of the power supplied by the grid and, in Zimbabwe Electricity Supply Authority (ZESA) projections linked to Vision 2030, this will rise to one-third, while by the 2040s it is expected to account for half of all electricity demand. So, a key challenge and opportunity is for such load growth to be met by new renewables generation capacity rather than coal-powered generation. Within the past two years the installation of the first solar PV plant to serve mines had taken place and renewable power generation has been integrated into several mine expansion and greenfield project announcements. While developments of this kind will help to meet growing demand for a reliable supply of power and reduce reliance on expensive diesel to power back-up generators, investment in grid-based generation of renewables and the associated transmission network remain essential.

Electricity least-cost generation planning indicates that, for Zimbabwe, renewables are now more cost-effective than fossil-fueled sources of electricity. Building on Zimbabwe's integrated resource plan, a model was developed to determine an optimal investment plan (World Bank 2023). This model confirms that, in a Zimbabwe-specific context, solar PV proves to be a powerful lever to increase supply and lower the cost of generation. In an improved macro-economic environment solar PV could rapidly expand from only a few MW today to 2 GW by 2030 and 6 GW by 2040. The solar PV investments would need to be complemented with a large-scale battery energy storage system (BESS), allowing load-shifting during the day, and providing primary and secondary reserves. At least 80 MW of BESS by 2025 will be needed, rising to 1 GW by 2030 and 4.5 GW by 2040. In case of lower load growth, wind remains valuable to diversify the energy mix, provides additional generation during low hydrological conditions, and meets the renewable objectives for capacity installed.[18]

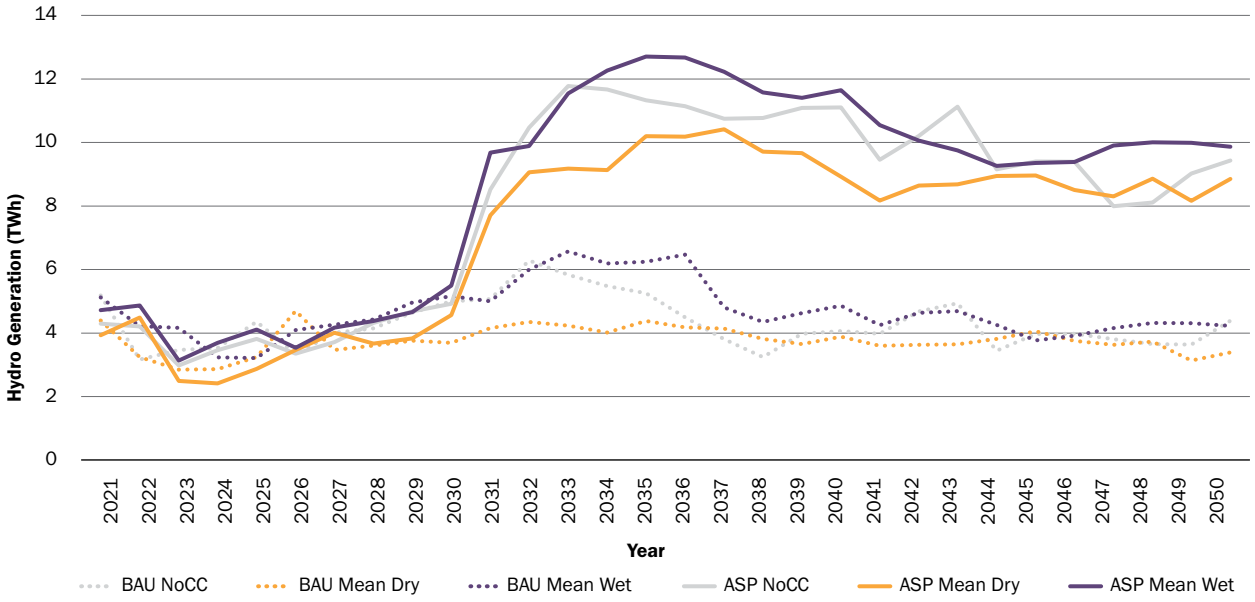
In the short to medium term, exploiting large natural gas resources in Mozambique may provide a stop-gap, while longer-term RE resources are built up in-country. These natural gas resources could become available to Zimbabwe in 2025. This gas could either be used to produce electricity in Mozambique, which would then be exported to Zimbabwe, or directly exported to Zimbabwe to produce electricity locally. It represents a cost competitive and flexible source of electricity, and is less polluting than coal.

The climate change impact analysis for this report confirmed that, given the high level of uncertainty around future hydroclimatic conditions, hydropower development decisions carry the climate risks. Multiple studies show that the hydropower output in the Zambezi is highly exposed under a wide range of climate scenarios. Under the driest scenarios, estimates are of up to a 58 percent reduction in hydroelectricity revenues relative to a scenario without climate change (IPPC AR6 2022:1348). The hydropower modeling for this report confirms this showing that there is a long-term downward trend to hydropower production

18 Key potential wind RE resources are along the border between south and north Matabeleland, the area surrounding Bulawayo. Mashonaland East and the Darwin mountain region.

across climate scenarios (Figure 3.1.5). Even with the construction of the Batoka and Devils Gorge hydroelectricity plants under the CCDR's ASP scenario, there is a significant decline in output by 2050 pointing to the climate risk of these investments. Increasing the share of RE from its low base in 2022 (less than 1 percent) to 45 percent by 2040 would reduce reliance on large hydro (55 percent in 2022), which is susceptible to drought and increases climate resilience. Drawing on natural gas resources and planned hydro developments, for example, Cahora Bassa North (495 MW) and Mphanda Nkuwa (800 MW), in the region through the Southern Africa Power Pool (SAPP) would be more cost effective than the development of the Batoka hydro power plant.

Figure 3.1.5: Range of climate change impacts on hydro power production (BAU verses ASP including Batoka dam)



Source: World Bank. 2023a.
Note: No further Climate Change (NoCC).

3.1.2. Transport and Mining

Ailing transport infrastructure and systems are also a break on mining and industrial expansion, regional integration, and rural-urban access to economic opportunities. Road transport is the dominant means of transport in Zimbabwe, with 80 percent of the traffic and trade (by volume) transported by road. There is a high penetration of commercial and passenger private vehicles, especially motorcycles, compared with regional and income benchmarks. There has been substantial growth of passenger and freight vehicle fleets. This is partly due to normal growth in travel demand, and partly due to other modes such as rail having deteriorated in accessibility and quality, particularly for heavy cargo. Declines in rail passenger traffic have been exacerbated both by unreliable passenger services and strong competition (in terms of price and service frequency) from cars, buses and shared taxis.

The current modal-split is not optimal and negatively impacts both roads and rail networks. The progressive shift in the use of the roads network, particularly by heavy freight, has subjected the road network to increasing loading pressure and, as a result, accelerated deterioration in road assets. This, in the absence of adequate maintenance funding, reduces the efficiency of road transportation and can adversely affect the potential for mining, and other productive sectors. Furthermore, high road transport costs for passengers (higher than rail) and limited physical road infrastructure negatively impact connectivity to social and economic centers.

Rail freight volumes have also declined due to deteriorating rail assets and inefficient management. With freight services shifting progressively to road despite low perceived road quality (2.8 for Zimbabwe compared with 3.3 for SSA) (World Bank 2022b), the railways system revenues have been on the decline. This also impacts the operational performance and connectivity of the regional railway network where, for example, the Beira Rail Corridor on the Mozambique side is not operational.

A well-functioning railway network is critical for sustaining Zimbabwe's economic growth, particularly for the development of the mining sector. Key domestic transport needs for the mining industry include: (i) coking coal and iron ore to steel plants; (ii) chromite to ferroalloy plants; (iii) ferrochrome to steel plants; (iv) nickel concentrate to smelter; and (v) thermal coal to thermal power plant. Access to export markets via border crossings is essential for that portion of mine output not used locally, which includes metallurgical coal, chromite and, increasingly, lithium ores and concentrates. Zimbabwe also has a central location in the sub-region, its extensive road and rail network are opportunities to grow industry and employment opportunities domestically, as well as increase market access and trade, boosting value addition and other economic activities within the sub-region (Trans African Highways, North-South and East-West corridors). By the 2040s, in the ASP scenario re-establishment of the steel industry would be associated with the transport annually of up to 5 million tonnes of iron ore from mine to steel plant (over some 50 km), Between 1 and 1.5 million tonnes of coal from Hwange and Limpopo regions (over 100–200 km) and lithium concentrates bound for China could rise to around 800,000 tonnes (but with domestic processing into lithium carbonate the amount would be significantly less).

Zimbabwe's geographical location has enabled it, historically, to play the role of a transport hub in the region, particularly for copper exports from the Copper Belt. Copper-mining companies that operate in the Copper Belt, spanning over the Democratic Republic of Congo (DRC) and Zambia, have historically used the north-south corridor to export cargos to Durban port through Zimbabwe. In doing so, they relied on both railway and road networks of both Zambia and Zimbabwe. However, Zimbabwe's position as a regional corridor will face competition from east-west corridors under development to ports in Tanzania and Angola.

Private sector participation in the rail network is nascent but investment needs are considerable and electrification is key to decarbonization. The country has a 30-year Build Operate Transfer (BOT) concession in place covering a 385 km railway line from Bulawayo to South Africa, owned and operated by Beitbridge Bulawayo Railway (BBR). The rest of the network (2,760 km) is owned and operated by National Railways of Zimbabwe (NRZ). The railways network connects the country to neighboring economies and key maritime gates, and is essential for the country's mining sector. The railway network has a design capacity of 18 million tons a year, but utilization has been on the decline, with transported freight being no more than one-fifth of the design capacity.

The electrical infrastructure (133 km electrified section between Dabuka in Gweru and Msasa in Harare) is largely obsolete and under-maintained. There is currently a total suspension of electric locomotives.[19] The operational inefficiency of the rail system increases operational costs, forcing the operator to increase tariffs to levels higher than neighboring countries. This negatively impacts the attractiveness of the rail network as a clean transportation system in favor of roads and trucking.

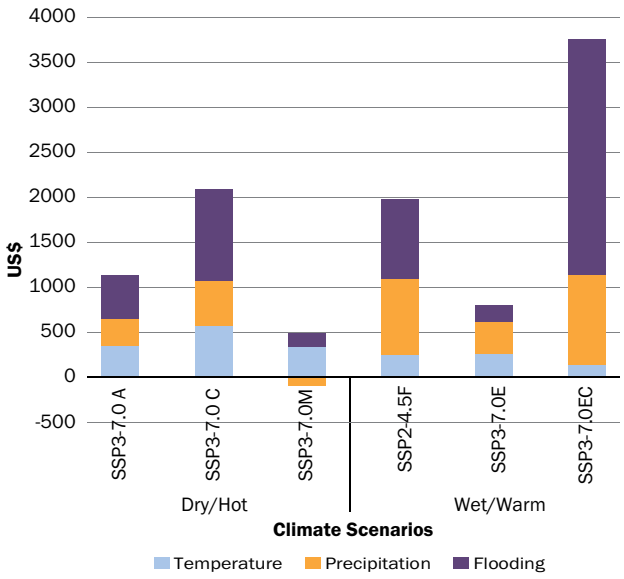
The mining sector offers opportunities to develop commercially viable railways systems through PPPs. The BBR BOT concession raises the prospects of further PPPs that could support development of the railways system increasing its operational efficiency and hence tipping the modal shift more in favor of railways. Additional opportunities lie in rehabilitating and reintroducing the electric locomotives as a first step, before then expanding the share of railways electrification. This could provide positive spill-over effects on reducing GHG emissions from transport for urban and intercity passenger, as well as freight transport systems.

19 30 operating electric locomotives, which were taken out of service.

The road construction and rehabilitation unit costs per km are relatively low compared with those of the railway system. This is expected to lead to more investments in the roads sector compared with the rail sector, particularly under the BAU scenario. As a result, the modal share will remain in favor of roads, either maintaining current ratios or increasing them. In light of growing mining activities, this means growing freight volumes transported by roads, which will lead to an increase in emissions and congestion. The growing reliance on roads will also face the risks of climate change impact on the physical infrastructure.

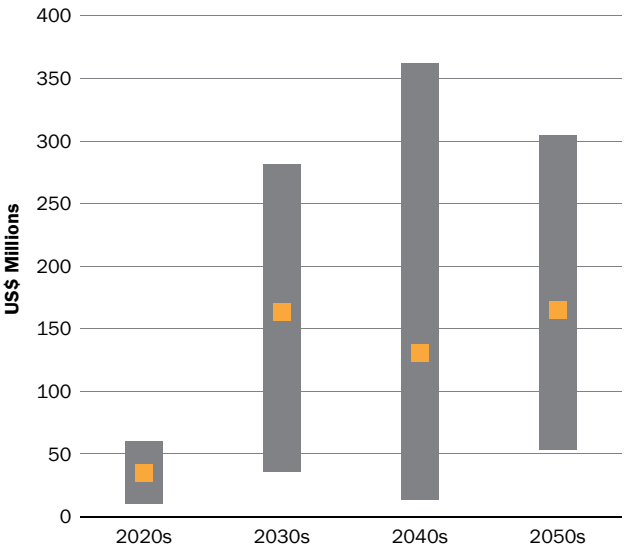
Estimates of the impact of climate stressors, specifically increased temperatures, precipitation, and flooding on road and bridge infrastructure, were estimated to be between US$ 50 and US$ 300 million a year. From 2031 to 2050, impacts from climate change are expected to result in increased annual damage per km of infrastructure relative to the baseline period (Figure 3.1.6). The magnitude of damage varies among dry/hot and wet/warm GCMs. Overall, damage is highest from a wet/warm scenario, with additional annual damage estimated at US$ 3,500 per km. Here, flooding related impacts account for the largest share of damage, followed by precipitation and temperature-related damage. For a majority of wet/warm GCMs considered, flooding accounts for the largest share of damage, followed by precipitation and temperature. However, for dry/hot scenarios, temperature-related impacts generally account for higher additional annual damage compared with precipitation-related impacts. Damage to road and bridge infrastructure is projected to increase, peaking before mid-century in 2040 (Figure 3.1.7.). By mid-century, damage is expected to range from US$ 50 million to US$ 300 million, which is modest compared with neighboring countries such as Malawi, where higher damage was driven by flooding, even under dry/hot scenarios.

Figure 3.1.6: Additional annual damage by climate hazard (US$ per km)[20]



Source: World Bank. 2023a.

Figure 3.1.7: Additional annual damage across scenarios: max, min and mean relative to baseline (US$ millions)



Source: World Bank. 2023a.

Under the BAU scenario, Zimbabwe will need to build the resilience of its road infrastructure to keep mining revenues flowing. In the road sector, this will include: (i) developing design standards that incorporate climate resilience; (ii) building vulnerability assessment capacities of the sector; and (iii) building the sector's capacities to maintain the network and to respond to emergencies. In addition, adopting regulations to incentivize more fuel-efficient fleets (newer trucks) would help reduce GHG emissions.

20 Dry/Hot scenarios: SSP3-7.0 ACCESS-CM2; SSP3-7.0 CNRM-ESM2-1; SSP3-7.0 MRI-ESM2-0; Wet/Warm scenarios: SSP2-4.5 FGOALS-G3; SSP3-7.0 EC-EARTH3; SSP3-7.0 EC-EARTH3-VEG

It is also anticipated that under the BAU scenario—with limited fiscal space—the GoZ will continue to put in place PPP concessions, particularly in the rehabilitation of the road network and possibly some in rail. The success of these initiatives, however, will largely depend on the adequacy of the country's PPP and macroeconomic enabling environment.

