REPORT ON CLIMATE RISK ANALYSIS IN THE BANKING SECTOR

BANK OF TANZANIA

March 2026

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LIST OF ACRONYMS

BoT	Bank of Tanzania
CMIP6	Coupled Model Intercomparison Project Phase 6
CRFR	Climate Related Financial Risks
CSV	Comma-Separated Values
GDP	Gross Domestic Product
GIS	Geographic Information System
IBTrACS	International Best Track Archive for Climate Stewardship
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
MDAs	Ministries Departments and Agencies
NBS	National Bureau of Statistics
NPLs	Non-Performing Loans
NGFS	Network for Greening Financial System
PD	Probability of Default
QGIS	Quantum Geographic Information System
RM	Reform Measure
RCP	Representative Concentration Pathways
RSF	Resilience and Sustainability Facility
SSP2	Shared Socioeconomic Pathway 2
TCFD	Task Force on Climate-related Financial Disclosures
TCVMP	Tanzania Climate Vulnerability Maps Platform
TIF	Tagged Image File (Raster format)
TMA	Tanzania Meteorological Authority
TZS	Tanzanian shilling
WBG	World Bank Group
XLSX	Excel Open XML Spreadsheet

FOREWORD

Climate change has emerged as one of the global challenges of the 21st century, with far-reaching implications that extend well beyond environmental degradation to affect economic activities, social welfare, and the stability of financial systems. For central banks' mandates, this challenge prompts an understanding of how climate hazards translate into risks to the financial sector and requires them to act decisively to safeguard financial stability.

Tanzania, like many other countries, is experiencing a gradual increase in average temperatures correlating with a greater likelihood of both severe rainfall events leading to floods and extended periods of dryness leading to drought. In addition, coastal regions are at risk from rising sea levels, posing threats to infrastructure, agriculture, and freshwater supplies due to saline intrusion. The potential repercussions of climate change could affect the banking sector through various channels.

The Bank of Tanzania has taken several steps to combat climate change, including issuing guidelines for managing climate-related financial risks and sustainability reporting, joining the initiative to green the financial system, integrating climate change into its strategic plan for 2025/26 to 2030/31, and establishing a banking sector climate data repository.

The 2026 report on Climate Risk Analysis in the Banking Sector offers a geospatial evaluation of the sector's resilience to climate change. The report was prepared in consultation with the various governments' Ministries, Departments and Agencies, the IMF and WB, and has drawn resources from the NGFS. This assessment includes loans and collateral impacts from climate hazards, based on moderate climate scenarios. I want to reassure the public that the banking sector has relatively low exposure to risks from droughts, floods, and tropical cyclones under the moderate climate scenario. The Bank remains dedicated to protecting the banking sector by continuously monitoring risks and maintaining the sector's stability.

Emmanuel M. Tutuba.

Governor

Bank of Tanzania

EXECUTIVE SUMMARY

The United Republic of Tanzania is undertaking sectoral reforms to address structural challenges posed by climate change. In the financial sector, the Bank of Tanzania, in collaboration with the International Monetary Fund, has implemented Reform Measures 13 and 14. Reform Measure 13 focused on establishing a climate data repository to strengthen the assessment of climate-related risks, while Reform Measure 14 intended to analyze climate change risks and their transmission mechanisms within the banking sector.

The development of the climate data repository has been supported through Technical Assistance from the World Bank. The repository integrates loan and collateral data from four large banks, which collectively hold more than 50 percent of the banking sector's assets. To enrich the analysis, vulnerability maps for floods and droughts were sourced from the Tanzania Climate Vulnerability Maps Platform implemented by the Prime Minister's Office.

The analysis shows that loans and collateral as at the end of September 2025, are concentrated in economically active districts, which generally face low to moderate climate hazard levels using the middle of the road scenario, while districts with higher climate hazard intensity have smaller loan portfolios. This implies the banking sector has low exposure to climate-related risks; however, monitoring is essential to cushion the sector against potential impacts of extreme climate events in economically active areas, given concentration risks, and to strengthen sustainable lending in areas with higher hazards.

The climate-related financial risks arise from the interaction between hazard exposure and the geographic concentration of banking assets. Floods and droughts can potentially reduce borrower income, lower collateral values, and increase credit and liquidity risks, thus affecting the financial sector and the economy at large. Therefore, it is paramount to integrate climate considerations into bank supervision and financial stability risk assessment to maintain the resilience of Tanzania’s financial system.

INTRODUCTION

1.1 Background

The global financial system faces a critical challenge from climate change, which potentially weighs on the core mandate of central banks to maintain price and financial stability. Physical climate hazards, including drought, flood, sea-level rise, and extreme weather events, increasingly threaten the stability of financial institutions through their impact on borrower creditworthiness, asset valuations, and infrastructure integrity.

Tanzania and much of Sub-Saharan Africa are exposed to physical climate hazards due to their geographical characteristics. The country experiences climate variability, ranging from prolonged drought cycles in the central plateau to seasonal flooding along major river systems, including the Rufiji, Wami, and Pangani, and increasing coastal flood risks along its 1,424 kilometer Indian Ocean coastline. Under credible climate scenarios, these hazards are no longer static; their frequency, intensity, and geographic reach are projected to increase materially over the long term.

These escalating environmental shocks, including droughts, floods, and other extreme weather events, are already disrupting agriculture, energy, manufacturing, trade, tourism, and building and construction sectors. For emerging economies like Tanzania, where economic activity is highly concentrated in climate-sensitive sectors such as agriculture, water resources, and energy, disruptions driven by climate variability, such as changes in rainfall patterns and increased evapotranspiration, can directly transmit into the financial system. These shocks can elevate credit risk by reducing borrowers' repayment capacity, particularly among agricultural and SME clients, while also creating liquidity pressures for financial institutions as cash flow becomes more volatile. In addition, asset repricing challenges may arise as climate risks are increasingly factored into collateral valuation and investment decisions, potentially leading to declines in asset quality. At the macroeconomic level, these disruptions can contribute to inflationary pressures, especially through food price volatility and supply constraints, thereby further tightening financial conditions and amplifying systemic vulnerability within the banking sector.

It is estimated that 54[1] percent of bank credit could be exposed to climate-sensitive sectors, making droughts, floods, and erratic rainfall potential drivers to increase in Non-Performing Loans. Consequently, these risks materialize within the banking sector's credit portfolios, potentially weakening the overall financial position of affected institutions. Furthermore, the global shift toward a low-carbon economy introduces additional transition risks driven by evolving policies, emerging technologies, and changing market preferences.

The Government of Tanzania has been implementing various measures to mitigate the adverse impact of climate change. In line with these efforts, the Bank of Tanzania has implemented initiatives such as the issuance of Guidelines[2], development of the Climate Data Repository, embed climate risk considerations into supervisory tools such as stress testing and scenario analysis, institutionalized climate resilience through the Five-Year Strategic Plan (2025/26–2029/30), joined the Network for Greening the Financial System (NGFS) and collaborates with government Ministries, Departments, and Agencies (MDAs), development partners, and other stakeholders to strengthen national climate resilience.

Climate hazards and transition pressures pose systemic challenges for the banking sector. As essential financial intermediaries, banks are responsible for directing capital from surplus to deficit units; however, climate-related disruptions increasingly undermine this core function. While banks have historically managed natural hazards, the modern financial environment is significantly more complex, magnifying these traditional risks into broader systemic vulnerabilities. Despite these challenges, they also create opportunities for banks to expand green finance, strengthen risk modelling practices, and support a more climate-resilient economy.

1.2 Rationale

The Bank of Tanzania (BoT) has taken decisive steps in line with the Government reform initiatives by integrating climate considerations into its regulatory and supervisory mandate, recognizing the threat that climate change poses to economic and financial stability. The BoT aims to expand its monitoring toolkit for safeguarding financial stability and promoting prudent

[1] World Bank (2024) Tanzania Country Climate and Development Report. Washington, DC: World Bank.
[2] The Guidelines on Climate Related Financial Risk Management and Disclosures, 2025 revised from 2022; Guidelines on Reporting of Sustainability Related Risks and Opportunities, 2025.

risk management across the financial sector by periodically conducting and publishing assessments of risks posed by climate change in the financial stability report.

This report, as an early warning tool, helps identify climate-related vulnerabilities on loan repayment capacity, collateral values, and overall stability of the banking sector. Also, assessing climate change risks and their transmission mechanisms in the banking sector will help the Bank better monitor concentration risks, guide banks toward more resilient lending practices, and ensure alignment with emerging regulatory standards on climate risk.

1.3 Objective and Scope

The primary objective of this report is to assess the exposure of the banking sector to physical climate hazards, particularly drought and flooding, their transmission channels, and the potential impact of those hazards on loan portfolios and collateral values under a plausible medium-emissions scenario. The analysis covers four banks that comprise 56.3 percent of the sector's assets. The geographic scope encompasses all regions of mainland Tanzania and Zanzibar.

The remainder of this report is structured as follows. Chapter two provides a conceptual framework for climate risk in the financial system, covering physical and transition risk categories, transmission channels to the banking sector, and a detailed exposition of climate scenarios. Chapter three describes the methodology, including spatial data processing protocols and data sources. Chapters four and five present empirical analyses of the banking sector loans and collateral exposure to drought and flood hazards, respectively. Chapter six presents policy recommendations, discusses limitations of the analysis, and provides a conclusion.

CLIMATE RISKS, TRANSMISSION CHANNELS AND SCENARIOS

Tanzania's banking sector is increasingly exposed to climate-related risks that may undermine financial soundness and stability if not adequately managed. These risks arise from physical climate impacts and transition dynamics associated with policy, market, and technological adjustments toward a low-carbon and climate-resilient economy. The two categories give rise to distinct but interconnected financial risks for banks and other financial institutions, and thus affect economic growth, with potential GDP losses of up to 4.0 percent by 2050[3], directly affecting borrower repayment capacity, collateral values, and fiscal conditions relevant to financial stability.