Under the ASP scenario, PPPs to expand the railways system would be a key way to create synergies between mining development, climate mitigation and adaptation. In the short term, there is a need to conduct assessments of the status of the various railways system components (rails, rolling stock, electrical system, signaling systems, stations, etc.) to identify the required works before estimating costs. This is planned by the GoZ under NDS1 and should consider climate mitigation and adaptation in the process, including options for converting more diesel lines to electrified lines and in ensuring that rehabilitation is climate resilient. In doing so, the GoZ needs to develop a coordinated approach that links the PPP modality to mining concessions to increase commercial viability. This would provide a path to modernizing and greening the rail system, as well as ensuring its resilience in the face of climate change.

Two additional paths to greening the transport system, under the ASP scenario, would be increasing the modal share in favor of railways; and electrifying the rail network. The first path would involve the GoZ adopting modal split targets and working toward these by expanding the railways network and improving its operational and financial performance, as well as setting axle loading limitations on the roads network. The second path would involve reducing emissions from the rail system, where the focus would be to rehabilitate and operationalize the existing, non-functional electric stretches, and then expanding the electrification to cover the whole network.

3.1.3. Mining Governance

The GoZ has taken several steps to incentivize investment in mining. Among the measures introduced by the present Government as part of its "Open for Business" policy are: (i) removal of mandatory indigenization requirements for diamonds and platinum in 2020; (ii) offering fiscal incentives to mineral exporters under which mining companies that export over 50 percent of output receive a range of tax breaks; (iii) registering certain enterprises as being in a Special Economic Zone; (iv) reducing royalty rates on sales of diamonds (from 15 to 10 percent) and PGMs (from 10 to 2.5 percent); (v) establishing the Zimbabwe Investment Development Agency (ZIDA) as a "one-stop shop" investment agency to streamline bureaucracy and provide business facilitation; (vi) opening the Victoria Falls Stock Exchange on which stocks are traded in US dollars, and listed companies can avoid capital gains tax and are not subject to foreign exchange conversion requirements; (vii) introducing a foreign exchange auction system in June 2020 to allocate hard currency in place of the previous administrative allocation system; and (viii) creating incentives for companies engaged in or planning to process minerals locally, by taxing exports of unprocessed minerals (e.g., platinum concentrate) and, in certain cases, imposing an outright ban on their export (e.g., chrome and lithium ores) and imposing restrictions on imports of mineral products (e.g., cement). To date, such measures appear to have had only marginal impact, as they try to compensate for fundamental investment barriers rather than tackling the barriers head on.

But many factors combine to make Zimbabwe a relatively high-cost location in which to operate mines. Aside from the costs of power examined above, remoteness from ports for imports of supplies and export of mineral products, a limited local supplier base, a limited local consumer base, and various imposed costs of doing business, are major contributors. The ZCM found that only 11 percent of supplies to mines (by value) are provided by locally-registered companies and even these include local companies that only distribute imported goods.[21] Local manufacturers are heavily impacted by foreign exchange shortages, lack of credit, and limited ability to compete in over-supplied regional markets. Transport costs are higher than regional

21 This is a significant reduction from 2012, where a World Bank study analyzing two major mining companies found that local content comprised 21 percent and 72 percent of total inputs.

peers, notably rail freight tariffs, which are double neighbors' rates, forcing miners of more bulky minerals to rely on the road network. The costs of doing business are high across all business sectors but, in the case of mining, some added costs are imposed, such as the marketing commission charged by the Minerals Marketing Corporation of Zimbabwe (MMCZ) on the export of all minerals other than gold.

Since the reintroduction of a domestic currency in place of the US dollar, the frequent changes and severity of currency control regulations have posed serious problems for mining companies. Hard currency surrender rules require a portion of US dollar earnings to be surrendered to the Reserve Bank of Zimbabwe (RBZ) at official conversion rates. The rules are subject to change by statutory instruments rather than legislation. In February 2023, the surrender requirement was standardized at 25 percent, a relaxation from 40 percent applicable in most of 2022. The surrender requirements put a squeeze on operating cash flows and, due to the difference between the official conversion rates and those in the parallel market, act as a "hidden" tax. Mining companies face difficulties in mobilizing capital to invest merely in sustaining operations, let alone expanding them or developing greenfield projects. Zimbabwe's political and economic risks severely limit foreign bank interest in potential project financing, such that incumbents looking to raise finance have no alternative but to seek equity partners or commodity-backed loans.

Concerns about the low quality of governance and corruption in the mining sector are factors affecting the negative perceptions held outside Zimbabwe among potential new entrants. The IMF (2022) recently concluded that "Zimbabwe's mining governance and transparency weaknesses constrain the sector's fiscal take and contributions to economic development." A 2020 report, commissioned by the Anti-Corruption Commission, to investigate governance and corruption in the mining sector, found that weak institutions and corrupt permitting practices take place in allocating mineral rights, acquiring and transferring equity interests, and obtaining fiscal and other business concessions from officials.

At the same time, industrialized countries are investing at home and have adopted strategies to make their own supply chains more sustainable and resilient. Governments of not only producing countries but also of consuming countries are acting to secure the integrity of critical minerals supply chains and manage increasing geopolitical risks. For example, Australia, Canada, the EU, Japan, the United Kingdom, and the United States have each prepared new critical minerals strategies that include financial incentives to facilitate the development of integrated value chains, as well as measures to mitigate demand impacts, such as the recycling of metals and batteries, materials substitution, and the adoption of circular economy principles. These countries are also looking abroad to secure their value chains.[22] The ideal solution for many of these countries is to develop resilient supply chains on their own territories. However, as lead times for developing new mines are long, countries are entering partnerships such as the Minerals Security Partnership (IEA).[23] Because countries continue to develop or implement their own strategies for critical minerals, and because companies in these countries enjoy government support and/or inexpensive financing, they tend to be able to move relatively quickly. This could compete with investment opportunities in Zimbabwe.

However, Zimbabwe stands to benefit tremendously from the ongoing energy transition, if it pivots toward, and is supported to seize, the opportunity. A robust governance framework for mining that meets international best practices, together with a conducive investment climate, is critical for Zimbabwe to balance risk and reward for investors, and attract high-quality investors to Zimbabwe's mining sector and downstream value addition opportunities. Beyond the generation of foreign exchange, fiscal revenue, local procurement, value addition, and jobs, rising demand for critical minerals significantly increases potential benefits from the sector. To take advantage of this opportunity, Zimbabwe will need to: (i) increase its supply-response capabilities; (ii) unlock long-term transformational development opportunities through strategic, resource-anchored transportation infrastructure investments; (iii) link mining with investments in

22 For example, the EU has recently announced memorandums of understanding with Namibia and Kazakhstan, and a separate one is being discussed with the DRC.

23 https://www.iea.org/policies/16066-minerals-security-partnership

RE to decarbonize value chains, achieve countries' NDCs, and alleviate rural energy poverty; (iv) support value addition beyond mining moving vertically (up and down) along the value chain;[24] (v) invest heavily in human capital formation from university graduates to skilled tradespeople; and (vii) strengthen governance, mining-impacted communities, and environmental stewardship with adherence to higher ESG standards has become a key feature of the mining industry.

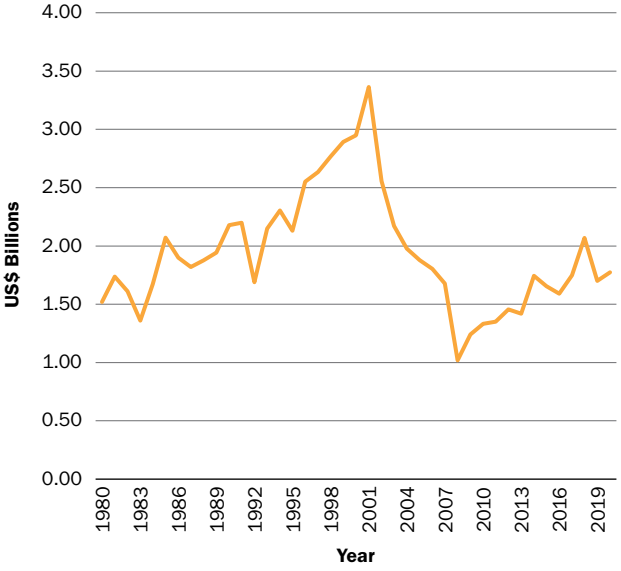
Actions needed to enable the ASP scenario in the mining sector span a wide range of political, economic and social measures, many of which are not specific to the mining industry. Were Zimbabwe to implement priority measures and unleash the quantum of investment implied by the ASP scenario, the mining sector would deliver both global public goods: (i) supplying critical minerals needed to mitigate climate change; (ii) improving the resilience of supply chains for the future global energy system and local public goods, thereby; (iii) generating hard currency and boosting state revenues; and (iv) providing an anchor for transformational infrastructure investment in resilient transportation and clean energy, which could catalyze resource-driven economic corridors.

3.2. Resilient Agriculture, Landscape Restoration, Food and Water Security

Agriculture has historically been a mainstay of Zimbabwe's economy, alongside mining, manufacturing and, increasingly, services. Agriculture currently contributes about 12 percent of GDP and 40 percent of export earnings, provides about 68 percent of raw materials to the manufacturing sector, and sustains a market demand for industrial products. The value of agriculture exports in 2021 was US$ 1.2 billion and has fallen by nearly 30 percent in real terms since 1995, eclipsed by the mining sector.

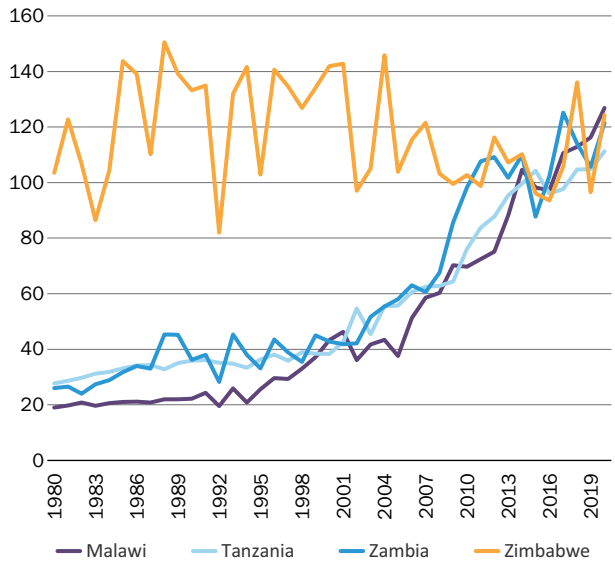
Productivity in agriculture has fallen since the introduction of the Fast Track Land Reform Programme in 2000, and has been well below the level of its peers despite recent improvements and is yet to recover peak output in 2000 (Figures 3.2.1 and 3.2.2). The FTLRP created around 146,000 family farms

Figure 3.2.1: Agricultural output 1980–2020 (US$ 2015 constant prices)



Source: World Development Indicators based on assessment of official exchange rates as conversion factors.

Figure 3.2.2: Crop production index 1980–2020 (2014–2016 = 100)



Source: World Development Indicators based on assessment of official exchange rates as conversion factors.

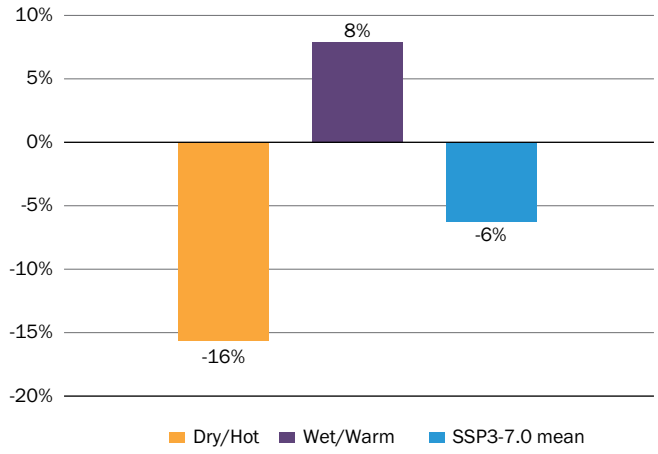
24 The lithium-ion battery value chain uses lithium, copper, manganese, cobalt, nickel, and titanium, all of which are abundant in Africa. It is foreseeable that the South African Development Community (SADC) countries could create a complete value chain that leverages existing manufacturing capacities while simultaneously developing and consolidating new capacities. Value addition opportunities exist for iron ore and aluminum in West Africa and for hydrogen in South Africa and Zimbabwe.

on about 5.8 million ha and around 16,000 commercial farms (so-called A2 farms) on 3 million ha. In total, the 8.8 million ha of farms, though only 20 percent of Zimbabwe's land area, are equivalent to 90 percent of the country's arable land.[25] Together with farms on communal land, Zimbabwe's agriculture is now predominantly smallholder-driven and around 95 percent rainfed, making it vulnerable to dry shocks. Less than 1 percent of smallholders have access to irrigation, yet there are over 10,000 dams in the country and Zimbabwe has dam storage capacity three times the SSA average per capita, even without taking into account Lake Kariba.

Realizing the potential of the FTLRP will require reorganizing key aspects of both the agricultural production process and, more broadly, the way that Zimbabwe's renewable natural capital is managed. The FTLRP and earlier land reforms have fundamentally changed, not only who uses the land, but the relationships between land, labor, capital, and water, as well as access to knowledge, technology, markets, and finance. Realigning these means of production is beginning to happen through the emergence of various new production models, such as the hub-and-spoke promoted by the Horticulture Development Council, out-grower models in wheat and tobacco, and the village aggregation model in the dairy industry. These models help link farmers with finance, knowledge and markets, but are work-in-progress.

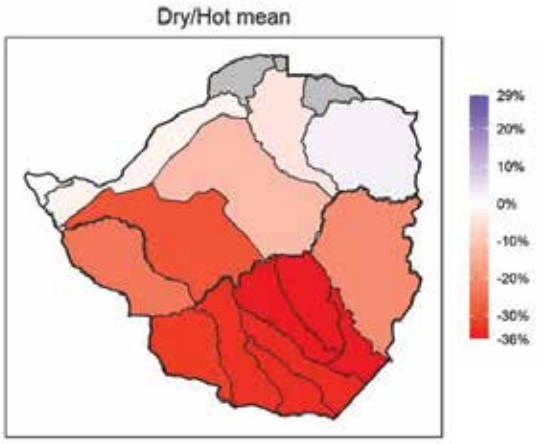
Climate impacts on total crop revenues were modeled for a range of GCMs, resulting in crop revenue losses as high as 16 percent in dry/hot GCMs to gains of 8 percent in wet/warm GCMs (Figure 3.2.3). These impacts on crop revenue were for a representative set of crops representing at least 80 percent of the total production revenues, as well as harvested area. These results should be understood in the context of Zimbabwe's already high exposure to drought hazard (as discussed in Section 1.3), which means that these climate impact results will exacerbate already highly variable output levels (see discussion on maize below).

Figure 3.2.3: Climate impacts on crop revenues based for dry/hot, wet/warm and SSP3-7.0



Source: World Bank. 2023a .

Figure 3.2.4: Maize yield shocks by sub-catchments under the dry/hot scenarios (%)



Source: World Bank. 2023a .

Maize is a strategic crop that is key to food security, accounting for over 50 percent of the average calorie consumption for over 85 percent of Zimbabwe's population. Since 2000, the country has faced food insecurity, as production has been below the 2.2 million tonnes (Mt) needed to supply sufficient maize for both human and livestock consumption. Production levels over the past two decades have averaged just below 0.8 Mt, varying from below 0.5 Mt to as high as 2.7 Mt. During deficit years, maize is imported from neighboring countries and bought from global markets, mainly from South Africa and Mexico. Maize yields

25 Land reform targeted a combination of arable and rangelands.

in Zimbabwe were 0.6 tonnes per ha in 2018 compared with 1.6, 2.2, and 5.4 tonnes per ha for Malawi, Zambia, and South Africa, respectively (Ritchie and Roser 2017).

Climate impacts on maize yields averaged minus 20 percent by the 2040s, with the south of Zimbabwe suffering the largest declines. While there were potential maize yield gains under the wet/warm scenarios of up to 10 percent, the climate impacts of dry/hot scenarios estimate yield losses of up to 20 percent by the 2040s. There was also considerable geographic variation in climate impacts on maize yields with the south of the country projected to see over 30 percent losses under a dry/hot scenario (Figure 3.2.4). This provides a clear direction to adaptation efforts in this part of the country, as there is a higher degree of certainty that climate change will have negative impacts on maize yields.

Impacts across the range of other crops point to the need to manage a higher degree of climate variability than is the case today. Rice is found to be the most sensitive crop to climate change (-25 to +30 percent change), followed by pulses (-20 to +10 percent), oil seeds (-15 to +12 percent) and other cereals (-15 to +10). Root crops (-8 to +6 percent) and specifically cassava (+/- 4 percent) were less sensitive to climate change impacts than other crop types, though these were again highest in the southwest of Zimbabwe.

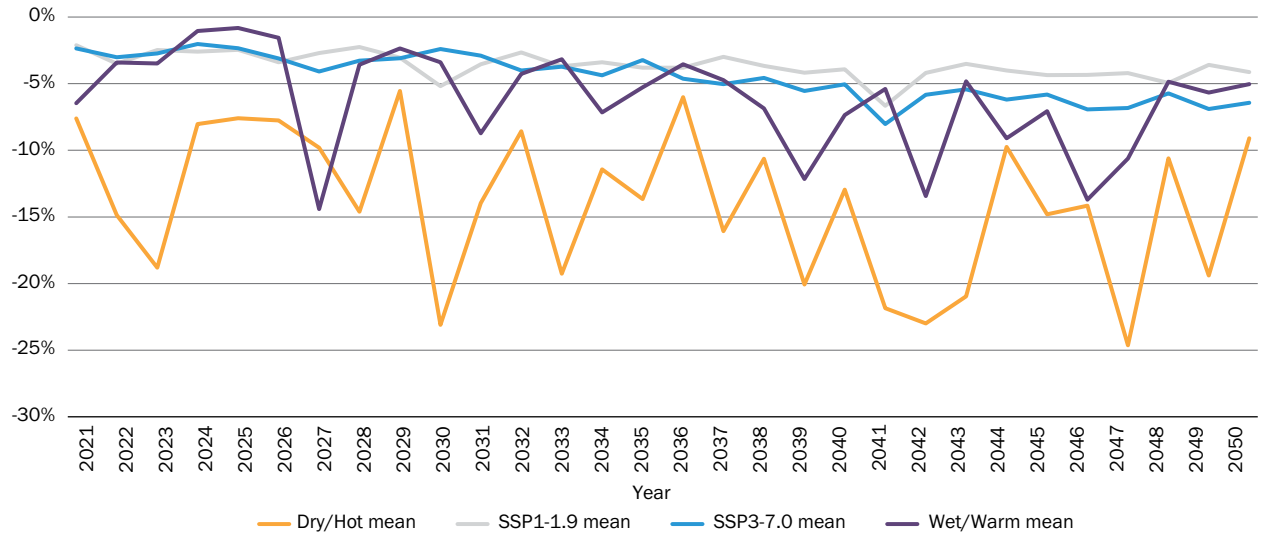
The climate impacts on production from soil erosion were in the opposite direction to those of temperature and rainfall. The impact of climate change on soil loss risk was modeled based on changes in runoff, climatic, and land factors, as well as farm management practices. By 2050, crop production declines from soil erosion averaged 1.9 percent under the wet/warm scenarios, with some more erosion sensitive crops such as oil seeds and bananas seeing higher losses. Erosion risk is highest in the mountainous eastern regions of the country under the wet/warm scenarios.

Irrigated agriculture is not immune from climate impacts, with potential revenue losses across all of the climate scenarios by the 2040s. For irrigated crops, water availability analysis was modeled using WHAT-IF and CLIRUN system models. The unmet water demands at a basin scale estimated by the water system model were then used to quantify reductions in crop yields, similar to rainfed crops. By the 2040s, these revenue loss projections were between 1.7 percent (goals-g3 GCM) to nearly 7 percent (mri-esm2-0 GCM). Sugarcane, which accounts for one-quarter of the irrigated agricultural area is the most vulnerable crop. Other crops with a relatively high share of irrigated area were tobacco (21 percent), wheat (13 percent), and maize (10 percent). These results highlight the need to assess the climate resilience of existing irrigation systems and are a reminder that irrigation, as an adaptation response, has its vulnerabilities.

Livestock production suffered production losses across all climate scenarios, irrespective of whether wet/warm or dry/hot. The climate impacts of livestock production were assessed for both changing heat stress on animals (direct effect) and availability of feed sources (indirect effect). By 2050, increasing temperatures are estimated to result in reduced livestock output ranging from 4 to 16 percent (Figure 3.1.5). The greatest impacts are to cattle milk, followed by goat meat and sheep meat. The wet/warm mean scenario is estimated to result in a 5 percent impact to total livestock productivity by 2050. Overall, shocks from the dry/hot mean scenario are higher, with livestock productivity impacts estimated to be down by 13 percent by 2050.

These findings point to a need for special attention to adaptation actions for: (i) maize production; (ii) erosion risk in the east; and (iii) livestock across the country. From past studies, such as the Climate Smart Agriculture Investment Plan (World Bank 2019), strategies to manage these risks have included: (i) crop-switching to drought- and heat-tolerant crop varieties, estimated to increase yields by 3–12 percent across all crops; (ii) irrigation, with estimated yield increases by between 50 and 140 percent; (iii) a combination of investment in irrigation and fertilizer, estimated to increase yields by 100 to 210 percent; (iv) improved feeding practices, found to reduce livestock feed intake by 63 percent; and (v) investment in climate resilient breeding programs for livestock.

Figure 3.2.5: Livestock production losses (%) three-year moving average



Source: World Bank. 2023a

The combination of switching to drought tolerant varieties and careful targeting of irrigation water to Zimbabwe's specific climate context could greatly improve resilience. One example of this is that maize is especially vulnerable to mid-season dry spells during the flowering stage, more so than wheat (Dryanthe et al. 2016). An extended dry and hot spell during this flowering stage can also lead to the so-called permanent wilting point, beyond which the crop cannot recover even if rains return. Lunduka et al. (2019) demonstrated, that in South East Zimbabwe (Chiredzi and Chipinge), yields of drought tolerant (DT) maize varieties yielded over 40 percent more than non-DT varieties. Promoting DT varieties, could generate an extra income of US$ 240/ha and better food security. The adoption of DT maize varieties currently stands at around 30 percent, leaving considerable scope for their expansion.

Investment in irrigation, while a key development and adaptation measure, needs an enabling environment to unlock private investment. NDS1 aims to expand irrigation by over 130,000 ha by 2030 through the expansion of dams. However, there is already considerable dam capacity across Zimbabwe which is underutilized. Even without including the dam storage capacity of Kariba, Zimbabwe has dam storage capacity (2,645 m^3/capita without Kariba), well above the SSA average (807m^3/capita). Scattered across the country, there are over 10,000 dams that could provide opportunities to significantly increase the availability of water for agriculture. This is a clear example of where realizing the potential of the FTLRP will require reorganizing how A1 and A2 farms can make full use of existing resources. While dam rehabilitation may require some catalytic public finance, improving the enabling environment for farmer-led irrigation development (FLID) could crowd in significant private investment. Clarifying rights and regulations for land use and tenure is central to improving the enabling environment for FLID. This involves individual capital investment that is difficult to relocate (unlike other investments in knowhow or agricultural machinery). These enabling measures include: (i) completing certification of beneficiary land rights; (ii) refining and streamlining land allocation and tenure policies; and (iii) enhancing eligibility of A1 and A2 farmers for medium-term credit.

Plans for expanding irrigation in the Mzingwane basin may need to be scaled back and shifted to basins in which water resources are less vulnerable to climate change, to avoid maladaptation. While plans to expand irrigation in the southern-most river basin of Mzingwane are modest – from 2,153 ha to 4,653 ha – the catchment is the most climate vulnerable in the country. Not only does it have the lowest rainfall

and lowest mean annual surface water runoff, but it also has limited and poor-quality groundwater reserves (Ministry of Lands, Agriculture, Water and Rural Resettlement 2020). It is both the most drought-prone river basin and under dry/hot GCM projections could see decreases in water availability of over 10 percent by the 2040s (IEc 2023). Investments in irrigation planned for the Mzingwane basin may, therefore, need to be scaled back and transferred to other more water-abundant basins, such as the Gwayi, Sanyati, Manyame or Mazowe basins. Establishing a basin-wide platform for joint discussions on water allocation could help manage the competing demands for water across irrigators, miners, other industries and cities (including Bulawayo and Beitbridge).

The climate modeling results for this report point to the need to manage ever higher levels of climate variability across the country. This calls for dynamic adaptation strategies such as conservation agricultural practices that can provide resilience to cope with both drought and flood. It also calls for broader landscape restoration measures to better regulate water and sediment flows as well as other ecosystem services that can supplement rural livelihoods with those available from wild products: wood, thatch, wild foods (honey, mopane worms, mushrooms), medicine etc.

Large-scale land restoration, as well as supporting adaptation to both wetter and drier climate futures, would reduce GHG emissions from land degradation. Ecosystems services in Zimbabwe provide benefits to a wide range of stakeholders according to how they use the landscapes. The current baseline value of selected provisioning, regulating and cultural services are estimated to be US$ 2.7 billion within Zimbabwe and US$ 10.7 billion to the rest of the world (Table 3.2.1).

Table 3.2.1: Baseline values of selected ecosystem services assessed (US$ millions per year) by stakeholder

Types of services	Explanation	Value to whom	Value per year (US$, millions)
Cultivated production	Production value net of human inputs	Commercial farmers and rural households	**365.4**
Livestock production	Production value net of human inputs	Communal farmers	**171.6**
		Commercial farmers	**120.1**
Wild resources	Value of wild harvested foods, fuel, and raw materials net of human inputs	Rural households	**576.1**
Sediment regulation	Cost savings due to vegetation capacity to hold soil in place or trap eroded soils before entering streams	Water utilities and private dam owners	**208.3**
Flow regulation (contribution to baseflows and groundwater)	Cost savings in water resources infrastructure due to facilitation of recharge by vegetation	Water utilities and/or direct water users	**673.8**
Nature-based tourism	Net income generated as a result of tourism to ecosystem-based attractions	Tourism sector	**229.7**
Carbon sequestration and retention	Avoided climate-change damages as a result of CO_2 uptake and avoided CO_2 emissions	Zimbabwe	**217.6**
		Rest of world[26]	**10 661.8**

There are significant benefits to the adoption of large-scale land restoration across Zimbabwe's diverse ecosystems (World Bank 2024). Comparing a BAU scenario with continued land degradation (eroding ecosystem services) with a resilient aspirational scenario (enhancing ecosystem services) the adaptation benefits were estimated to be over US$ 400 million a year to Zimbabweans based on investments in

26 The value of carbon sequestration and retention to the rest of the world has some potential to be captured by Zimbabwe through mitigation and VCM.

restoring degraded natural habitats, riparian buffers, conservation agriculture as well as in conservancies and improved management of tourism facilities in state protected areas.

The mitigation benefits of this large-scale land restoration were estimated to reduce emissions by an average 11 million tCo_2e per year up to 2050 as compared to the BAU scenario. This is equivalent to around a quarter of Zimbabwe's annual emissions (GoZ 2022). Using a relatively low estimate of US$ 4.5 per tCO_2e (Ecosystem Marketplace 2021), landscape restoration could generate around US$ 50 million a year in carbon credits. Valuing these emissions reductions at the social value of carbon would generate around US$ 686 million a year in global benefits (World Bank 2017).

Together the proposed investments in conservation agriculture and large-scale land restoration have a positive net present value of US$ 3.56 billion. This represents a return on investment (ROI) of 3.2 after taking into account the costs of promoting conservation agriculture, restoring degraded landscapes and riparian buffers, as well as, establishing community conservancies for nature-based tourism. The nature of investments were different in each catchment leading to a spread of ROIs highest in Save (4.5) and lowest in Runde (1.5). If the global benefits of carbon sequestration associated with the resilient scenario are included the ROI increase to 10.5 (World Bank 2024).

Not all investment in land restoration requires long-term public financing and there are opportunities to draw down both climate and carbon finance. For example, because conservation agriculture is beneficial to farmers, public finance is mainly needed to support research and extension to promote its adoption by farmers, including smallholders. By contrast curbing the unsustainable use of rangelands, trees, and wild resources will require recurrent public financing both for capital investment and for the recurrent costs of enforcement and regulation. There are, however, significant opportunities to draw down climate finance through already accredited Zimbabwean institutions such as EMA and IDBZ as well as opportunities to draw down carbon finance, recently legislated for in Zimbabwe (see Chapter 2).

An enhanced agricultural knowledge innovation system is key to building the evidence base to drive adaptation and mitigation measures in the AFOLU sector. Zimbabwe has a vibrant history of investment in agricultural research and extension, involving both the public and the private sector. For example, the Government's Pfumbvudza program is built on conservation agriculture principles on a carefully designed household plot that is: (i) adequate for a household's annual grain food and nutritional requirements; (ii) is operated using household labor; and (iii) amenable to manual irrigation by bucket during mid-season dry spells. Conservation agriculture principles promoted for Pfumbvudza include mulching and organic manure application, which combine to improve the moisture-holding capacity of soils during drought spells and heatwaves. Building on this agricultural knowledge innovation system and extending it beyond agriculture to evaluate interventions in land and landscape restoration is key to addressing climate action. This includes investment in research, public extension workers, innovation platforms based on strong public, private and civil society service partnerships, and information communication technology (ICT)-enhanced information dissemination systems.

Agricultural insurance levels are low and could be scaled-up. Currently, US$ 3 million in written premium covers just 3.5 percent of agriculture value added. Agricultural insurance commonly covers risks related to crop losses arising from weather events, pest infestations, and diseases, as well as loss and damage of agricultural equipment, mainly for the sugar, maize, tobacco, cotton, and wheat subsectors. Small-scale commercial farmers can also benefit from climate-related index insurance. Agricultural insurance in Zimbabwe is dominated by tobacco insurance, a key export earner, where cover is provided for hail, in addition to other perils that affect the crop. While the overall demand for insurance including microinsurance has increased in recent years, the actual level of insurance coverage in the agriculture sector remains low owing to supply side constraints such as limited data and technical underwriting capacity, as well as demand-side constraints, such as low financial capability and low confidence in insurance products.

Under the BAU scenario, priority should be on rigorously testing and promoting conservation agriculture, particularly to protect maize harvests, and on private sector led initiatives to slow deforestation and land degradation. Building on the government-supported Pfumbvudza program, the following no-regrets and low-cost actions should be prioritized: (i) research and extension to test conservation agriculture technology packages in the newly defined agroecological zones across the country, taking an evidence-based learning approach targeting interventions with high ROIs; (ii) farmer-led irrigation development by providing guarantees to commercial banks to provide access to finance and technology for smallholder farmers to tap into the existing 10,000 plus dams, as well as ground and surface water sources; (iii) sub-catchment management land and water use planning to map land degradation, for example, by reestablishing riparian reserves and reestablishing agreements on water abstraction rights; (iv) scaling-up and broadening out agricultural insurance markets; and (v) promote clean cooking by working with private sector and voluntary carbon markets to scale up access to efficient cook-stoves. This can be done with existing public resources allocated to the agriculture sector (around US$ 200 million a year), supplemented with development-partner and climate-facility financing that leverages commercial finance. These actions would build resilience to climate change and help realize the potential of the FTLRP.