Financial institutions' vulnerability is heightened by their exposure to climate-sensitive sectors, where shocks to these sectors are transmitted to the financial system primarily through credit, concentration, and operational risks. Without effective identification, measurement, and mitigation, climate-related risks may accumulate on bank balance sheets and amplify systemic vulnerabilities.

2.1 Types of Climate-Related Financial Risks

2.1.1. Physical Risks

Physical climate risks arise from changes in the frequency, severity, spatial distribution, and timing of weather and climate events. Following the framework established by the Task Force on Climate-related Financial Disclosures (TCFD), these are categorized into acute risks, discrete, high-intensity events, and chronic risks, reflecting long-term shifts in climate parameters like mean temperature, precipitation, and sea levels. Collectively, these factors pose a growing threat to the banking sector by undermining borrower repayment ability and collateral values, impacting the banking sector's balance sheet.

Rising temperatures and the increasing frequency of droughts and floods adversely affect climate-sensitive sectors. This has become evident through recent weather events such as tropical storm Jobo in April 2021, floods and mudslides in Hanang in December 2023, and cyclone Hidaya in May 2024. The disruption caused by such events undermines borrower

[3] World Bank (2024) Tanzania Country Climate and Development Report. Washington, DC: World Bank.

cash flows and likely increases default risks. Furthermore, flooding causes direct physical damage to housing, transport infrastructure, farmland, and productive assets. For banks, this leads to collateral devaluation and a subsequent rise in Non-Performing Loans (NPLs), particularly within geographically concentrated, flood-prone portfolios. These factors elevate credit risk and the Probability of Default (PD), ultimately undermining the stability of the banking sector's balance sheet

The longer-term physical risks and operational disruptions further increase banking exposure. Declining water availability and drought-related reductions in hydropower output create energy supply volatility, raising operating costs for firms and households while indirectly straining debt-servicing capacity. Concurrently, sea-level rise, coastal erosion, and saltwater intrusion threaten high-value coastal real estate, tourism, and port infrastructure, intensifying sectoral and geographic concentration risks. These climate shocks elevate internal operational risk by disrupting branch operations, payment systems, and business continuity, reinforcing the need for climate-resilient operational frameworks across the banking system.

2.1.2. Transition risks

Transition risks arise from policy reforms, market adjustments, and technological changes associated with the shift toward a low-carbon and climate-resilient economy. Strengthened climate-related regulations, environmental standards, and evolving international trade requirements may increase compliance costs and reduce profitability for firms operating in emissions-intensive or environmentally sensitive sectors. Borrowers who fail to adapt face heightened credit risk, with potential implications for banks' asset quality and capital adequacy.

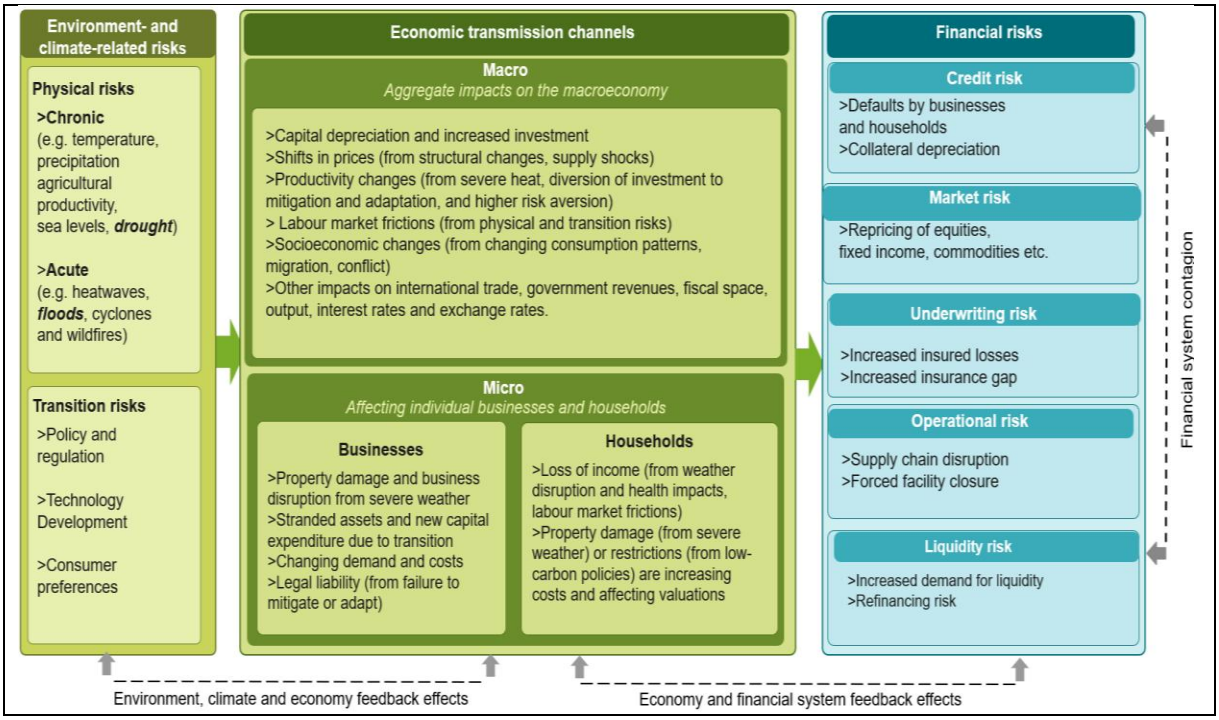
Transition risks are currently less material than physical risks in Tanzania, as the economy is heavily dependent on agriculture, which is not a high-carbon sector and not subject to near-term decarbonization policies. Also, per capita energy consumption and industrial carbon intensity are low relative to those of high-income countries and major emerging markets. However, transition risks are relevant through international channels: export sectors facing carbon border adjustment mechanisms, international financing conditions that increasingly incorporate carbon risk premiums, and requirements from development finance institutions and correspondent banks for climate risk disclosure. Moreover, technological change and market reallocation may also lead to stranded or impaired assets, particularly where banks are exposed to carbon-intensive or climate-vulnerable investments. These developments

underscore the importance of integrating climate-related risks into governance arrangements, prudential risk management, stress testing, and supervisory oversight to preserve financial stability.

2.2 Transmission Channels to the Banking Sector

Climate change (physical hazards and transition pressures) manifests in banks' balance sheets as financial losses through transmission mechanisms operating at micro and macro levels, crystallizing into climate-related financial risks that amplify traditional banking risks (operational, credit, market, and liquidity). This implies that climate risk cannot be managed solely through credit monitoring; it requires integrated surveillance spanning hazard science, macro-financial modeling, and balance-sheet stress testing, each corresponding to a distinct layer of the transmission chain. Figure 2 illustrates the transmission channels through which environmental and climate-related risks propagate from the real economy to the financial system.

Figure 1: Transmission Mechanism



***Source**: NGFS 2020*

2.2.1. The Micro-Level Transmission

At the microeconomic level, climate-related shocks directly affect individual businesses and households, which constitute the primary borrowers in the banking system. Extreme weather

events can damage collateral, disrupt production, and interrupt supply chains, forcing firms to incur additional costs while reducing revenues (Addoum et al., 2020). Households may also experience income losses due to agricultural shocks, an increase in labor costs, or other impacts associated with extreme weather conditions (Burke et al., 2015).

These events weaken borrowers' repayment capacity and may simultaneously reduce the value of pledged collateral. Empirical evidence suggests that firms exposed to climate shocks often experience declines in productivity and profitability, increasing the probability of loan default (Hong et al., 2019). In Tanzania's rural districts, where livelihoods depend largely on rainfed agriculture, drought events have been associated with delays in loan repayment.

2.2.2. The Macro-Level Transmission

The macro-level transmission captures the aggregate economic effects of climate hazards that affect the entire lending environment in which banks operate. Even a bank with a perfectly diversified loan portfolio, with no single borrower exposed to climate risk, would face deteriorating credit conditions if macro-level climate transmission sufficiently weakens the overall economy. For the Bank, the macro transmission level is therefore a financial stability concern that extends beyond the individual institution to the system.

Further, climate disruptions may influence government revenues, fiscal balances, trade flows, and inflation dynamics, which in turn affect financial sector stability (NGFS, 2019). Empirical evidence suggests that climate-related disasters can have persistent negative effects on output and investment. In Tanzania, prolonged droughts in the central zone are associated with reduced sunflower production, while previous El Niño-related floods have damaged transport infrastructure and slowed trade, thereby affecting economic activity and banks' loan portfolios.

2.3 Financial Risk Outcomes

Micro and macroeconomic disruptions ultimately manifest on bank balance sheets through the following financial risk categories.

i. **Credit risk**: where climate hazards simultaneously elevate the probability of default through borrower income disruption and the loss given default through collateral value impairment, producing compound Expected Credit Loss increases that the IFRS 9 Stage 2 and Stage 3 recognition lag may conceal for 12 to 24 months after the hazard

onset. Further, credit risk is propagated from collateral impairment, as drought-induced land value depression and flood damage may progressively erode the effective security cover on performing loans.

ii. **Market risk** arises from the repricing of climate-exposed equities, fixed income instruments, and commodities held in bank portfolios.

iii. **Operational risk** encompasses both the physical disruption of branch operations during climate events and, more pervasively, the model risk arising from credit assessment and collateral valuation frameworks that do not incorporate climate parameters.

iv. **Liquidity risk** emerges when simultaneously stressed borrowers draw down credit facilities, reduce deposits, and trigger liquidity demands at the moment when climate-impacted collateral is hardest to liquidate.

2.4 Feedback Loops and Supervisory Implications

The transmission is not a one-way pipeline from climate hazard to financial loss. It contains feedback loops running in both directions that can amplify individual climate shocks into broader systemic disruptions. The most consequential runs from the bank balance sheet back to the real economy, such that credit tightening from affected banks reduces investment and consumption, amplifying the economic contraction and generating a second wave of loan impairment. Early warning monitoring, countercyclical capital buffers, provisioning flexibility during acute climate events, and the Climate-Resilient Lending Framework are essential for maintaining financial stability.

2.5 Climate Scenarios

Global average temperature, calculated as the mean of near-surface air and sea-surface temperature anomalies, which are deviations from a historical baseline, forms the foundation of modern climate modeling. These anomalies allow scientists to develop structured climate scenarios that translate observed changes into quantitative projections, exploring how different levels of policy ambition, technological shifts, and socioeconomic trends influence future warming. The Paris Agreement[4], is fundamental to this framework as it sets definitive

[4] The Paris Agreement of December 2015 is a legally binding international treaty on climate change adopted by 195 Parties at the UN Climate Change Conference (COP21) in Paris, France whose overarching goal is to hold

thresholds and benchmarks for global climate action. These benchmarks allow for the evaluation of policy progress and the assessment of potential financial and environmental outcomes across various emissions pathways.

2.5.1. The Representative Concentration Pathways (RCPs)

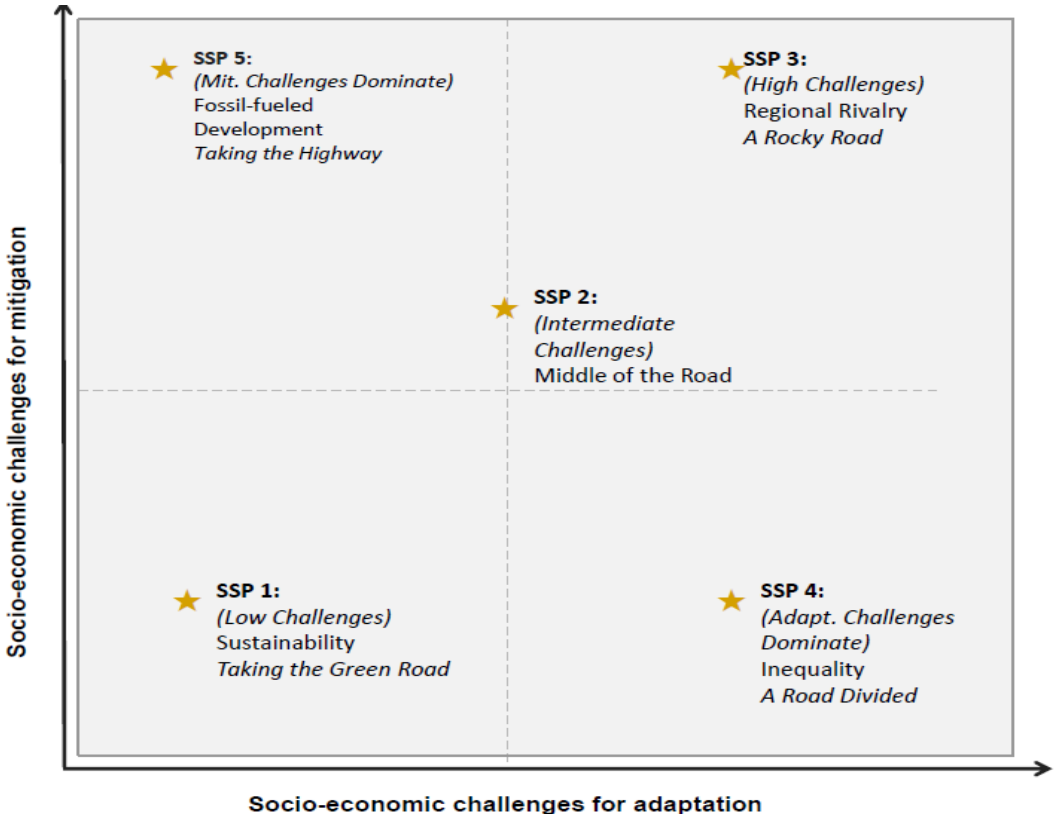
The RCPs were introduced by the IPCC Fifth Assessment Report (AR5), which are standardized scenarios that characterize possible futures for greenhouse gas concentrations based on their approximate radiative forcing level by 2100, measured in watts per square metre (W/m^2). These pathways range from the aggressive mitigation of RCP 2.6 to the high-emission RCP 8.5 trajectory. This report specifically adopts RCP 4.5, a moderate stabilization scenario where global emissions peak around 2040 as its primary analytical baseline. Under this pathway, global mean temperatures are projected to rise by 1.8–2.5°C by the end of the century.

2.5.2. The Shared Socioeconomic Pathways (SSPs)

The SSPs, introduced in the CMIP6 generation of models for the IPCC Sixth Assessment Report (AR6), advance climate modeling by integrating radiative forcing trajectories with narratives on socioeconomic development, governance, and adaptation capacity. These pathways span a wide spectrum from aggressive decarbonization (SSP1-1.9) to fossil-fuel-intensive growth (SSP5-8.5) (**Figure 2**).

"the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels.

Figure 2: Shared Socioeconomic Pathways

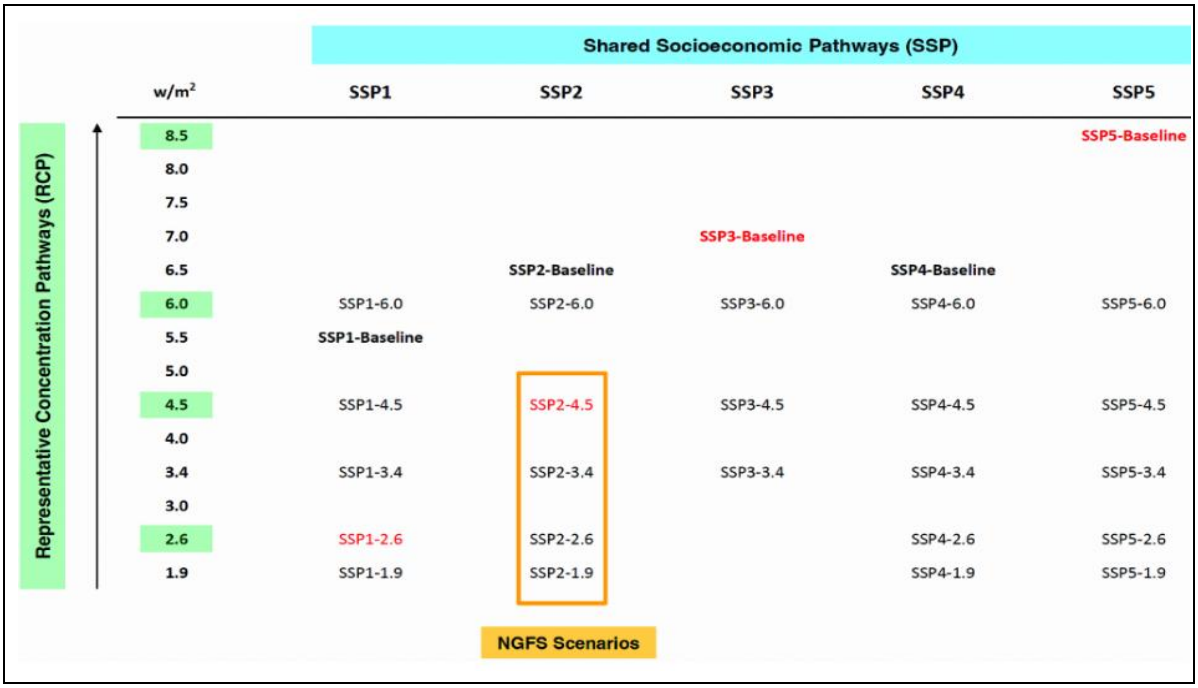


***Source**: Narratives in O'Neill et al., 2016*

2.5.3. The NGFS Climate Scenarios

The Network for Greening the Financial System (NGFS) has developed a suite of climate scenarios specifically designed for financial sector stress testing, drawing on the SSP/RCP frameworks (**Figure 3**). The NGFS framework provides the macro-financial linkage to project climate hazards onto the banking sector's balance sheets. The NGFS scenarios are organized along the speed and orderliness dimensions of the climate transition and the severity of physical hazards.

Figure 3: Relationship between RCPs, SSP and NGFS



Source: *Mohaddes & Raissi (2025).*

2.5.4. Selected Climate Scenarios

The assessment of climate-related financial risks reported in this report utilized the ready-made Tanzania Vulnerability Maps hosted under the Prime Minister's Office platform. The platform considered the SSP 2-4.5 with an additional radiative forcing of 4.5 W/m² by the year 2100, which represents the medium pathway of future greenhouse gas emissions. This scenario assumes that climate protection measures are being taken. Two types of hazards were analyzed, which are drought and floods.

Further, for riverine and coastal flood hazards, similar vulnerability layers were obtained from the World Resources Institute.

As per the current policy measures and practices, it is estimated by IPCC that it is difficult to limit global temperature rise below 1.5°C by the end of the century. For this reason, the climate scenario analyzed is the Shared Socioeconomic Pathway (SSP2-4.5) using the Coupled Model Intercomparison Project Phase (CMIP6), representing a moderate mitigation pathway with approximately 2.7°C of global warming by 2100. The time horizon of primary analytical focus is 2020–2039, representing the average period over which current long-duration credit exposures will mature.