Under the ASP scenario, additional public resources can be put into public goods such as agricultural research, large-scale irrigation schemes, livestock breeding, and landscape restoration that will deliver benefits in the medium term. The agricultural research and extension system should develop programs for crop-switching to drought- and heat-tolerant crop varieties. NDS1 development plans for agriculture include investment in expanding the area equipped with irrigation by over 130,000 ha, livestock breeding programs, and improved livestock feeding practices. There would likely be a rapid expansion of financial services, not only agricultural insurance but also to finance mechanization and the deployment of precision agriculture technology under this scenario. In parallel at-scale land restoration, with an ROI of 3.2 in ecosystem services within Zimbabwe, would be a key climate action increasing the provision of ecosystem services and reducing net GHG emissions. Pursuing these investments would first enable import substitution, for example in the dairy industry, and then a revitalization of Zimbabwe's agricultural export industry, particularly in horticulture to both the Europe and East Asia.

3.3. Protecting and Growing Human Capital

This section addresses the challenge of supporting the poorest and most vulnerable in the face of both existing climate variability and future climate change impacts. It focuses first on social protection systems, second on key actions to dampen the climate impacts on human health, and third on actions to halt the decline of the education system and improve the supply of STEM skills that Zimbabwe needs to grasp opportunities in mining and precision agriculture.

3.3.1. Social Protection

Poverty and vulnerability are becoming more chronic in Zimbabwe and the country is increasingly vulnerable to cyclical climate shocks. Poverty more than doubled from 22.5 to 49 percent between 2011 and 2020, before falling slightly to 43 percent in 2021. This increase in poverty was almost wholly a rural phenomenon, with shocks such as drought, inflation, and the pandemic found to be the proximate causes of the poverty increase. El Ninõ-influenced drought has been pervasive over the past several years in Southern Africa, and the frequency of droughts has risen. Compared with a drought happening in one in every 10 growing seasons in the period 1902–1979, a drought occurred in one in every four growing seasons in the period 1980–2011. Wards with the highest levels of poverty were also those that experienced high drought frequency, suggesting that drought frequency is one of the causes of the increase in extreme poverty (Sharma et al. 2022).

Large proportions of the population are therefore increasingly affected by chronic poverty and seasonal food insecurity. Humanitarian agencies' food assistance and the GoZ's Food Deficit Mitigation (FDM) response rely on the yearly Zimbabwe Vulnerability Assessment Committee (ZimVAC) assessments to target grain distributions during the lean season. Recently, large proportions of the population have been affected and have been in need of emergency relief during the lean season. For example, as a result of the 2019 drought, ZimVAC assessments indicated that up to 7.7 million people were in need of food assistance at the peak of the lean season between January and April of 2020 in rural and urban areas of Zimbabwe (ZimVAC 2019). According to official figures, the GoZ's FDM grain distribution covered 760,000 households or 3 million people (although these figures remain unreliable) and the World Food Programme's (WFP) Lean Season Assistance Program covered about 3.7 million individuals across all districts of the country during the peak in March and April 2020 (World Bank, UNICEF and WFP 2020).

Many African countries are increasingly establishing and expanding government-led social safety nets to protect the chronic food insecure caseload in a more cost-effective way that enhances people's resilience. These include safety nets, such as the Ethiopia Productive Safety Net Program or the Kenya Hunger Safety Net Program, targeting the poor and vulnerable who live in areas that are chronically food insecure year-on-year, or that are subject to cyclical droughts or other disasters. There programs support climate-smart public works and payment for environmental services (PES) that create short-term employment, and generate positive climate adaptation and mitigation benefits. Compared with humanitarian assistance that is mobilized based on uncertain appeals, safety nets are more cost effective, sustainable, and reach beneficiaries faster. Proactive response scenarios to cyclical droughts through safety nets reduce the humanitarian caseload and increase people's resilience through avoiding income and asset losses by households (Wylde et al. 2020). Adequate and predictable transfers can reduce negative coping mechanisms, rebuild asset stocks, reduce debt burdens, and have greater impacts on nutrition, investments, and productivity, as well as economy-wide multipliers, with long-term consequences, and potentially better value for money overall. For example, early response and resilience for 15 million people in Kenya, Ethiopia, and Somalia (including social protection) could have saved US$ 4.3 billion over the previous 15 years, or an average of US$ 287 million a year, instead of responding to shocks when they occur (Cabot Venton 2020).

However, Zimbabwe is largely responding to chronic food insecurity and cyclical vulnerability through a humanitarian approach, rather than through its safety nets. The yearly response to lean season vulnerability is implemented through consecutive rounds of emergency response, mainly grain distribution, either through the WFP Lean Season Assistance Program (funded by development partners) or through the FDM Strategy, funded by the GoZ. As mentioned above, these emergency programs assist large proportions of the population, from 1 to 3 million people in a regular year, and up to 6 million people during a major drought year, such as in 2020. Beneficiaries are targeted on a annual basis and provided with grain (or occasionally cash relief by the WFP) to help them get through the lean season. As such, they are not reached with regular transfers that could allow them to make investments in their livelihoods or other interventions, such as productive inclusion support, which would increase their future resilience. The reliance on humanitarian relief as the chosen response to chronic and seasonal food insecurity is currently preventing investment in a more sustainable and cost-effective government-led safety net system that could support these predictable needs.

Currently, therefore, more than 80 percent of the extreme poor in Zimbabwe do not receive regular social assistance support. Existing safety-net systems have low coverage and adequacy levels, and their targeting could be improved. Among all social assistance programs, the Basic Education Assistance Module (BEAM), which provides a school-fee waiver to poor households, had the highest coverage, reaching 6 percent of the population. The HSCT—Zimbabwe's main cash transfer program—has very low coverage, reaching a mere 0.4 percent of the population. Social protection coverage of the poorest quintile and the food poor, whose need for assistance is higher, was very low. Only about 20 percent of the poorest quintile and food poor

were covered by at least one social protection program (Sharma et al. 2022e). Volatile public financing, high reliance development-partner financing, channeled through humanitarian agencies, and delivery system weaknesses and capacity gaps are among the main reasons for the low effectiveness of social protection spending. Analyses show that if all social protection programs were eliminated, the food poverty headcount ratio would increase by just 1.7 percentage points, from to 30.4 to 32.1 percent (World Bank 2023).

To improve the coverage and adequacy of social safety nets in the face of climate volatility, Zimbabwe will need to implement a shock responsive social protection (SRSP) system. Shock responsiveness measures could be introduced into a flagship expanded HSCT by increasing payments to existing households (vertical expansion) or adding additional households in response to a shock (horizontal expansion). The HSCT can cover the chronic caseload, as well as expand in times of shocks, while FDM and WFP LSA would be activated in times of larger shocks. The triggers for a shock response, and the transfer amounts and modalities, among other issues, will need to be incorporated in the standard operating procedures for vertical and horizontal expansion of the HSCT.

Livelihoods and productive inclusion interventions could also be added as a component of a flagship safety net to help beneficiaries diversify incomes and invest in more climate resilient livelihoods. Evaluations of productive inclusion programs from around the world show that they significantly increase poor people's incomes, savings, spending on food, and other essentials, and increase their productive assets such as livestock. They also help the poor diversify their income sources, which is very important in the context of climate change. For example, farmers are able to add other ways of making a living, such as non-farm petty trading activities or diversifying into more drought-resistant crops and products that protect them if their crops fail. Many of these impacts were found to be sustained in the medium term, three to four years after the project (Andrews et al. 2021).

Even under a BAU scenario, there are reforms that would improve efficiency and responsiveness of existing social protection systems. These include:

- **Strengthening delivery systems to respond effectively and rapidly when a shock hits.** Significant institutional strengthening is needed to improve the delivery performance of routine programs and their expansion during shocks. Currently, payments of government social assistance programs are not timely and predictable, with beneficiaries often not receiving transfers for months, or receiving transfer values that had completely eroded due to inflation. Targeting also needs to be strengthened as the Proxy Means Test (PMT) is outdated and no longer able to accurately identify the poorest households, and the caseload has not been recertified for many years, leading to a sizable inclusion errors in the caseload. Grievance mechanisms and monitoring and evaluation (M&S) systems are weak, and non-functional. The program's management information system (MIS) is also outdated. There is therefore a need for benchmarking of transfer values against international comparators, strengthening of targeting mechanisms, digital payments, MIS, grievance, and M&S systems.
- **Leverage the newly developed MIS/beneficiary registry as a registry of vulnerable people in Zimbabwe that can be used to target support in the event of a shock.** This will involve entering data on beneficiaries of all social assistance programs onto the registry, and ensuring districts are trained and supported in data management, and keeping the system functional and up to date.

In the ASP scenario, NDS1 places social protection as one of the integral crosscutting pillars for reducing poverty and vulnerability, aiming to increase the reach of social protection interventions. Key social protections goals that would improve climate resilience include:

- Increasing financing and capacity for expansion of safety nets coverage and adequacy.
- Increasing coverage to 70 percent of the extreme poor, with the majority under a functional and robust government-led safety net (as opposed to supported through annual humanitarian appeals).

- The adequacy of benefits is improved and maintained at a purchasing power of at least 15 percent of the poverty line or 20 percent of household consumption.
- The flagship safety net has a strong shock responsiveness focus and can quickly expand to additional beneficiaries, or provide existing beneficiaries with additional benefits in times of shock, through agreed standard operating procedures.
- The flagship safety net has a livelihoods component that supports beneficiaries to expand more climate-resilient income-generating opportunities. Beneficiaries diversify income sources, and increase incomes and profits by 50 percent.
- Scaling up livelihoods and productive inclusion interventions to help beneficiaries diversify incomes and invest in more climate-resilient livelihoods. Proven livelihoods packages include the provision of small grants, life and business skills training, financial literacy, and savings groups, all enhanced through sensitizing beneficiaries on more climate-resilient value chains.
- Introduce climate-smart public works programs which create short-term employment and incentivize smallholder farmers to organize land rehabilitation programs. This would involve self-selection of the poorest in rural areas, due to wage rates provided being below market rates. Subproject menus of public works could include soil and water conservation, afforestation/reforestation, small-scale irrigation and flood protection.

Social protection is a critical pillar of climate change adaptation, particularly for a drought-prone country such as Zimbabwe, with a chronic caseload of food insecure people. Responding through a safety net that has adequate coverage is faster, more cost effective, and more sustainable to reach populations vulnerable to chronic and cyclical drought and food insecurity than a yearly humanitarian appeals approach. Livelihoods programs layered over a social safety net are proven to increase household resilience by diversifying sources of income, increasing profits, income and food security. These efforts can be made even more climate resilient by sensitizing beneficiaries on more drought-resistant value chains and practices.

3.3.2. Education as Adaptation

The education system in Zimbabwe is key to facilitating social mobility as a core climate adaption strategy. Education has been foundational to social mobility in Zimbabwe, providing a well-trodden path to higher incomes and women's empowerment. With over 60 percent of people living in rural areas, over half of whom are below the international poverty line and vulnerable to climate shocks, education should also be considered a core adaptation strategy. Education can both equip individuals to cope with the impacts of climate change in climate-vulnerable sectors such as agriculture, and enabling them to seek employment in less climate-vulnerable services and industrial sectors.

Though education might be considered a medium- to long-term adaptation strategy, the urgency of acting on education is due to worrying trends in enrolment in primary education. While Zimbabwe's Human Capital Index (HCI) is above the level predicted by both its national income and by its poverty rate, among the HCI components schooling showed the lowest share of progress in the past decade. The number of school-age children (4 to 18 years old) enrolled in the education system in Zimbabwe increased from 2012 to 2021, but only from 3.92 million to 4.63 million, failing to match population growth. The gross enrolment rate increased from 80 to 77 percent, driven by a substantial decline in primary education net enrolment since 2012. Though the BEAM provides poor households with a school-fee waiver and overs 6 percent of the population, it has failed to prevent enrolment rates from falling and meeting the large increase in households that have fallen into poverty in the past decade (World Bank 2022c).

The education system is also key to supplying skills for climate action. Climate risks and opportunities highlight the demand for STEM skills. In agriculture, STEM skills will be key in managing risk though the

application of conservation and precision agriculture. Growth of the mining sector will also create demand for STEM skills across blue and white-collar job types from mining technicians to engineers, as well as for ESG management skills needed both in the private and public sectors to attract the right investors, collect appropriate revenues, manage revenues, and use them for inclusive and sustainable development. Due to the limited employment opportunities, Zimbabwe has lost a human capital to both neighboring and developed countries.

A large number of students do not continue into the secondary school leading to low tertiary enrolment compared with neighboring and peer countries. The sharpest drop in gross enrolment is between primary and lower secondary school. Secondary school gross enrolment (52 percent) has fallen below Kenya (57 percent), and is well short of South Africa's near universal coverage. Dropout rates are mainly in the upper secondary, as only a small share of students pass the exam required to continue in upper secondary school. In 2021, only one-quarter of the candidates for the O-level examination achieved the demanding requirements of obtaining a pass grade in five subjects. At 8.5 percent in 2019, enrolment in tertiary education is low by regional comparators and lags behind other countries, such as Botswana (23.4 percent), South Africa (20.5 percent), and Kenya (11.7 percent).

To improve human capital development, Zimbabwe needs to keep students in school longer, improve the quality of education, and retain teachers, particularly in STEM subjects. An expansion of financial assistance to lower-income families through BEAM would increase primary enrolment rates, while improvement in the quality of education would reduce students dropout rates by increasing pass rates at O-level and A-level exams. A recent study of the tertiary education sector in Zimbabwe reports "high teacher vacancy rates due to large-scale emigration and a recruitment freeze triggered by the fiscal crisis," as one of the main factors affecting the quality of post-secondary education. The shortage of academic qualifications among Zimbabwean faculty is more noticeable in STEM higher-education programs. Reflecting emigration to South Africa and other countries in the region. Policies to retain teachers generally, and specifically STEM faculty members, are needed and could, even under the BAU scenario, be facilitated through partnerships with agriculture and mining sectors.

3.3.3. Human Health and Climate Change

The main health-related impacts of climate change in Zimbabwe are expected to be from water-borne diseases and malaria. Water-borne diseases were responsible for 4.1 percent of the total non-injury deaths recorded between 2015 and 2019, followed by malaria (1.8 percent). By the 2040s, water-borne diseases are projected to increase from between 57 and 123 percent for the wet/warm and hot/dry scenarios, respectively (Figure 3.3.1). Increases in water-borne disease are expected to be highest in the low-lying areas of the east and south of the country, as average temperatures there will be higher than in other parts of the country, The projected climate impacts on malaria incidence are modest, with the dry/hot scenario leading to reductions, and the wet/warm scenario to leading increases at the national level. Under the dry/hot scenario, malaria incidence will drop in most parts of the country, but will rise in the Eastern Highlands, as temperatures will become more conducive for the spread of malaria (Figure 3.3.2). This points to the need to expand malaria advisories, preventions measures (such as insecticide treated nets) and cures to the Eastern Highlands. Heat-related diseases were only responsible for 0.2 percent of the total non-injury deaths between 2015 and 2019, and even under the hot/dry scenario they are projected to reach only 150 deaths annually in the 2040s centered in large cities due to heat island effects.