METHODOLOGY AND DATA

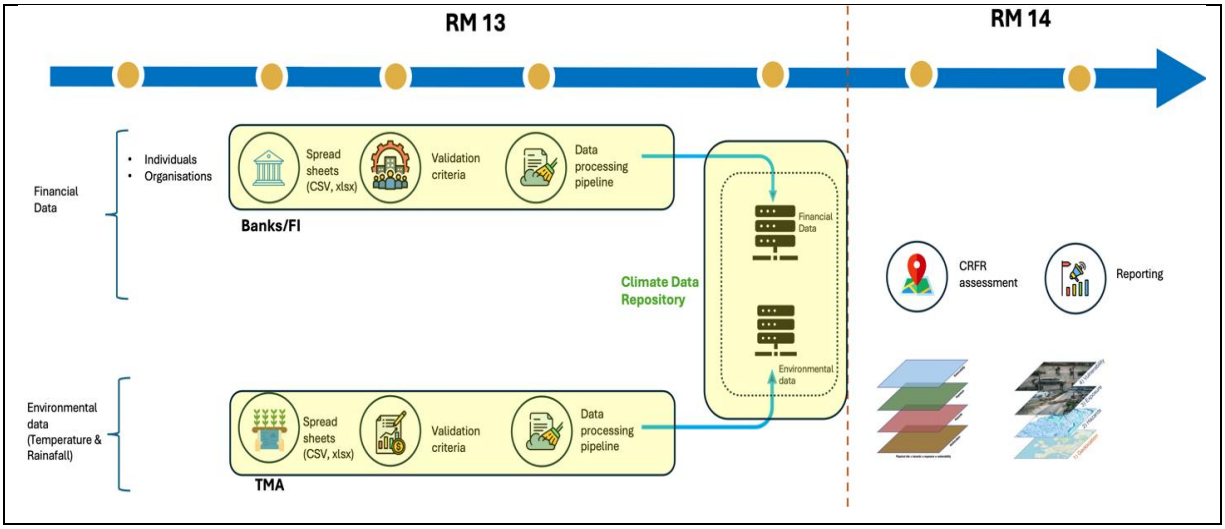
This section describes the analytical framework, data sources, and processing methods used to analyze climate risk hazards to the banking sector.

3.1 Data

3.1.1. Financial Data

The financial dataset represents outstanding loans and collateral sources from the Climate Data Repository as of September 2025. The database, among other information, includes a unique loan identifier, economic sector, geographic location of loans and collateral by Region, District, and Ward, and some with street and geocoordinates (latitude and longitude), outstanding loans, collateral pledged, and collateral value.

Figure 4: A simplified Climate Data Repository Schema



***Source**: Bank of Tanzania*

3.1.2. Hazard Maps

Climate hazard data (raster layers) for drought and flood were obtained from the Tanzania Climate Vulnerability Maps Platform (TCVMP) hosted by the Prime Minister's Office, while riverine flood and coastal flood were sourced from the World Resources Institute (WRI, 2020). The layers for drought and flood represent climatology projected conditions under SPP2-4.5 scenarios for 2020-2039. Tropical cyclone data were obtained from the International Best Track Archive for Climate Stewardship (IBTrACS) (Gahtan et al., 2024).

3.1.3. Administrative boundaries

District-level shapefiles were used to provide geographic reference for linking climate hazards with loan and collateral data, obtained from the National Bureau of Statistics (NBS).

3.2 Spatial Data Processing

Spatial data was processed and analyzed using Quantum Geographic Information System (QGIS) and R for raster and vector files to calculate statistics and visualize patterns. The hazard maps obtained from TCVMP were combined with bank exposures in QGIS to develop vulnerability maps for risk assessment.

Excel was used to prepare, integrate, and analyze financial data charts. Python was used to geocode and randomize the dataset that lacked coordinates, using available geographical information for Regions, Districts, Wards, and Streets.

3.3 Data Limitations

The results in the analysis, while qualitative, should be interpreted with caution, given various data limitations. The geographic locations for some loans and collateral that lacked coordinates have been generated considering available information on regions, districts, wards, and streets; they are not exact coordinates. Further, the analysis of riverine and coastal flooding effects may extend beyond the riverbed and coastline; hence, precise location data could provide a more conclusive analysis of exposure. Furthermore, the analysis does not include severe climate scenarios or a time horizon beyond 2039, which would likely yield different results regarding the impact of climate hazards on the banking sector.

BANKS' LOANS EXPOSURE TO CLIMATE HAZARDS

The analysis of climate-related risks to the banking sector is based on loan portfolios from four banks, forming a combined loan portfolio of TZS 26.25 trillion as at September 2025, which accounts for 60.2 percent of the total banking sector loans. These loan portfolios are used to assess potential financial exposure to climate hazards under the SSP245 climate scenario, focusing on drought and floods[5]. Further analysis was done to analyze riverine floods and coastal floods. Hazard levels are measured using the mean hazard value for each district derived from climate scenario datasets.

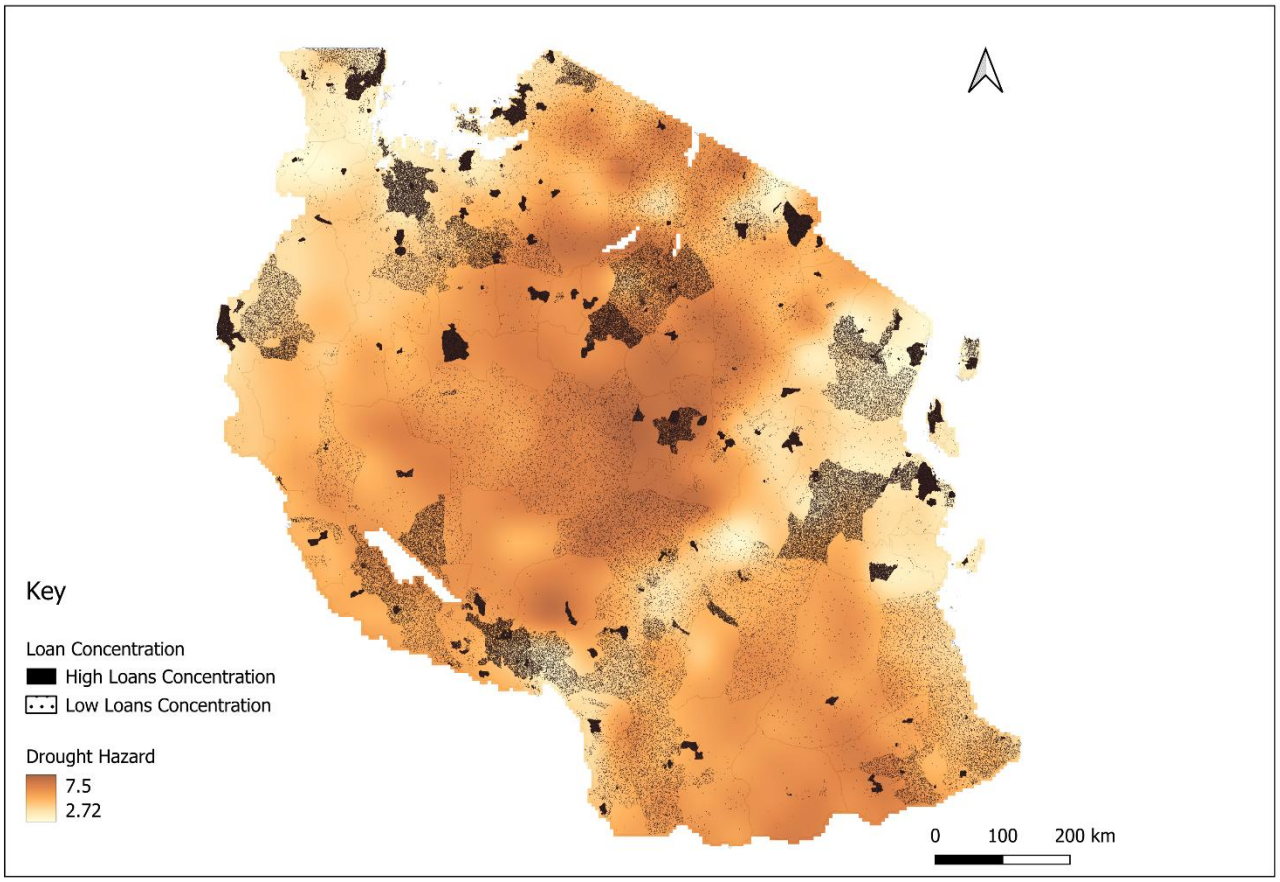
4.1 Drought Hazard

Drought conditions are due to the absence of rainfall, the compounding effect of precipitation deficits, and temperature-driven evapotranspiration increase. The country's agricultural heartland, spanning the central plateau regions of Dodoma, Singida, Tabora, and parts of Morogoro and Shinyanga, receives between 500 and 800 mm of annual rainfall concentrated in two seasons, placing it on the margins of rain-fed agricultural viability. The Indian Ocean Dipole and El Niño-Southern Oscillation are the primary inter-annual drivers of drought variability in Tanzania.

Climate change is projected to transform drought from an episodic shock absorbed periodically within the normal cycle of agricultural risk into a structural, chronic condition that progressively erodes the creditworthiness of agricultural borrowers and the value of agricultural collateral over the life of long-duration credit facilities. The banking sector, drought risk demands analytical rigor and supervisory attention because it is slow-moving, spatially diffuse, and capable of accumulating into systemic stress before conventional credit monitoring systems register its full extent.

[5] Cognizant of other types of floods such as flash floods, pluvial floods, and urban floods.