Under the ASP scenario, universal access to WSS would be restored, but under the BAU scenario access would continue to deteriorate as it has done over the past two decades. Combined effects of increased water-borne illness due to climate change and investments in WSS infrastructure are shown in Figure 3.3.3. Access to basic water services declined from 72 to 63 percent over the period 2000–2021, while basic sanitation coverage declined from 30 to 26 percent over the same period. Declines in access to

Figure 3.3.1: Change in water-borne disease mortality/morbidity

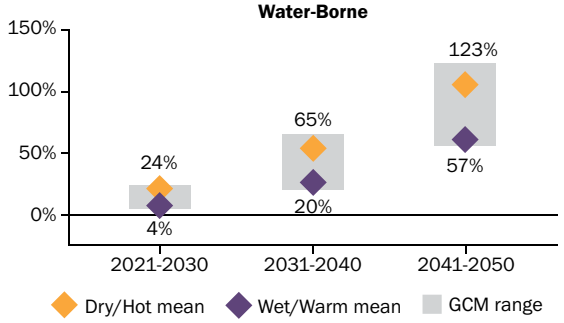


Figure 3.3.2: Change in malaria mortality and morbidity by district, 2041–2050

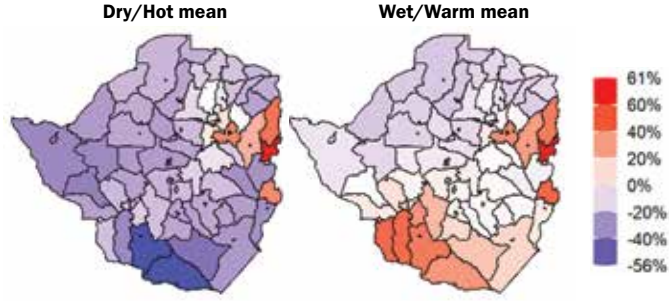
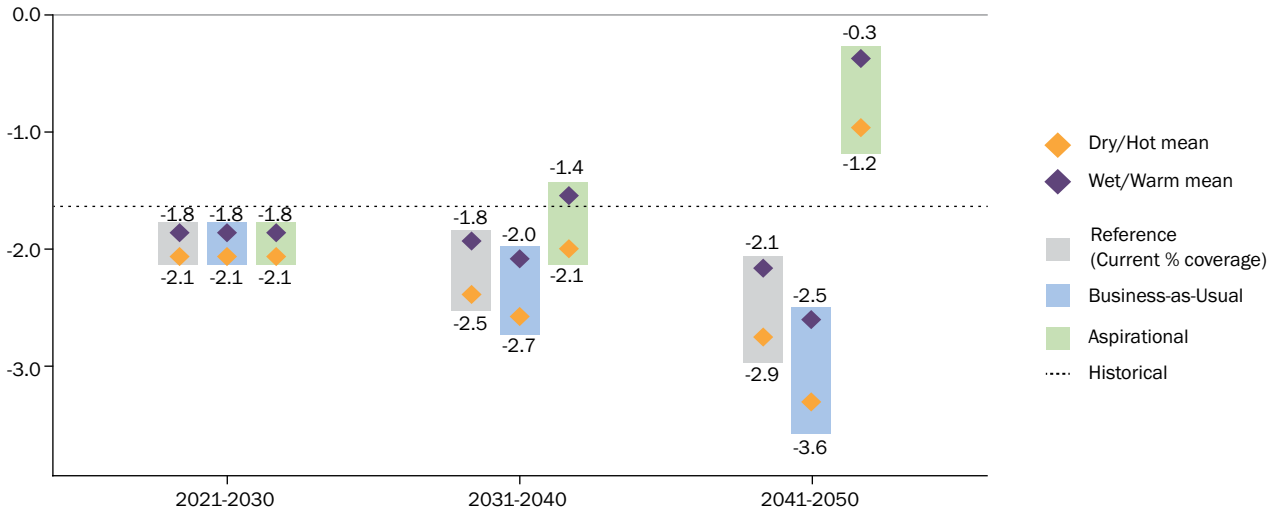


Figure 3.3.3: Effect of water-borne illness on mean labor hours in Zimbabwe, per worker a year under BAU and ASP scenarios (y-axis % of labor hours)



Source: World Bank. 2023a

water services have been greater in rural areas, while sanitation has declined more in urban areas. These declines have been driven by: (i) the deteriorating macroeconomic context, leading to a decreasing ability to pay for services; (ii) a lack of investment from government; (iii) limited external support for the sector; (iv) deteriorating electricity availability from the grid for water and wastewater pumping and treatment; and (v) loss of engineering capacity in local government authorities (LGAs). In urban areas particularly, these factors have contributed to a shift from managed urban development (with LGAs auctioning off land to developers to service and resell) to informal development of areas without WSS or other services. For example, it is estimated that 500,000 people in and around Harare live in areas that have no formal WSS services. In rural areas, institutions for overseeing the operation and maintenance of water supply systems have deteriorated, particularly over the past decade. Rural District Councils have a key oversight role of rural WSS assets, whether developed by central government, local government or NGOs.

Key sector priorities that could be pursued to stem the decline in WSS services, even under the BAU scenario, include: (i) finalizing and adopting the water sector master plan and developing a WSS climate change response plan; (ii) supporting LGA investment planning to direct the type and location of in WSS infrastructure that is built and plan for its maintenance; (iii) setting up a regulatory function in the ministry responsible for WSS services; and (iv) introducing RE for urban and small towns' WSS systems in place of highspeed diesel back-up generators.

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4

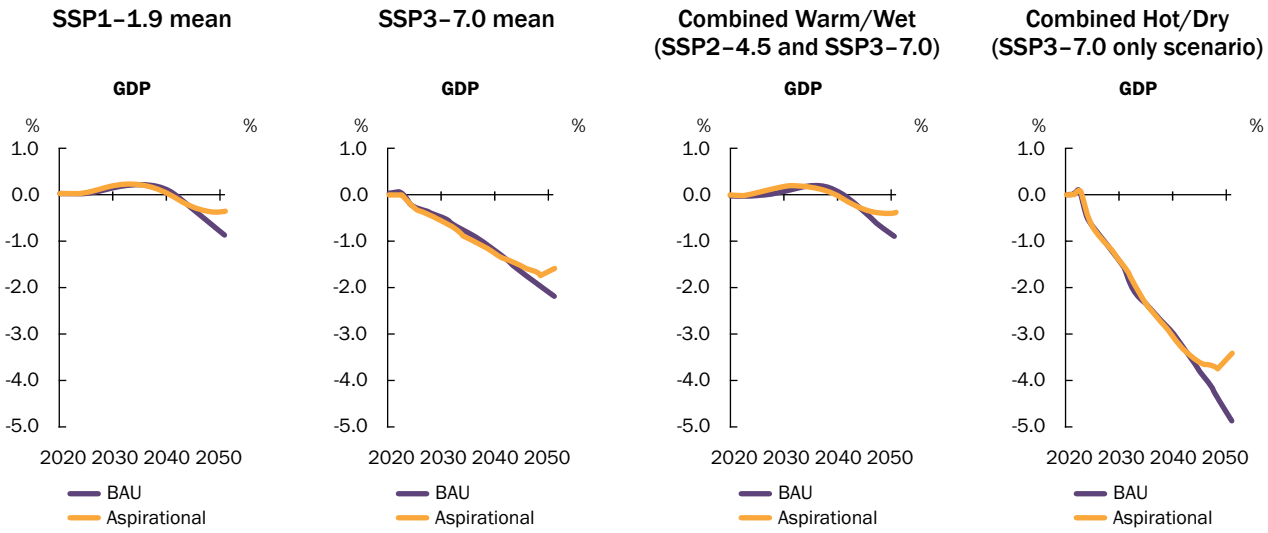
Climate Impacts on Growth and Poverty Reduction

4. Climate Impacts on Growth and Poverty Reduction

4.1. Opportunities and Threats to Macroeconomic Performance from Climate Change

The CCDR simulations show that climate change will impose large costs on the economy for both the BAU and ASP scenarios, but that in outer years GDP losses are lower in the ASP scenario. The impacts on these two growth scenarios (BAU and ASP) under a range of climate scenarios are relatively similar, both in terms of trend and the magnitude of the reduction until the 2040s. However, thereafter the development interventions set out in the ASP scenario provide a basis for strengthening resilience in the outer years, particularly under the combined hot/dry climate scenario (Figure 4.1.1). In the Paris-aligned world scenario (SSP1–1.9 mean), the climate impacts are under 1 percent of GDP (for both BAU and ASP), while in a world on course for an average 3.6°C of warming (SSP3–7.0 mean), this rises to around 2 percent of GDP. Most relevant to drought-prone Zimbabwe, though, is that under a combined cluster of SSP3–7.0 hot/dry global climate models (GCMs), this rises further to an 5 percent GDP loss for the BAU scenario versus 3.5 percent for the ASP scenario.

Figure 4.1.1: Climate impacts on GDP across policy and climate scenarios

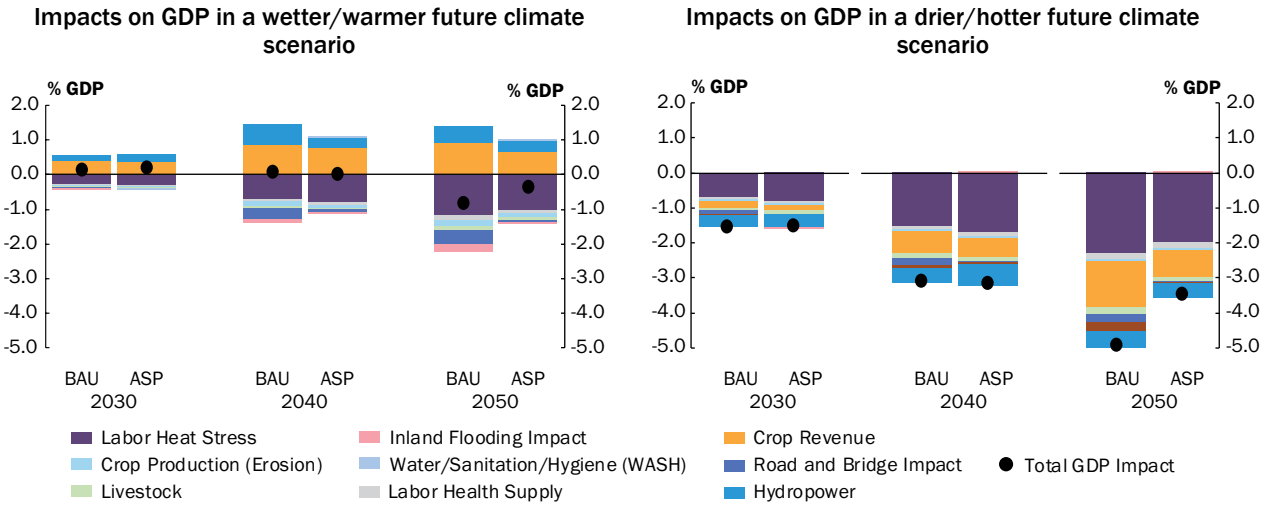


Source: World Bank staff calculations using CC-MFMOD.[27]

The greater resilience of the ASP scenario in outer years is due to a structural economic shift away from agriculture to industry and services. Across all climate change scenarios, the largest negative impacts on GDP come from labor heat stress (Figure 4.1.2). This is based on changes to labor productivity across agriculture, industry and services, with agriculture expected to experience the highest labor productivity shock due to the high level of outdoor activity. Other damage channels contributing to the loss of GDP only become significant under the hot/dry or wet/warm GCMs in line with SSP3–7.0. In hot/dry scenarios, GDP losses are driven by crop revenue losses (up to 2 percent of GDP in CNRM-ESM2-1). In wet/warm scenarios GDP losses are driven by flood damage, including to roads and bridges (up to 0.7 percent of GDP in EC-EARTH3-VEG). The difference between climate impacts on GDP in the BAU and ASP scenarios in the outer years is driven by the greater structural exposure of the BAU growth path to agriculture in the 2050s driving up heat stress and crop losses.

27 Some minor climate impact channels are not uniformly included across climate scenarios, e.g., inland flooding is only in combined scenarios.

Figure 4.1.2: Climate impacts on GDP by growth and climate scenarios disaggregated by channel of impact



Source: World Bank staff calculations using CC-MFMOD .

The climate modeling results highlight potential risks from heat stress on labor productivity (across all scenarios), on crop revenues, livestock and hydropower output (in dry/hot), and damage to roads and bridges (in wet/warm) scenarios. Across all scenarios average temperatures rise with negative implications on labor supply productivity across agriculture, industry, and services sectors (Figures 4.1.3 and 4.1.4). Labor supply shocks ranged from productivity losses of between +5 and -10 percent across climate scenarios. During 2041–2050, labor productivity shocks are expected to be highest for the agriculture sector, where productivity is currently very low, followed by the industry and services sectors. The wet/warm mean scenario is estimated to result in productivity losses of 7, 4, and 4 percent for the agriculture, industry, and services sectors, respectively. Overall, shocks from the dry/hot mean scenario are higher, with productivity losses estimated at 12, 8, and 8 percent for the agriculture, industry, and services sectors, respectively.

4.2. Opportunities for and Threats to People

The long-term trajectory of poverty will depend on the growth and climate scenarios. If Zimbabwe continues to grow at the rate at which it has grown in the recent past, poverty will decline in the coming decades, but at a very slow pace. Microsimulations show that, in the baseline scenario with no further climate change, the national poverty headcount will drop from 41 percent in 2020 to 29 percent in 2050 (Figures 4.2.1 and 4.2.2.). Most of this decline will be a result of people moving from rural to urban areas, as the poverty rate in rural and urban areas remains relatively unchanged. On the other hand, if Zimbabwe realizes the aspirational GDP growth rate of 10 percent a year on average up to 2030, it will dramatically bring down the poverty headcount ratio to 11 percent. Continued GDP growth at a robust rate of 4.5 percent up to 2050 will drive the poverty rate to levels below 10 percent by 2050.

Although the large differences between BAU and ASP scenarios are dominated by the growth effect, there are significant variations within each growth path. For example, with BAU growth, rural poverty will be equally high in 2030 and 2050 compared with 2020 under the dry/hot scenario. In general, the poverty rate is the most favorable in the wet/warm scenarios, while it is most unfavorable in dry/hot scenarios. This is explained by a loss in income due to lower crop yields and a steeper decline in labor productivity in a hotter and drier future. Projected poverty also varies significantly across locations and socio-economic dimensions. While the difference between male-headed and female-headed households is negligible, there is a considerable difference across urban and rural areas, and between agricultural and non-agricultural households. For example, in the dry/hot future without a higher growth, the poverty rate among agricultural households will be 69 percent, compared with 24 percent among non-agricultural households.