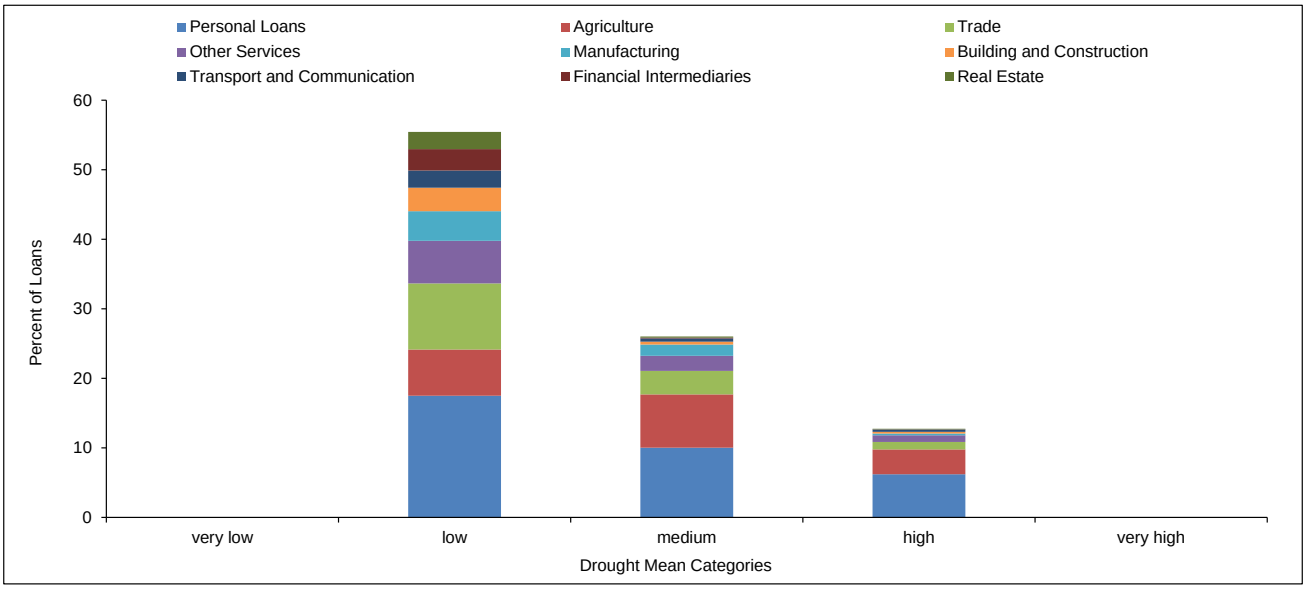
Figure 5: Drought Hazard and Loan Exposure



***Source**: Bank of Tanzania Computations*

Figure 5 illustrates the spatial distribution of drought hazard overlaid with the geographic locations of loan exposures. The intensity of the color indicates drought magnitude; darker shades show greater drought levels. Loan locations are overlaid for visual assessment of the exposure of the banking sector's loan portfolio to drought hazard. The distribution shows that loans are not concentrated in areas with higher drought intensity, indicating that the banking sector has insignificant exposure to the drought hazard.

Chart 1: Share of Loans Exposed to Drought



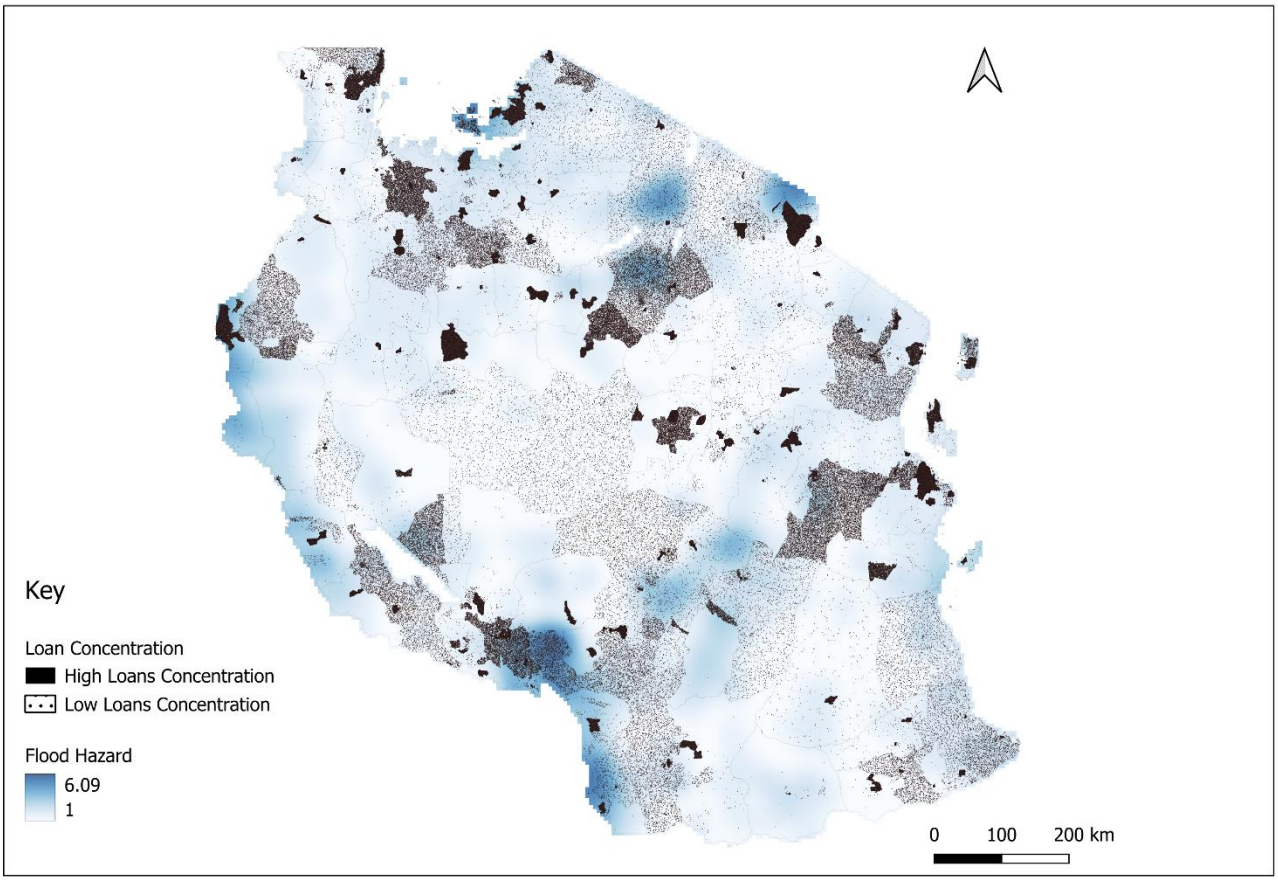
***Note**: Drought mean categories are equal bands in the range of 1-9.*
***Source**: Bank of Tanzania Computations.*

The analysis of loans' exposure to drought shows that 59.6 percent of loans across various economic activities are exposed to low drought mean levels, with 27.3 percent and 13.1 percent falling under medium and high drought levels, respectively. The majority of loans falling under high drought levels comprise 6.2 percent of personal loans, 3.6 percent of agricultural loans, and 1.1 percent of trade loans, implying that the banking sector's exposure to drought hazards is not alarming.

4.2 Flood Hazard

The flood risk landscape is driven by two annual rainfall seasons, the long rains (March to May) and the short rains (October to December), whose intensity is modulated by the Indian Ocean Dipole and El Niño-Southern Oscillation. Annual rainfall ranges from below 500 mm in the semi-arid central plateau to over 2,000 mm in the Southern Highlands and around Lake Victoria, creating highly uneven flood exposure across the country. The most economically significant expression of this risk is riverine flooding, where Tanzania's five major river systems, the Rufiji, Wami-Ruvu, Pangani, Ruvuma, and Kagera, periodically exceed their channel capacity and inundate adjacent floodplains.

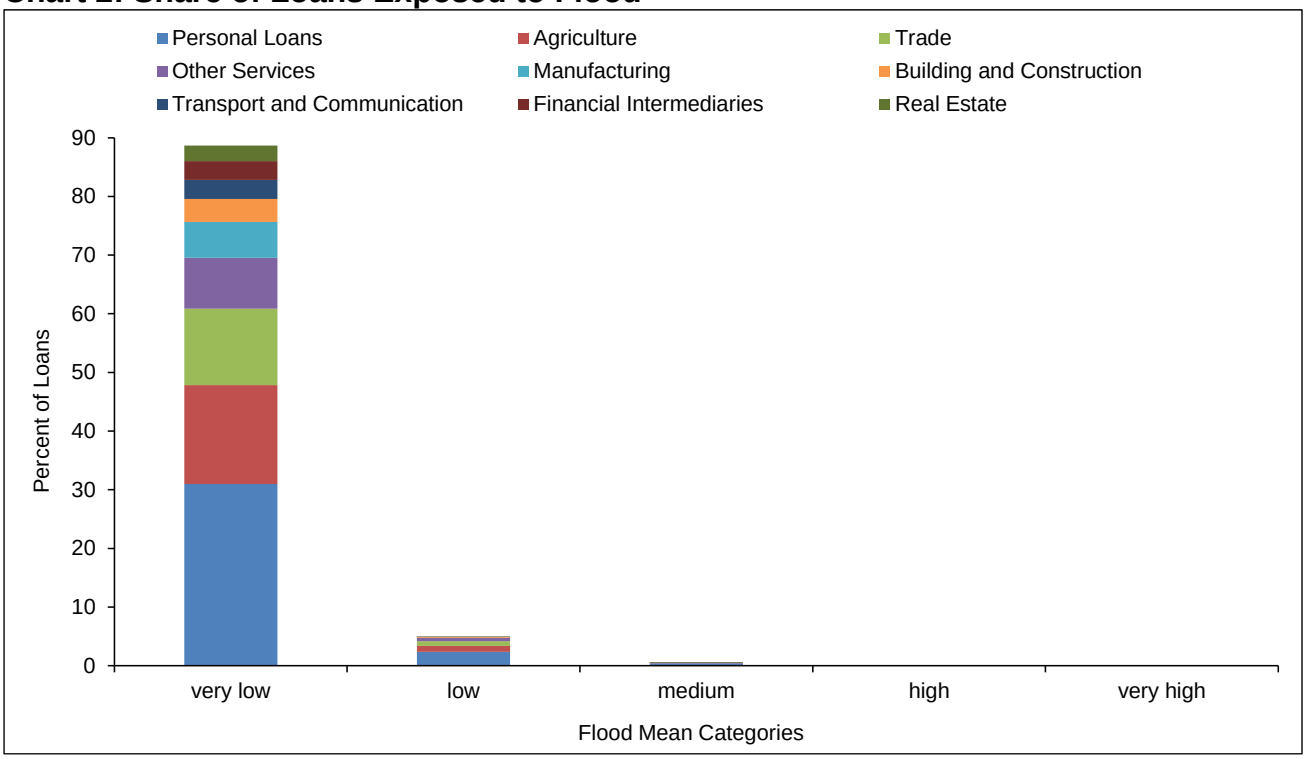
Figure 6: Flood Hazard and Loan Exposure