Figure 4.2.1: Poverty reduction under BAU growth path and a range of climate scenarios

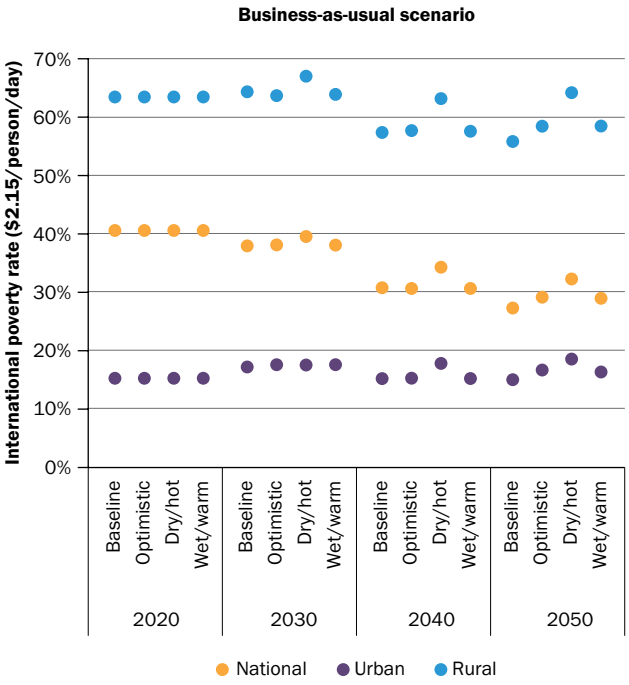
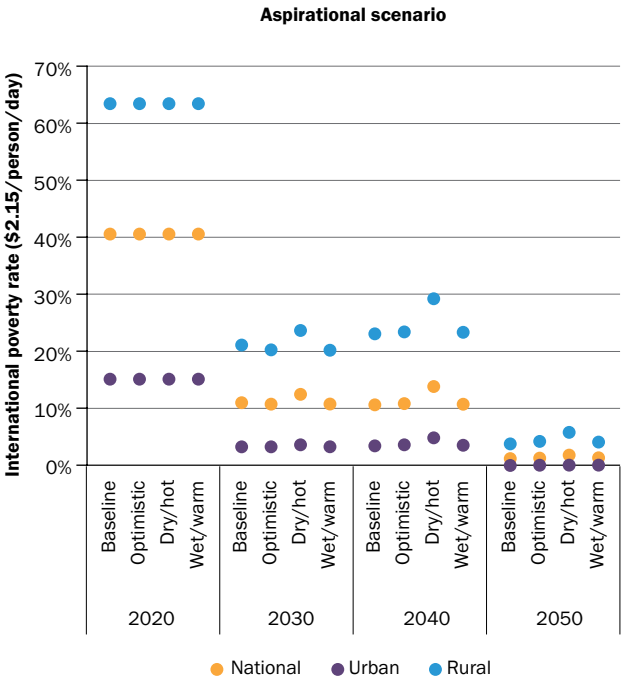


Figure 4.2.2: Poverty reduction under ASP growth path and a range of climate scenarios



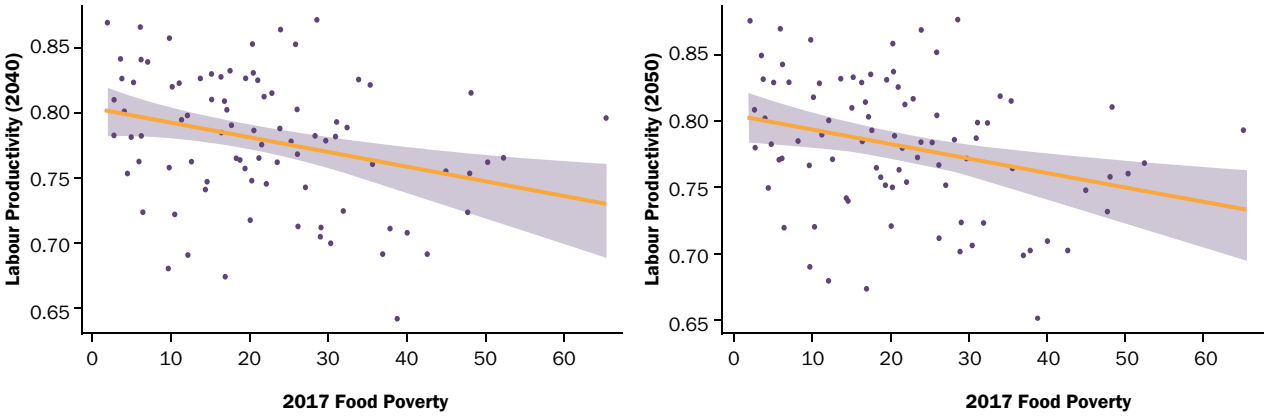
Source: World Bank staff calculations.

There are also risks to the realization of the ASP, or even the BAU, growth scenarios. Between 2011 and 2020, Zimbabwe saw a doubling of the poverty rate due to proximate causes such as drought, macroeconomic volatility, inflation, natural disasters, and external shocks such as the COVID-19 pandemic. Such reversals may happen again because of macroeconomic instability, erratic rainfall, or other exogenous shocks. The ASP growth path is premised on growth of the minerals sectors, which is dependent on global prices and demand. Informal mining is particularly vulnerable to heat stress. Other frictions to structural transformation, such as low employment elasticity of minerals-based growth and low human capital of workers preventing a sectoral reallocation, may continue to trap many in poverty, even in urban areas.

There has been a historical correlation between weather shocks and welfare in Zimbabwe. Land use in rural areas is dominated by cropping (around 10 million ha), and more than 90 percent of rural employment is in agriculture, which aggravates the exposure and vulnerability of the rural population to drought and other climate shocks. Rural wards that experienced droughts more frequently in the 30-year period from 1981 to 2012 were poorer in 2012 (World Bank 2022e).

This pre-existing vulnerability to drought will be aggravated by climate change. A decline in labor productivity due to heat stress will be the largest contributor to the decline in GDP. Looking ahead to 2050, relatively poorer districts will experience a greater loss in labor productivity through the heat stress channel (Figure 4.2.3). By 2050, Mbire, Chiredzi, Hwange Urban, Kariba Urban, Kariba and Mwenezi are projected to experience the highest labor productivity losses (in that order). At the same time, Mutasa, Marondera Urban, Mutare Urban, Nyanga, Marondera and Makoni will be the least affected. Workers in poorer districts are more likely to be in agriculture and less likely to have secondary education, limiting their mobility to non-agricultural occupations that are less affected by heat stress. Households in the lower wealth quintiles and poorer areas also have lower access to basic water and sanitation services, which exposes them to the health impacts of climate change through a higher incidence of water-borne and

Figure 4.2.3: Association between labor productivity loss and poverty in 2040 and 2050



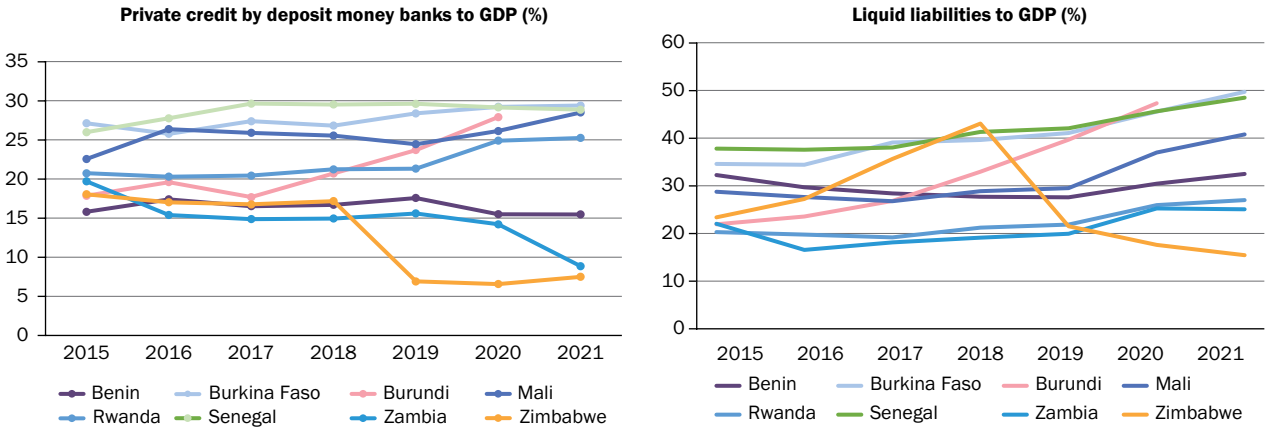
Source: World Bank staff calculations using projections of loss in labor productivity loss due to heat stress and spatial distribution of extreme poverty.

vector-borne diseases. Access to time-saving cooking fuel can improve household welfare through a higher labor force participation, especially that of women, by 3–5 percent (Martey et al. 2022; Li et al. 2023; Manjula and Gopi 2017; Bharati et al. 2017). Currently, only the households in the upper wealth quintiles have access to clean cooking fuel.

4.3. Financial Sector: Climate Impacts and Opportunities

Zimbabwe's financial sector remains resilient, although the levels of financial development, including development of green and sustainable finance, trail behind peer countries. As of 2022, the financial and insurance activities accounted for about 8 percent of the country's GDP. The financial sector comprises primarily banking and financial services, non-bank financial intermediaries, in particular insurance and pension services, and the capital market and securities. As of the end of 2022, the banking sector's total assets were ZW$ 3.81 trillion (US$ 3.8 billion). For the insurance sector, assets reached ZW$ 129 billion (US$ 129 million), and there were 985 registered pension funds with ZW$ 319 billion (US$ 319 million) in assets. In the capital market, the size of Funds Under Management (FUM) by the asset management industry rose from ZWL534 billion (US$ 534 million) in 2021 to ZWL1.60 trillion (US$ 1.6 billion) by the end of 2022. Overall sector development in terms of access, depth, efficiency, and stability lags behind peer countries. Figure 4.3.1 shows Zimbabwe's financial sector depth in relation to its regional peers, measured

Figure 4.3.1: Financial sector depth of selected African countries, 2015–2021



Source: World Bank, Global Financial Development Database.

by private credit by deposit money banks to GDP, and liquid liabilities to GDP. Overall development of green and sustainable finance also remains limited, although there has been growing interest by the banking sector in supporting green projects in recent years. In terms of the capital market, there has been no issuance of green bonds to date.

Climate change is expected to have adverse implications for financial stability, as indicated in the Financial Stability Report 2021, where the residual risk was assessed as 'moderate' and the direction of climate change risks on the financial sector was evaluated as 'increasing'. The assessment by the Reserve Bank of Zimbabwe (RBZ) highlighted that the likely impact of climate change and natural hazards such as cyclones and earthquakes on financial stability was "moderate". This took into account potential impacts, among others, on the agriculture sector, businesses and infrastructure that could lead to increased credit and operational risks for financial institutions. The assessment also considered risk mitigants, including the promotion of a green economy, the adoption of sustainable banking practices led by the RBZ, and the decentralization of Civil Disaster Response units. Notably, out of eight types of risk assessed, climate change is the only category for which the direction of risks is assessed as "increasing".

The banking sector is exposed to climate change via its impacts on key sectors including agriculture and manufacturing. Based on the RBZ's sectoral analysis of commercial bank loans and advances, at 24.8 percent, the agriculture sector stands out as the largest recipient of loans, followed by individuals (20.7 percent), distribution (retail) (13 percent), manufacturing (12.5 percent), services (11.6 percent) and mining (8.4 percent). The country's high vulnerability to drought is a form of physical risk that may result in increased credit risks for the financial institutions given the considerable size of loans and advances flowing to the agriculture sector. The impact of drought on the manufacturing sector as illustrated by the 1991/92 drought that resulted in a 25 percent reduction in manufacturing output, also presents similar risks to the banking industry. Overall, asset quality remained satisfactory wherein the ratio of non-performing loans (NPLs) as at end March 2023 stood at 3.3 percent, which is within the internationally acceptable NPL threshold of 5 percent. Intensifying the RBZ's supervisory monitoring to ensure that banks identify NPLs and accurately reflect asset classification and provisioning in their balance sheets is a priority.

Enhancing the capacity of commercial banks to assess climate risks requires capacity building. The RBZ issued the Climate Risk Management Guidelines in April 2023 and these now need to be followed up with establishing suitable frameworks to facilitate the implementation of this policy and by capacity building of the regulated entities. The Guidelines cover two broad requirements, namely: (i) governance, comprising board, management, business environment, strategy formulation, strategy implementation and internal control; and (ii) risk management processes, comprising capital and liquidity, credit risk, market risk, liquidity risk, operational and other risks, and stress testing. In addition, the Guidelines also cover the expectations on financial institutions regarding risk monitoring and reporting and disclosure. Data gaps remain one of the significant obstacles for industry players to comprehensively assess climate risks and need to be addressed through close collaboration with other stakeholders.

The insurance industry has been significantly affected by climate-induced weather events, through exposure to heightened financial risks. According to the Insurance and Pension of Commission of Zimbabwe (IPEC), the insurance industry's tobacco book has been significantly impacted by hail risks, which resulted in recurring substantial claims. Due to low retention capacity, most of the local industry risks on tobacco are reinsured in the international market. In addition, IPEC highlighted that certain insurers are encountering difficulties due to inadequate underwriting practices in agriculture insurance. These challenges can be attributed, in part, to the insufficient supervision and regulation of climate risk insurance, with Zimbabwe's regulatory frameworks falling behind those of other jurisdictions.

The contribution of the financial sector in Zimbabwe to climate finance has thus far been limited due to the constrained capacity of domestic players and the challenges posed by macroeconomic volatility.

Realizing Zimbabwe's climate actions and sustainable development goals hinges on effective mobilization and a significant scale-up of climate and sustainable finance from various sources, including public, private, and alternative channels, both domestically and internationally.

Concessional finance is needed to attract private capital. Amid macroeconomic constraints faced by the GoZ, concessional climate finance, particularly in the form of grants, has dominated the climate financing landscape. Examples of concessional finance include the Special Climate Change Fund's provision of US$ 3.98 million to scale up adaptation measures and reduce vulnerability in rural communities in Buhera, Chimanimani, and Chiredzi Districts (Natural Region V), as well as the US$ 10 million funding from the Green Climate Fund and World Food Programme for implementing the Integrated Climate Risk Management for Food Security and Livelihoods project. While concessional finance by itself is insufficient to support Zimbabwe's transition to a low-carbon economy, it is instrumental in expanding access to private capital, for example through the use of blended finance.

While policies have been implemented to foster growth of green and sustainable finance, actionable strategies need to be implemented to translate these policies into tangible outcomes. Based on the IMF's studies, three specific financial instruments that have opportunities to be further unlocked by countries in SSA are climate-linked debt instruments, climate-related insurance schemes, and international carbon credit schemes. The need to enhance the depth of offerings of green and sustainable finance products is recognized by the GoZ. For the banking sector, the RBZ published the Climate Risk Management Guidelines that have overarching objectives of promoting sustainable financing and investment activities. In the securities market, the Securities and Exchange Commission of Zimbabwe (SECZ) has put in place requirements for sustainable finance reporting and disclosure. The SECZ is also working closely with the Committee of Insurance, Securities and Nonbanking Financial Authorities of SADC to develop minimum guidelines on sustainable finance, and establish a regional debt market model law covering, among others, the development of sustainable bonds. As a signatory to the Nairobi Declaration on Sustainable Insurance, IPEC has introduced initiatives to augment the contribution of the insurance industry in accelerating a prototype agriculture index product for smallholder farmers is being developed.

Recognizing the GoZ's intention to rely on carbon credits as a source of revenues, scaling up carbon market will require regulations and capacity development initiatives, including collaboration with financial institutions. As stipulated under the Carbon Credit Framework (2023), a national carbon credit registry will be created to monitor and regulate carbon credit agreements. In July 2023, the GoZ entered into agreement to establish a regional carbon registry, namely the Victoria Falls Carbon Registry, owned by and operated in Zimbabwe in collaboration with the Carbon Trade Exchange. In attaining the GoZ's goal for Zimbabwe to become a regional hub for carbon credit trading, the GoZ will need to clearly articulate the roles that can be played by the financial sector, including brokers, banks, and institutional investors across the carbon credit creation process, including project development to secondary trading.

4.4. Disaster Risk Financing

The two severe droughts of 1991/92 and 2015/16 led to a 6.0 and 5.5 percent fall in GDP, respectively, demonstrated the overall impacts of climate variability. In 1991/92, Zimbabwe was hit by a drought that killed more than 1 million cattle and left more than 5 million people in need of food aid. In early 2016, the GoZ reported that one-quarter of the population were food insecure. More recently, in 2022, low rainfall in the upper-Zambezi catchment led to reduced hydropower generation on Lake Kariba and widespread power rationing, with direct consequences on industry and economic growth.

The average annual cost of disaster response is estimated at US$ 81 million a year and may reach US$ 540 million for one in 50-year events. This estimate is based on costs of emergency food relief due

to drought, and residential and industrial property damage due to floods and tropical cyclones.[28] Costs are expected to increase once damage to public assets and infrastructure is included. Currently, most of these costs are borne by the GoZ, as few losses are insured. With only US$ 33 million prearranged to finance disaster response, the GoZ faces an annual funding gap of US$ 48 million.

Disaster risk financing for climate shocks and other natural disasters is mainly financed through ex-post budgetary reallocations and international development partners. While Zimbabwe has a general contingency budget for unforeseen expenditures, including those from climate shocks, budget reallocations that draw on unutilized funds from non-performing capital projects are the main source of disaster risk financing. Zimbabwe also has a range of funds that either explicitly serve as contingency reserves, or are routinely used to respond to climate shocks. Most of the funds are hosted at line ministries or departments, and are used as back-up funds for specific contingencies that affect them. Reallocations within votes are easy to make and can be mandated by the relevant Minister. Reallocations between votes require parliamentary or presidential approval and are also regularly used to finance disaster response. Despite widespread poverty and food insecurity, Zimbabwe spends only 0.4 percent of its GDP on social protection, less than one-third of the SSA average (see Chapter 3).