***Source**: Bank of Tanzania Computations.*

Figure 6 illustrates the spatial distribution of flood hazard overlaid with the geographic locations of loan exposures. The intensity of the color indicates flood depth; darker shades depict higher flood levels. Loan locations are overlaid for visual assessment of the exposure of the banking sector's loan portfolio to flood hazard. The distribution shows that loans are not concentrated in areas with higher flood depths, thus the banking sector has insignificant exposure to flood hazard.

Chart 2: Share of Loans Exposed to Flood



***Note**: Flood mean categories are equal bands in the range of 1-9*
***Source**: Bank of Tanzania Computations.*

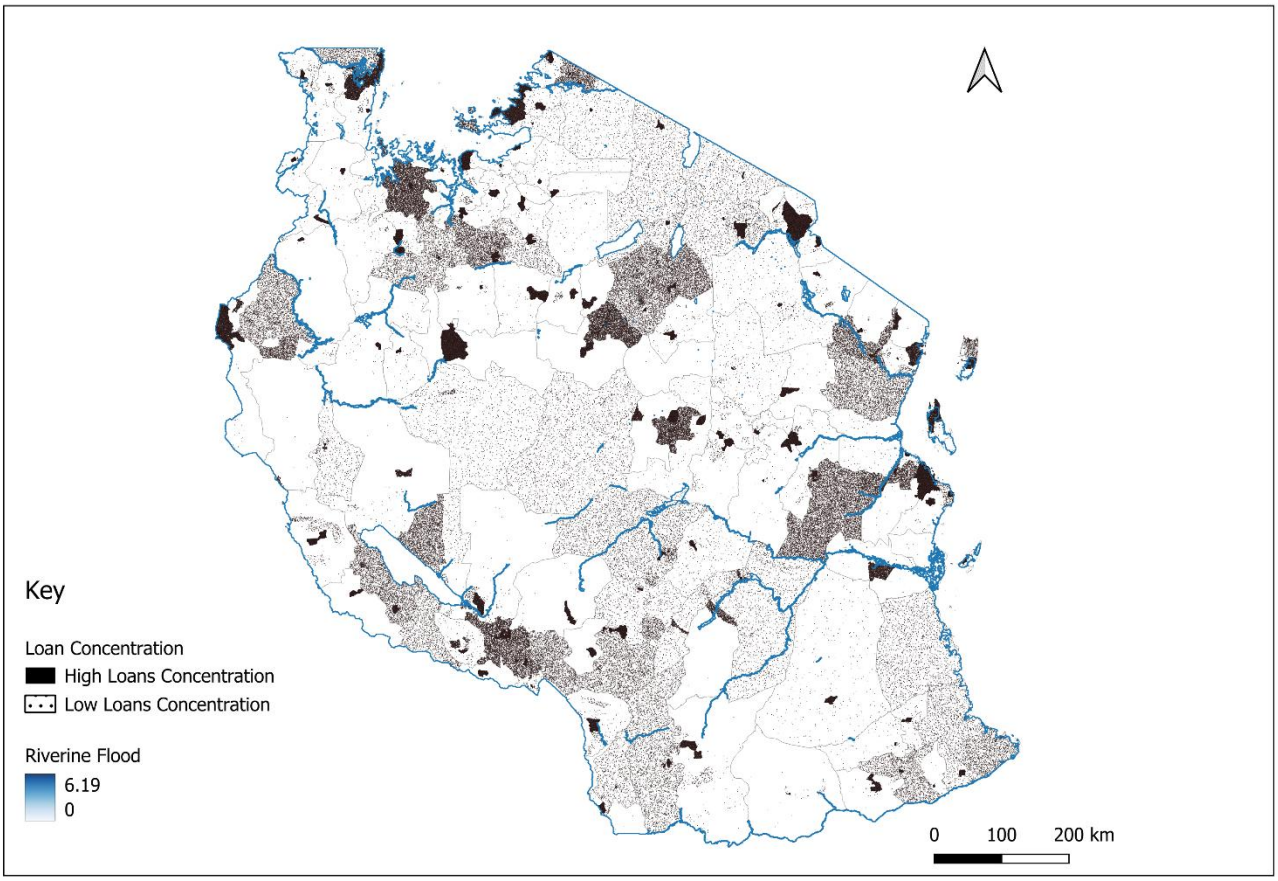
The share of loans exposed to floods depicts that 94.1 percent of loans fall under very low flood mean levels, 5.3 percent in low flood mean levels, and the rest fall under medium flood levels, implying that the banking sector's exposure to flood hazards is insignificant.

4.2.1. Riverine Flood

Riverine flooding is among the climatic hazards affecting some areas in Tanzania, driven by intense rainfall, river overflow, and changes in land use patterns. Such events can cause widespread disruption to economic activities, particularly affecting sectors dependent on physical infrastructure, agriculture, and transport networks.

In the context of the banking sector, riverine floods can pose serious threats by influencing borrowers' ability to repay loans and, in turn, impacting banks' liquidity and solvency.

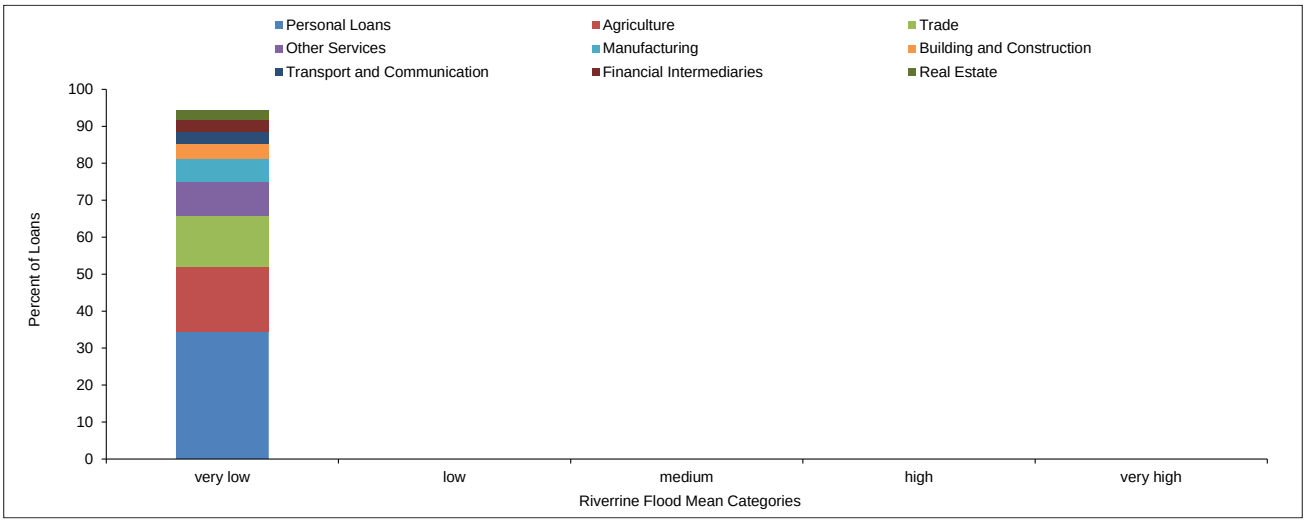
Figure 7: Riverine Flood Hazard and Loan Exposure



Source: *Bank of Tanzania Computations.*

Figure 7 illustrates the spatial distribution of riverine flood hazard overlaid with the geographic locations of loan exposures. River flow channels indicate the paths of the water bodies. Loan locations are overlaid to depict a visual evaluation of the exposure of the banking sector's loan portfolio to riverine flood hazard. The distribution shows a low concentration of loans along the river paths, indicating that the banking sector has insignificant exposure to riverine flood hazard.