Zimbabwe's efforts to tap into financial markets for climate and disaster risk finance are modest and limited to drought insurance, which is inadequate to cover potential losses and risks faced by the country. The GoZ remains exposed to significant and increasing flood and storm risk, as there is currently no insurance for public assets and critical infrastructure. Access to the international insurance market is through the African Risk Capacity (ARC) from which the GoZ first took out a national drought insurance policy in 2019 and, since then, continues to purchase cover, although due to financial constraints the amount of coverage purchased declined sharply in 2022. In 2020, Zimbabwe received a payout of US$ 1.4 million from its drought policy, benefiting over 155,000 people through direct cash transfers. The policy is designed to cover losses of about US$ 130 million or at least 3.5 million people.[29] However, due to the limited ability of the GoZ to pay premiums, the ceding percentage has remained low (under 10 percent) and, in 2022, dropped sharply to 1.74 percent, which only covers 42,000 people (World Bank, 2024c). As a result, Zimbabwe is still heavily dependent on international aid, especially to respond to its persistent food insecurity.

The GoZ's access to the domestic insurance market is nascent and again limited to drought through a pilot Area Yield Index Insurance scheme. The scheme is being implemented by state-owned agricultural insurer, AFC Insurance, on the back of the GoZ's Pumvudza input scheme. The pilot covers four districts, namely Chivi, Bulilima, Makonde and Nkayi, from December 2022 to July 2023. The GoZ paid 100 percent of the premium for a sum insured of US$ 4 million, which is equivalent to the cost of inputs provided. The index used was 60 percent of historical crop yields. Key lessons emerging from the pilot include: (i) the need to address the high cost of crosscutting experiments, which have the potential to affect sustainability; and (ii) the need to review the program design, taking into consideration the lack of direct pay-out to farmers, not only limiting ex ante benefits of insurance but also delaying payment.

Overall, the GoZ's risk financing instruments are inadequate for the scale of losses and the range of perils that Zimbabwe faces (Figure 4.4.1). Furthermore, the use of domestic insurance is severely constrained by macroeconomic volatility. As such, there is a substantial gap between available prearranged disaster and climate risk funds, and the average annual cost of disaster response.

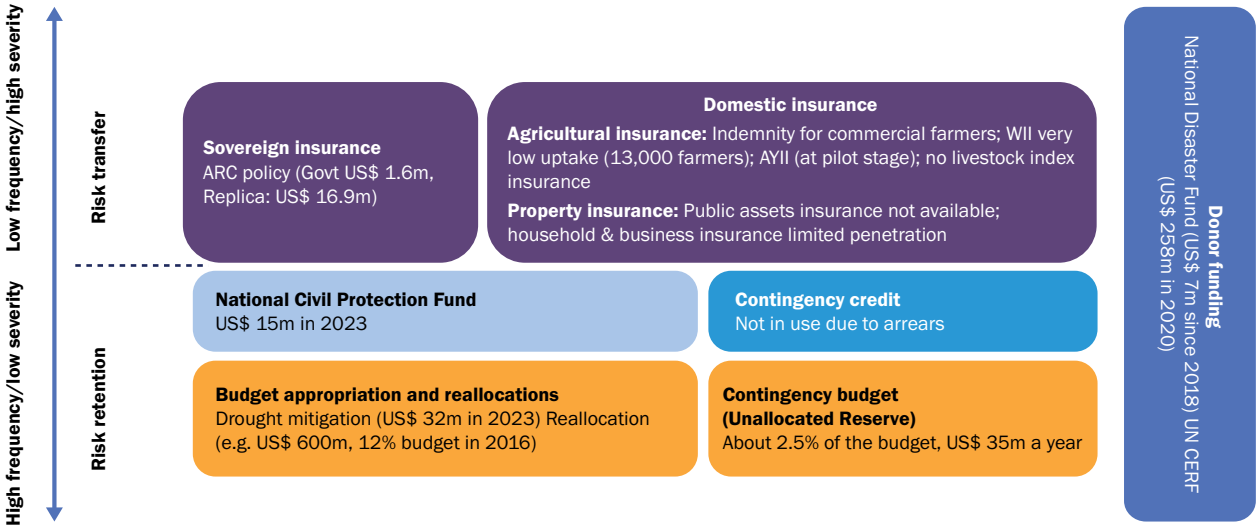
The large and growing scale of economic losses associated with climate-related disasters in Zimbabwe calls for a more systematic approach to disaster risk finance. Strengthening the use of the available

28 Findings from the funding gap analysis undertaken by the World Bank team.

29 Designed to trigger at a 1-in-4-year loss (i.e., a loss with a 20 percent probability of occurring) and exit at about a 1-in-15-year loss (i.e., a loss with about a 7 percent probability of occurring).

instruments and expanding the range of risk finance instruments could generate savings of about US$ 34 million for moderate loss events, and up to US$ 140 million for severe shock events, based on indicative analysis carried out by the World Bank. A more in-depth financial modeling and technical analysis should be carried out to right size the potential financial instruments that the GoZ could consider.

Figure 4.4.1: Status of risk financing instruments in Zimbabwe



4.5. Financing Needs for Climate Action

The costs of climate action in Zimbabwe are estimated at US$ 10 billion for adaptation and US$ 4.8 billion for mitigation. The National Adaptation Plan (2024) estimates economy-wide adaptation costs at just over US$ 10 billion up to 2030. The NDC, updated in 2021, states that US$ 4.8 billion is needed to reduce GHG emissions by 30.65 $MtCO_2e$ a year by 2030. These headline figures should not be interpreted as additional public spending requirements. First, some of these investments are already included in development expenditure. For example, the fiscus already provides for some of the public investment for improving the efficiency of the electricity grid (a mitigation measure) and increasing the agricultural area irrigated (an adaptation measure). Second, private benefits in investing in climate action will trigger private investment. For example, investment in air conditioning to reduce heat stress could be private sector-led.

It is acknowledged in the NDC that, though the US$ 4.8 billion cost of mitigation is conditional on external support, some of the investments will come from planned public development expenditure. Under the BAU scenario, estimated levels of public investment average around US$ 1 billion a year and are expected to be relatively flat up to 2050. Under the ASP growth scenario, public investment would be expected to grow to US$ 4.5 billion a year in the 2040s. Under the ASP scenario there could also be financing available from the MDBs following reengagement.

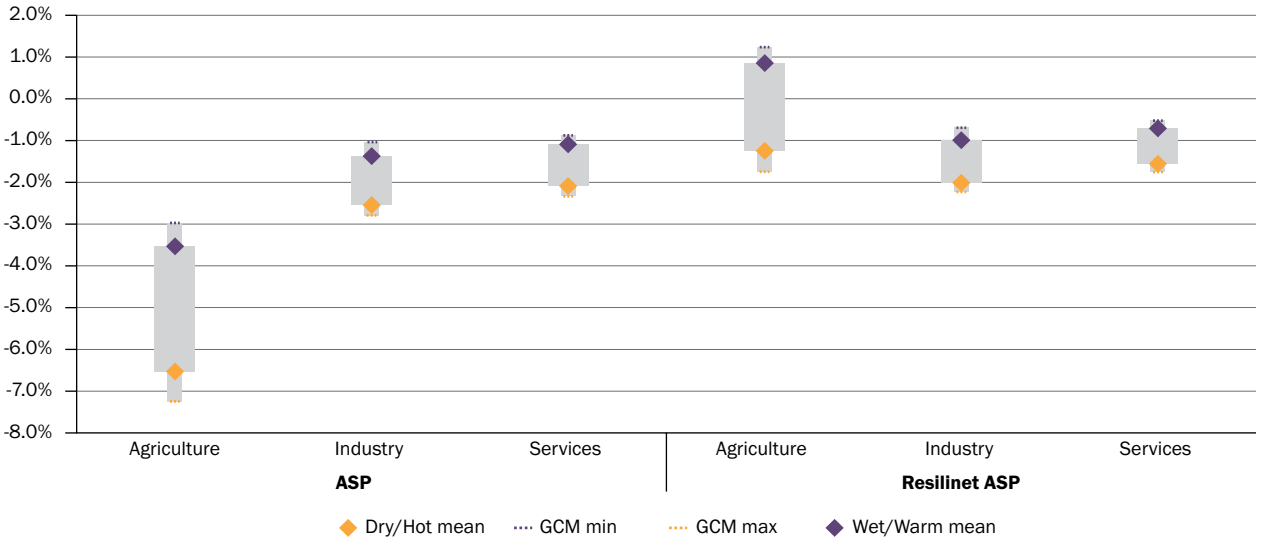
Public expenditure trends, under the BAU scenario, show only a modest overlap between planned development expenditure and the cost of climate action leaving US$ 11 billion to be financed from other sources. Climate tagging of the BAU public expenditure flows indicate that only US$ 0.3 billion of planned development expenditure overlaps with NDC mitigation actions, a mere 6 percent of the cost of NDC mitigation actions up to 2030. This is mainly on renewable energy projects in rural areas and improving the efficiency of the electricity grid. Existing public expenditure flows that overlap with adaptation measures are expected to be in the order of US$ 2 billion up to 2030, equivalent to 20 percent of the

costs set out in the NAP. This includes expenditure on agricultural research and extension, WSS, water resources development and irrigation, as well as, soil and water conservation and catchment management. With very limited opportunity to reallocate public sector spending to fund additional climate action, around US$ 11 billion would need to be financed from the private sector, existing development partners, climate and carbon finance.[30] This would be equivalent to a near doubling of annual private sector investment from 7 percent to 13 percent of GDP.

Under the ASP scenario, there is far more scope to finance climate action with opportunities to share the burden across public and private sector as well as from MDBs. Climate tagging of NDS1, reveals US$ 0.8 billion in mitigation expenditure and US$ 4 billion in adaptation expenditure in the run up to 2030.[31] These would leave US$ 8.5 billion of climate actions to be financed in the remainder of this decade. Some of the additional public finance available under this ASP scenario could be reallocated to priority climate adaptation investments with long-term economic returns such as the safety net and education programs needed to protect and grow human capital. The balance would need to be financed from the private sector, existing development partners and MDBs, as well as, climate and carbon finance. Though this would still require a substantial increase in both private and MDB investment it is within the expected parameters of the ASP scenario.

Many climate actions have positive economic returns and private benefits that can spur private investment. High-level economic modeling for the LEDS, shows that the 38 mitigation measures it identified to abate emissions of 33.2 $MtCO_2e$ a year by 2050 have an aggregate NPV of USD 7.1 billion. Similarly modeling on a sub-set of adaptation investments in conservation agriculture and landscape restoration is shown to have an NPV of US$ 3.6 billion (World Bank 2024 and 2023). Likewise, investments in air conditioning to reduce heat stress and investment in mechanizing agriculture have direct private returns that will trigger private investment (Figure 4.5.1).

Figure 4.5.1: Labor productivity shock from heat stress in ASP scenario before (LHS) and after (RHS) including adaption measures (air conditioning and mechanizing agriculture)



Source: World Bank. 2023a.

30 This estimate avoids double counting the cost of climate actions, for example in the AFOLU sector, which would have both mitigation and adaptation benefits The background study on ecosystems valuation estimated climate US$ 1.6 billion of investments in CA and land restoration to reduce emissions by a third of Zimbabwe's 2030 target and provide adaptation benefits of US$ 400m a year.

31 This includes the assumption NDS1 levels of expenditure would continue in the NDS2 covering the second half of the 2020s,

Firms are already investing in climate action but would do more if currency exchange restrictions were lifted and if there were tax incentives for investing in renewable energy and energy efficiency. According to a recent green business survey (IFC and CZI 2023) firms are already investing in climate action. The majority of firms surveyed had already invested in efficient lighting (72 percent) and energy efficient machinery (65 percent) but only 28 percent had invested in RE, citing barriers including: (i) currency exchange restrictions; (ii) import taxes on equipment; and (iii) tax rules on off-setting RE investments against company revenues. Those firms that had invested in RE reported that this was primarily driven by the increase in load-shedding by the state-owned utility (ZESA) and pointed out that they had not yet managed to put 'net metering' into practice due to a combination of engineering and administrative issues. In 2022, the GoZ did introduce legislative changes supporting IPP agreements for RE to grid investments. This legislation included exemptions for repatriating foreign currency. However, the legislation did not include similar incentives for off-grid investments, which would be an interim step in resolving the current electricity shortage. Firms requested the removal of barriers to off-grid RE expansion. The survey also reported that the adoption of climate adaptation and mitigation measures was related to the size of companies. Over half of large-scale firms, but only one-quarter of small-scale firms, had adopted measures to reduce their exposure to climate-related risks over the past three years. The main recommendations from Green Business Survey were for GoZ to:

- Incentivize investment in low carbon production systems through: (i) enabling duty free importation of all low carbon emission machinery and equipment; (ii) facilitating low-interest loans for climate-smart equipment investment; and (iii) grant funding for research on new environmentally friendly manufacturing techniques;
- Undertake awareness raising of low-carbon and environmentally friendly production technologies and their potential benefits in relation to carbon-border adjustment mechanisms and trade-related deforestation regulations being put in place by the EU and other trade blocs;
- Enforce existing domestic carbon tax laws, as enshrined in existing frameworks, to ensure a level playing field;
- Undertake curriculum-based interventions to equip human resources, including curriculum reviews at key technical institutions to enhance climate action skills and knowledge to drive among graduates and technicians.

This shows the potential for the public sector to take on a role that is catalytic and enabling of private sector investment in climate action. In the concluding chapter that follows this theme of a catalytic role of the state is explored through examining low-cost and 'no regrets' climate actions that can build economy-wide resilience and accelerate Zimbabwe's low-carbon development.

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5

Conclusion and Priorities for Action

5. Conclusion and Priorities for Action

Achieving and maintaining high growth rates will be critical to reducing poverty and dealing with the consequences of climate change. Macroeconomic modelling for this CCDR shows that only the ASP scenario will deliver the significant poverty reduction, improved delivery of basic services, and better access to external financing and FDIs needed to modernize the economy and address climate change challenges. Addressing key macroeconomic constraints to growth, strengthening governance, consistent implementation of the Vision 2030 and NDS1, pursuing the roadmap for arrears clearance and reengagement are all needed to support GoZ aspirations to propel the country to becoming a UMIC.

But development alone will not be enough to avoid the macroeconomic impacts of climate change. This report shows that climate change will impose large costs on the economy for both the BAU and ASP scenarios. Relevant to Zimbabwe's drought-prone context, hot/dry global climate models, aligned with a four degree increase in global temperatures[32], suggest a near 5 percent GDP loss for the BAU scenario *versus* 3.5 percent for the ASP scenario by 2050.

Pursuing key climate actions could help Zimbabwe dampen these impacts on growth and could help spark a transition from the country's current BAU growth path to its ASP growth path. Though the scope and scale for climate action under the BAU and ASP growth paths are different, there are a set of 'no-regrets' actions under BAU that could lay the foundations for Zimbabwe's transition to the ASP growth path. Once on that ASP growth path, this report has also identified ways to make the ASP growth path greener and more resilient. Priority actions are organized around the following three key areas:

- Greening the mining industry and supporting low emissions, resilient infrastructure
- Supporting conservation agriculture, landscape restoration, food and water security
- Protecting and growing human capital

The next sections summarize first the low-cost and 'no regrets' actions that can be taken in the short-term under the BAU scenario and then the measures that could be taken in the medium-term to make the ASP scenario greener and more resilient.