Chart 3: Share of Loans Exposed to Riverine Flood



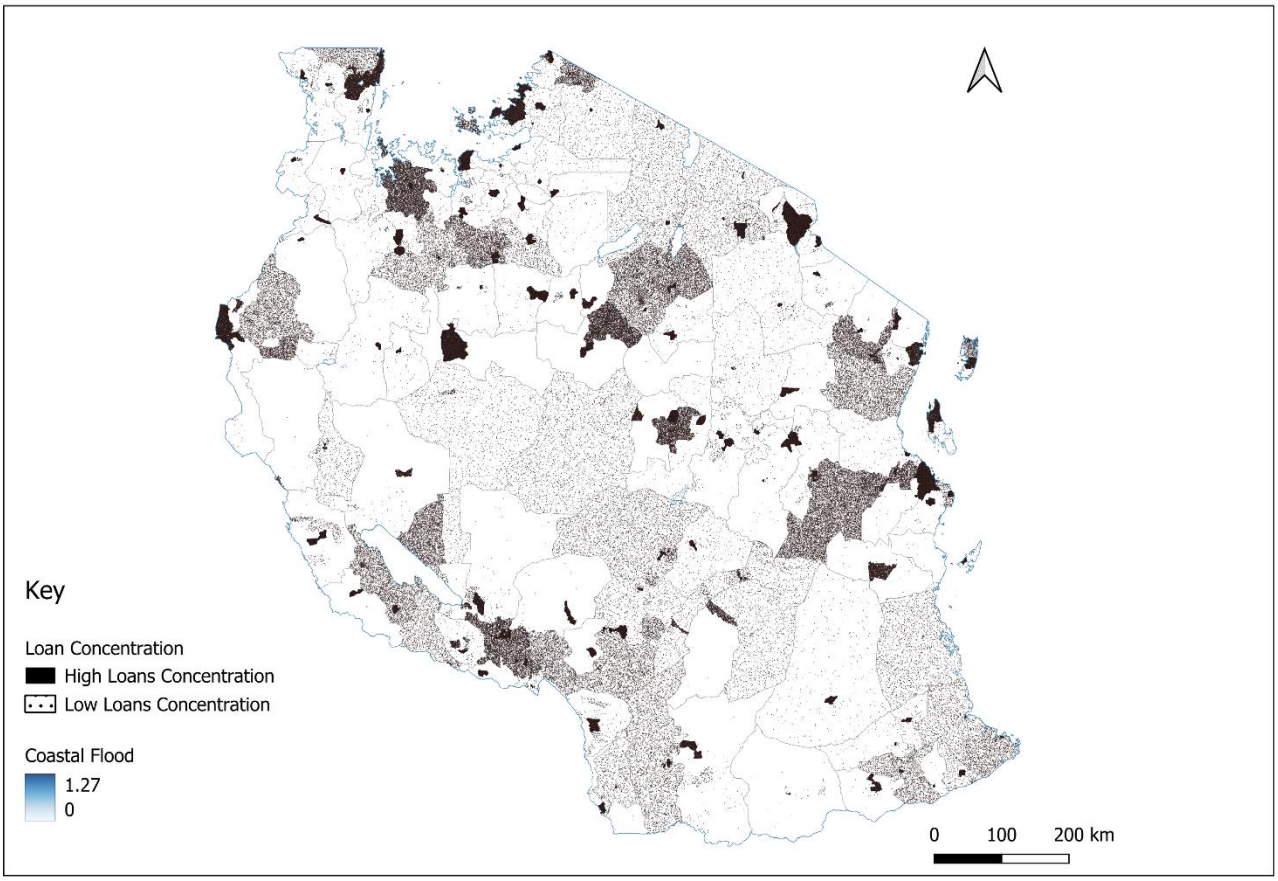
***Note**: Flood mean categories are equal bands in the range of 0-6*
***Source:** Bank of Tanzania Computations*

The analysis of loans exposed to riverine flooding indicates that, across all economic sectors, exposure levels are very low on average, suggesting that the banking sector's overall vulnerability to riverine flood hazards is currently minimal. The findings imply that riverine flood risk does not currently pose a material threat to the banking sector, with limited expected impact on borrower repayment capacity, asset quality, or overall financial stability.

4.2.2. Coastal Flood

Coastal flooding poses financial risks to banks by increasing loan defaults and reducing cash inflows in flood-prone districts. High loan concentrations make banks particularly vulnerable, as coastal flood events can disrupt investment and damage infrastructure.

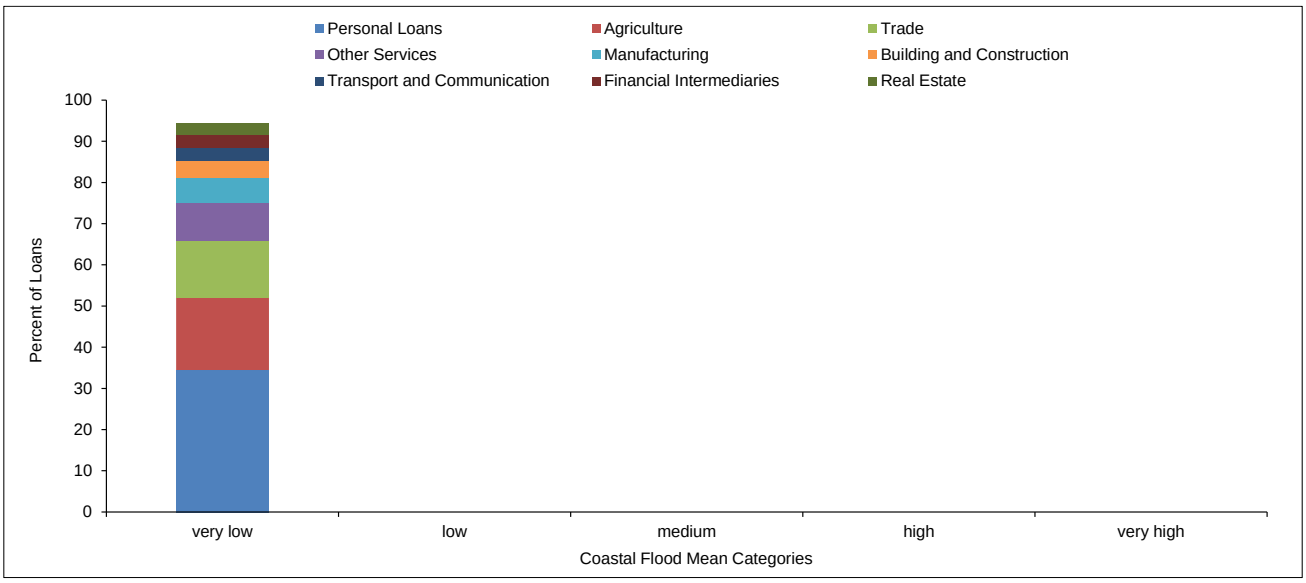
Figure 8: Coastal Flood Hazard and Loan Exposure



***Source**: Bank of Tanzania Computations*

Figure 8 illustrates the spatial distribution of coastal flood hazard overlaid with the geographic locations of loan exposures. Loan locations are overlaid to depict a visual evaluation of the exposure of the banking sector's loan portfolio to coastal flood hazard. Despite the concentration of loans in the coastal zone, the associated coastal flood hazard is low.

Chart 4: Share of Loans Exposed to Coastal Flood



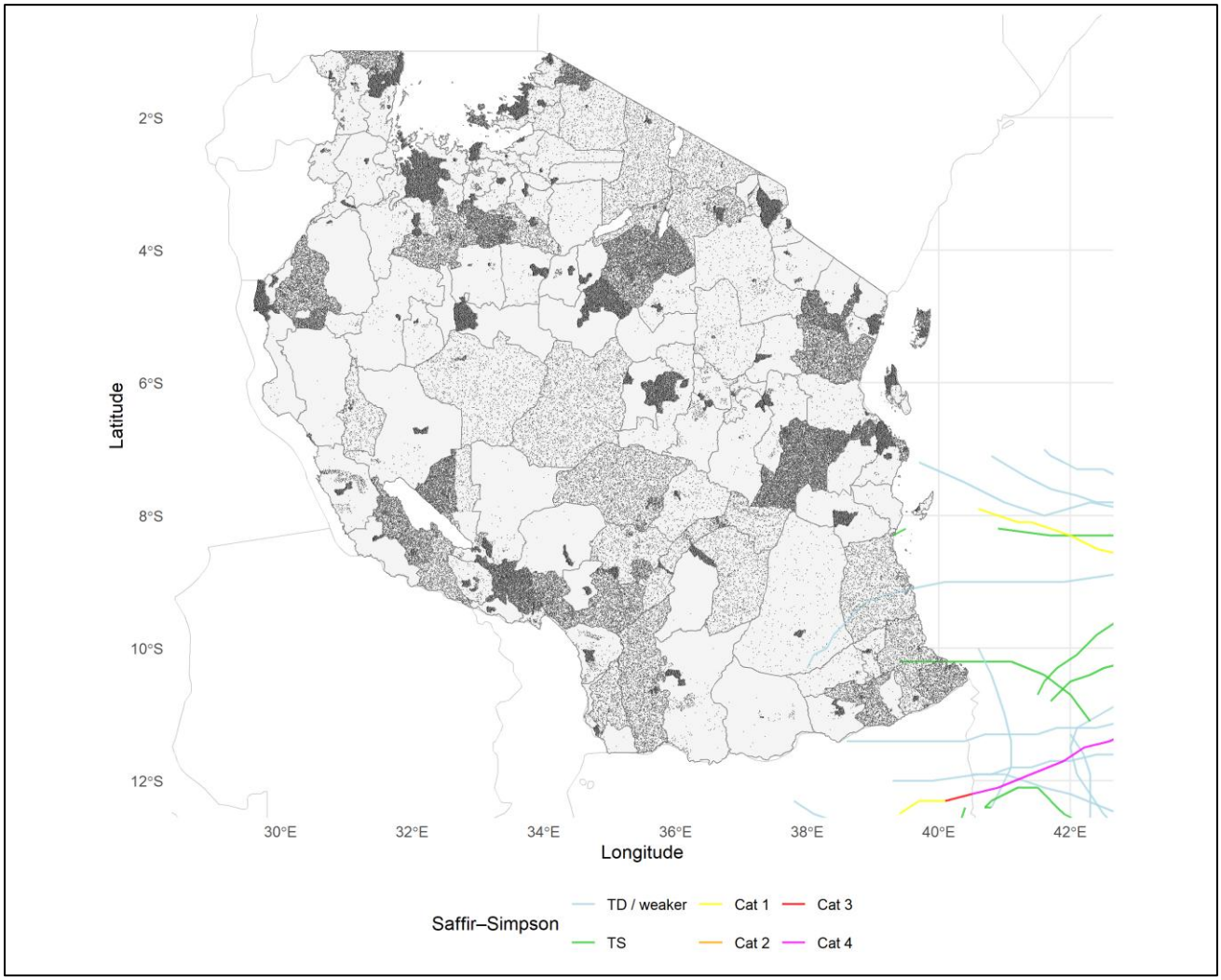
***Note**: Flood mean categories are equal bands in the range of 0 -1.2*
***Source**: Bank of Tanzania Computations*

The analysis of loans exposed to coastal flooding indicates that, across all economic sectors, exposure to coastal flood hazards remains very low on average, indicating that the banking sector's overall exposure to coastal flooding is currently insignificant. The findings imply that coastal flood risk is not currently a significant source of financial vulnerability for the banking sector, with minimal expected impact on loan performance, asset quality, or liquidity conditions. However, the Bank will maintain ongoing monitoring and incorporate forward-looking climate scenarios, as rising sea levels and extreme weather events could increase coastal exposure over time, potentially elevating future financial risks.