5.1. Prioritizing Existing Resources for Low-cost and 'No-regrets' Actions

Put in place a robust governance framework for the mining sector that meets international best practices to accelerate investment in green mining. Zimbabwe is at a crossroads, the governance of the mining sector is a key lever in determining whether Zimbabwe follows the BAU or ASP growth path. Though GoZ has taken several steps to incentivize investment in mining (see Chapter 3), to date, these measures have had only marginal impact, as they try to compensate for fundamental investment barriers rather than tackling the barriers head on. Instead, the country's mining laws need to be modernized, to introduce a licensing regime offering improved security of tenure and sanctity of contract. Uncertainty and discretion in, for example, regularly re-setting royalty rates should be avoided. In parallel there needs to be a shift away from state ownership of mining interests toward a transparent and competitive allocation of mining concessions with green mining standards. Along with dropping retention requirements for export revenues (enforced conversion to local currency), this would enable the free flow of capital into the mining sector, and associated energy and transport infrastructure. This transition could also improve working conditions in the mining sector, encouraging partnerships between large-scale and artisanal miners, and providing a path to formalization of the industry that would reduce artisanal miners' vulnerability to heat stress and flooding.

32 SSP3–7.0

The policy certainty and transparency of these priority mining sector governance reforms could begin to catalyze investment in associated low-carbon infrastructure, particularly in renewable energy (RE). With electricity being the single-biggest brake on mining sector growth and mineral processing, these reforms would encourage mining companies to be more likely to enter into partnerships with IPPs willing to invest in RE, particularly solar PV and large-scale battery energy storage systems (BESS), which are on the least-cost electricity generation path. In the absence of these mining sector governance reforms, options for low-carbon development of infrastructure are limited, relying heavily on enabling investment in off-grid RE and building the resilience of road infrastructure. Under this BAU scenario the priority would be to keep mining revenues moving through a continuation of the PPPs being put in place on key transport corridors. In addition, low cost, 'no-regrets' actions include: (i) carrying out climate vulnerability assessments in transport; (ii) adopting climate-smart design standards; and (iii) building capacity to maintain the network and to respond to emergencies. Given the expanding mining sector and the share of road transport projected under the BAU scenario, putting in place targets to improve the efficiency of trucks would help abate growth of emissions anticipated.

Climate adaptation actions across agriculture, water, and land-use management can help address development and climate challenges resulting from land reforms. Following the FTLRP, agriculture output fell sharply as historical relationships between land, labor, capital, and water were disrupted and smallholder farming became the predominant mode. To address both the challenge of disrupted agricultural development and the future threat of climate change impacts, Zimbabwe needs to reinvigorate its agricultural knowledge innovation system. This can build on the government-supported Pfumbvudza program, and Zimbabwe's history of applied agricultural research and extension. Specifically, there are four no-regrets and low-cost actions that existing budgetary resources can be re-prioritized toward: (i) research and extension for conservation agriculture through piloting and rigorous testing of CA technology packages in the newly defined agroecological zones across the country, taking an evidence-based learning approach targeting interventions with high ROIs; (ii) farmer-led irrigation development by providing guarantees to commercial banks to provide access to finance and technology for smallholder farmers to tap into the existing 10,000 plus dams, as well as ground and surface water sources; (iii) sub-catchment management land and water use planning to reduce land degradation, for example by reestablishing riparian reserves and reestablishing agreements on water abstraction rights; and (iv) promoting clean cooking by working with private sector and voluntary carbon markets to scale up access to efficient cook-stoves. This can be done with existing public resources allocated to the agriculture sector supplemented with development-partner and climate-facility financing that leverages commercial finance. These actions would build resilience to climate change and help realize the potential of the FTLRP.

Protect and build human capital which are development actions that have significant adaptation co-benefits. More than 80 percent of the extreme poor in Zimbabwe do not receive regular social assistance support. Under the BAU scenario, around 40 percent of the population will remain below the international poverty line, with many more people vulnerable to falling below it, due to projected combination of natural climate variability and the impacts of climate change. The continued reliance on humanitarian relief as the chosen response to chronic and seasonal food insecurity would prevent investment in a more sustainable and cost-effective government-led safety net system that can support these recurrent needs. The best option for developing a flagship safety net program would be to focus on scaling up the HSCT, while introducing mechanisms for vertical and horizontal expansion during shocks, and livelihoods support to improve beneficiaries' resilience. Even under a BAU scenario, reforms to the HSCT can be adopted to improve beneficiary registration and targeting, triggering linked to existing early warning systems, regional benchmarking of policy on transfer values, and to moving to digital payments. These reforms would make more efficient use of existing government resources (US$ 56 million in 2023) and could be used to direct development partner emergency response resources (around US$ 200 million a year). Complementary to these reforms and expenditure in a national social protection system would be increasing investments

in WSS to halt the current decline in services, as there will be an up-tick in water-borne disease driven by climate change, as well as modifying the targeting of prevention measures on malaria, which is set to increase in the Eastern Highlands.

Table 5.1: Summary of priority low-cost and 'no regrets' climate actions to make the BAU growth path greener and more resilient

Area of Action	BAU Scenario - planned development investment	Additional or replacement 'no regret' low-cost climate actions	Rationale/benefit of additional or replacement action
Greening the mining industry	Continued capital investment in mining sector SOEs	Shift away from SOEs to transparent, competitive allocation of concessions with security of tenure, with enhanced regulation	Foundational to unleashing private investment and transition to ASP growth path
	Clearance of ZESA debt	Complement with ZESA tariff reforms	Supports ZESA financial viability and service reliability
	Rural electrification fund	Use funds for improving grid efficiency and instead promote private sector investment in RE and on-grid storage	Reduce burden on fiscus and bring private sector investment in IPPs with associated management efficiency
	Road infrastructure development and road PPPs using tolls	Adopt resilient designs for roads/ bridges and network DRR assessments.	Resilience of road network to keep mining revenues flowing.
		Regulate for more efficient road transport	Incentivizes private sector reduction in GHG emissions
Resilient agriculture, landscape restoration, food and water security	Agricultural education, crop and livestock research, agricultural extension, livestock health advisory services	Take evidence-based and participatory approach to research on tailored CA technology and facilitate access to insurance	For example, promoting DT varieties, could generate an extra income of US$ 240/ha and better food security.
		Restart sub-catchment management planning and map land degradation	Will improve targeting of the limited available public investment
	Dam rehabilitation for irrigation development	Incentivize farmer-led irrigation development by facilitating access to finance and technology for small-holder farmers	Leverages farmer investment in irrigation so that the limited public resources can be used for dam rehabilitation
	Improved Access to Modern Energy Services for 160 communities	Use newly adopted carbon framework to scale-up access to efficient cook-stoves.	Shift from public to private investment in clean cooking
Protecting and growing human capital	More than 80 percent of the extreme poor in do not receive regular social assistance support	Improve HSCT beneficiary registration and targeting, introduce mechanism for vertical and horizontal expansion during shocks, move to digital payments	More efficient use of existing government and development partner resources
	Declining coverage of WSS services in both urban and rural areas	Rehabilitate water supply and sanitation services, reduce costs by including RE in water systems	Anticipate doubling of water-borne disease incidence driven by climate change
	Per capita annual expenditure in health has fallen to half average of LMICs	Modify the targeting of malaria prevention advice	Prepare for 60 percent increase in malaria hotspots e.g. Eastern Highlands

5.2. Medium-term Actions to Accelerate Resilient and Low-carbon Development

As the economy transitions to the ASP growth path there will be far more scope for building resilience and a low-carbon development pathway for Zimbabwe. The NDS1 that underpins Vision 2030 and the ASP growth path set out US$ 40 billion of development investments in the period 2021 to 2025. Around 70 percent was to come from the public sector and 30 percent from the private sector. Around 15 percent of the planned expenditure (public and private) would have climate co-benefits. However, some of the other planned development investments could be replaced with more climate-smart alternatives, where these build greater resilience and lower GHG emissions further without holding back development gains. This report has suggested changes to the investments specified or the approach outlined in the NDS1 and Vision 2030 as follows:

Leverage the financial viability of the mining sector to drive investment in RE and in so doing give Zimbabwe a competitive advantage in key export markets with a carbon border adjustment mechanism. Projections for energy consumption across mining and mineral processing are expected to rise sharply under the ASP scenario, reaching 21 TWh a year in the 2040s. Meeting this demand would require investment of an estimated at US$ 7 billion. NDS1 plans for most of this investment to be made by the private sector, with ZESA as the off-taker. However, an alternative would be to incentivize the mining sector to be the primary off-taker and only sell surplus to ZESA. This would be an opportunity to transition mining to renewable and resilient energy through power-to-mine investments that could also support broader RE scale-up. This greening of the mining sector would give a competitive advantage to Zimbabwe in key export markets adopting ESG and CBAM policies.

Given the high level of uncertainty around future hydroclimatic conditions, reduce reliance on large hydro in the energy mix. Multiple studies show that the hydropower output in the Zambezi is highly exposed under a wide range of climate scenarios. Under the driest scenarios, estimates are of up to a 58 percent reduction in hydroelectricity revenues relative to a scenario without further climate change. This report confirms that there is a long-term downward trend to hydropower production across climate scenarios. Even with the construction of the Batoka and Devils Gorge hydroelectricity plants there is a significant decline in output by 2050 pointing to the climate risk of these investments. Increasing the share of RE from its low base in 2022 (less than 1 percent) to 45 percent by 2040 would reduce reliance on large hydro (55 percent in 2022) increases climate resilience.

Supported by the transport needs of the mining sector, promote PPPs to revive the railways system and increase the modal share carried by rail. GoZ could develop a coordinated approach that links the PPP modality to mining concessions to increase commercial viability. This would provide a path to modernizing and greening the rail system, as well as ensuring its resilience in the face of climate change. In tandem GoZ could adopt modal split targets and set axle loading limitations on the roads network.

Promote mechanization, precision agriculture and access to finance to raise productivity levels. NDS1 development plans for agriculture include investment in expanding the area equipped with irrigation by over 130,000 ha. These investments could be made more resilient by complementing them with a revival of Zimbabwe's agricultural knowledge innovation system and rapidly expand financial services to accelerate mechanization, farmer-led irrigation, the deployment of precision agriculture technology as well as the expansion of agricultural insurance. Pursuing these climate and development investments would first enable import substitution, for example in the dairy industry, and then the agricultural export industry, particularly in horticulture to European and Asian markets.

Draw down climate and carbon finance for at-scale land restoration to support adaptation to both wetter and drier climate futures as well as reduce GHG emissions from land degradation. Investments in restoring degraded natural habitats, riparian buffers, conservation agriculture have significant benefits. The adoption of large-scale land restoration across Zimbabwe's diverse ecosystems estimated to be worth over US$ 400 million a year to Zimbabweans. These benefits include increases in agriculture and livestock production and the availability of wild resources, improvements in water and sediment regulation, as well as, higher revenues in nature-based tourism. The mitigation benefits of this large-scale land restoration are estimated to reduce emissions by an average 11 million tCo_2e per year up to 2050. Using a relatively low estimate of US$ 4.5 per tCO_2e, landscape restoration could generate around US$ 50 million a year in carbon credits. Valuing these emissions reductions at the social value of carbon would generate around US$ 686 million a year in global benefits.

Expand the HSCT into a national safety net program that is shock-responsive and supports productive livelihoods. Expand the HSCT to cover 70 percent of the extreme poor, improving the adequacy of benefits and creating a flagship safety net. A dynamic safety net could also provide existing and additional beneficiaries

with top-up benefits in times of shock, triggered by early warning systems, through agreed standard operating procedures. These shock-responsive mechanisms could also be complemented with support to productive livelihoods through well tested mechanisms such as small grants, life and business skills training, financial literacy, savings groups as well as climate-smart public works which create short-term employment including: soil and water conservation, afforestation/reforestation, small-scale irrigation and flood protection.

Increase investment in water, sanitation and health services to further protect human capital from climate change. Large-scale rehabilitation and climate-proofing of WSS systems to achieve universal access to WSS by 2030 along with a strengthening of health systems to address the other climate related health issues impacting labor supply and labor heat stress.

Invest in the education as a core mechanism for adaptation and to supply STEM skills for key growth sectors such as mining and agriculture. Education has been foundational to social mobility in Zimbabwe. Climate risks and opportunities highlight the demand for STEM skills. In agriculture, STEM skills will be key in managing risk though the application of conservation and precision agriculture. Growth of the mining sector will also create demand for STEM skills across blue and white-collar job types from mining technicians to engineers both in the private and public sectors. Policies to retain teachers generally, and specifically STEM faculty members, are needed and could, even under the BAU scenario, be facilitated through partnerships with agriculture and mining sectors.

Table 5.2: Additional climate actions making the Vision 2030 scenario greener and more resilient

Area of Action	Vision 2030 Scenario ASP scenario	Additional or replacement climate actions making the ASP scenario more resilient and greener	Rationale/Benefit of additional or replacement action
Greening the mining industry	ZESA as the off-taker for IPPs	Leverage the financial viability of private sector mining concessions to drive investment in RE	Competitive advantage in key export markets adopting ESG and CBAM policies
	Development of Batoka and Devils Gorge hydroelectricity plants with focus on supplying electricity from own-sources	Expand investment in RE and battery storage from 1% to 45% to reduce reliance on large hydro in the energy mix. Strengthen domestic grid and electric interconnections to allow for increased renewable based imports (bilateral and SAPP)	Hydropower output in the Zambezi is exposed climate change. Under the driest scenarios there is a 58 percent reduction in output. Rapidly meet increasing demand from mining and increase the country's resilience to drought
	Assessment of railways infrastructure and rolling stock	PPPs to rehabilitate and electrify key rail corridors to facilitate transport of mining and other freight	Shift some of the financial burden to the private sector and reduce carbon footprint through modal shift
Resilient agriculture, landscape restoration, food and water security	Development and rehabilitation of smallholder irrigation through the National Accelerated Irrigation Program and through the Commercial Irrigation Facility	Complement with investment in agricultural knowledge innovation systems and expanding financial services to accelerate mechanization and precision agriculture	Realize full potential of available water resources, and land reforms for import substitution and developing export markets in drying parts of the world
	Limited investment in sustainable forestry management and land restoration	At-scale land restoration to restore degraded natural habitats, riparian buffers and enhance nature-based tourism	Ecosystems services worth US$ 400 million a year and mitigation benefits of 11 million tCo_2e per year. Draw down climate finance and carbon markets worth at least $ 50m/yr
Protecting and growing human capital	Purchase, transportation and distribution of grain (US$ 281 m). Allowances for labor constrained and food poor households, program being scaled up from 23 to 33 Districts (US$ 121m). Monthly upkeep allowances for vulnerable individuals and household (US$ 85m)	Reform existing fragmented system of social protection and replace with a national safety net program based on expanded HSCT that is shock-responsive and builds recipient resilience though climate-smart public works	Adaptive national safety net that can channel GoZ and donor resources efficiently while also having positive climate adaptation and mitigation impacts

Area of Action	Vision 2030 Scenario ASP scenario	Additional or replacement climate actions making the ASP scenario more resilient and greener	Rationale/Benefit of additional or replacement action
	Universal access to basic services: WSS, health and education	Climate-proofing of WSS systems and strengthening of health systems to address the other climate related health issues impacting labor supply and labor heat stress. Enhance supply of STEM skills for key growth sectors such as mining and agriculture	Supports social mobility and societal ability to adapt to climate change

5.3. Conclusion and Looking Ahead

Though the opportunity for pursuing climate action under the BAU scenario is highly constrained, implementing the 'no-regrets' measures dampens climate impacts and could help the country to transition to the ASP growth path. The 'no-regrets' measures identified by this report are based on the state enabling climate-smart investments by individuals and the private sector, with only very modest public sector investments. The catalytic public finance needed to enable these measures should be prioritized by the GoZ and its development partners, along with increasing the country's capacity to tap into climate funds and voluntary carbon markets.

Once on the ASP growth path, there is far greater scope for resilient and low-carbon development. This ASP growth path would be driven by a revitalized partnership between the state and the private sector, and benefit from full re-engagement of development partners, the MDBs, climate funds, and voluntary carbon markets. Additional climate measures set out in this report offer a way to further dampen the effects of climate change and improve the country's competitive advantage in key sectors such as mining and agriculture. These additional climate measures can be taken without losing proposed development gains set out in Vision 2030. This more resilient ASP growth path could also return Zimbabwe to a net zero pathway in the second half of the century.

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