4.3 Tropical Cyclone Hazard

Tanzania is affected by tropical cyclones that emanate from the ocean, specifically along the eastern coastline of the country. Tropical cyclones can result in strong winds, rainfall, and flooding. Tropical cyclones are thus an important climate hazard to be analyzed for assessment of impact in the banking sector. The occurrence of the recent tropical storm Jobo in April 2021 and cyclone Hidaya in May 2024 is evidence of the existence of storms in the country. Despite its low impact, a severe storm can have significant repercussions for the assets and collateral of the overall portfolio of the banking sector. Tropical cyclone intensity is described using tropical depressions, tropical storms, as well as the Saffir-Simpson Hurricane Wind Scale for categories 1 to 5 (National Hurricane Center, n.d.)

Figure 9: Tropical Cyclone Hazard and Loan Exposure



***Source**: Bank of Tanzania Computations.*

Figure 9 demonstrates that tropical cyclones mainly hit the country along the eastern coastline. The intensity of the tropical cyclone is generally weaker, implying a relatively low impact on the banking sector.

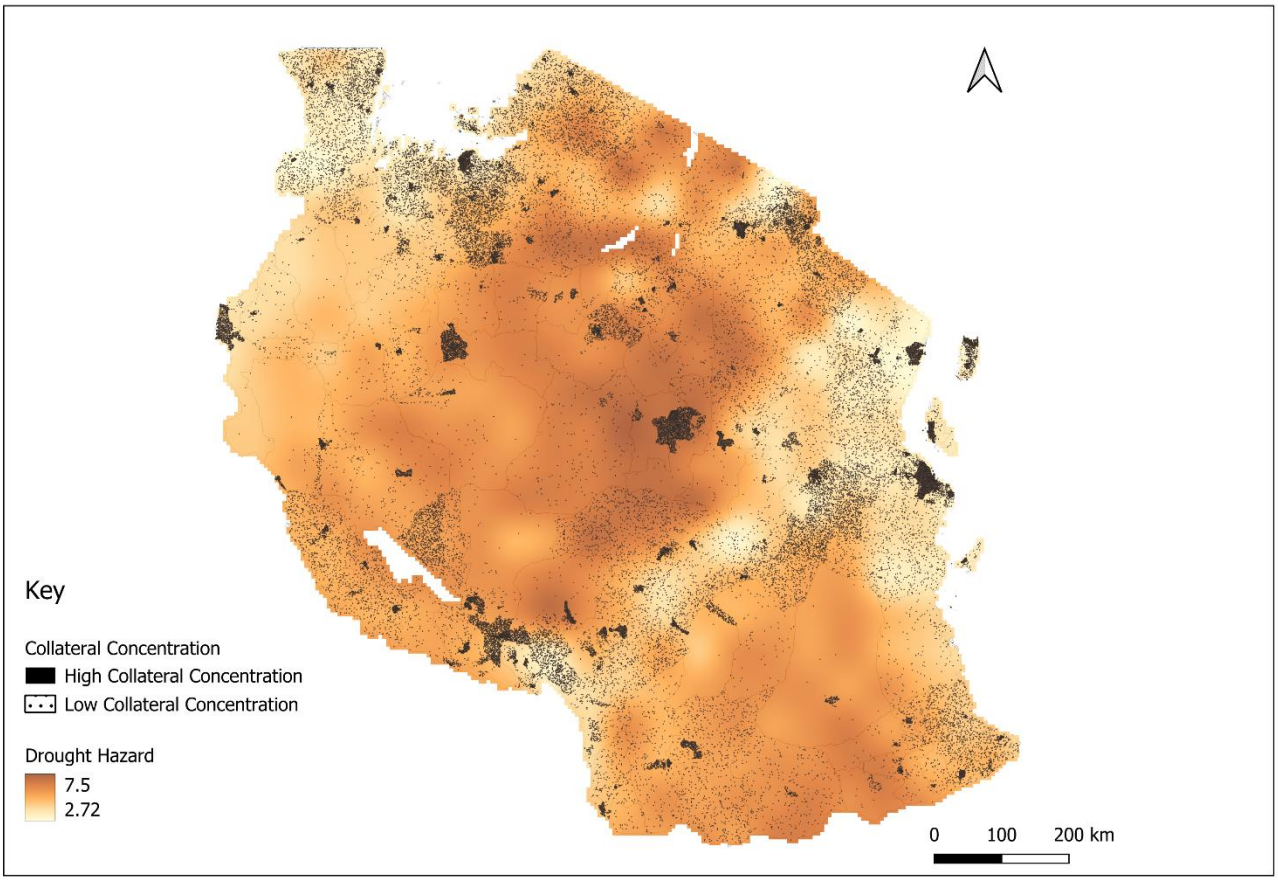
COLLATERAL EXPOSURE TO CLIMATE HAZARDS

The analysis of climate-related risks to the banking sector is based on collateral values of four banks, with the majority associated with 82.2 percent mortgages, 8.7 percent financial assets, 3.5 percent cash, 3.3 percent landed properties, and 2.3 percent other collateral. The value of collateral across districts with respect to distribution reflects the geographic concentration of financial activity in major commercial centers. The districts with the highest collateral values are largely urban and economically active areas where banking services, real estate markets, and commercial lending are concentrated.

5.1 Drought Hazard

The assessment of drought risk exposure for bank collateral evaluates how drought severity interacts with the geographic location of pledged collateral. Severe drought conditions can reduce agricultural output and household income, thereby weakening borrowers' repayment capacity and increasing credit risk for banks. By integrating drought intensity with the spatial distribution of collateral, the analysis identifies areas where potential losses are likely to be higher in the event of borrower default.

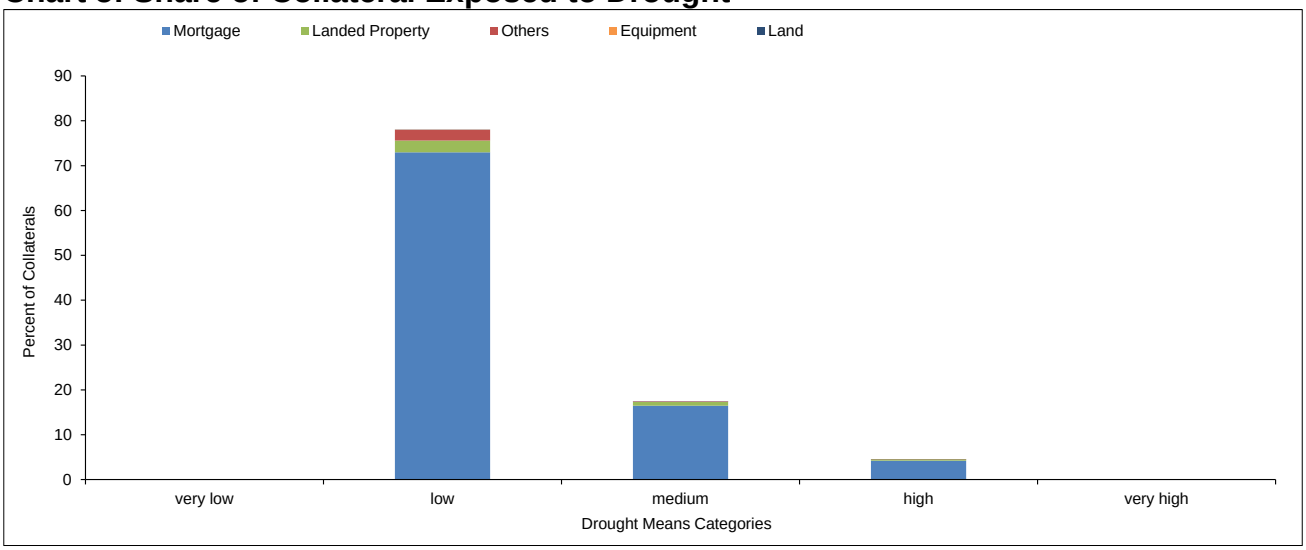
Figure 10: Drought Hazard and Collateral Exposure



***Source**: Bank of Tanzania Computations.*

Figure 10 illustrates the spatial distribution of drought hazard overlaid alongside the geographic locations of collateral exposures. Drought intensity is represented through a color gradient, with darker shades indicating higher levels of drought severity risk. Collateral locations are overlaid for visual assessment of the exposure of the banking sector's collaterals to drought risks. The figure indicates that most collaterals are located in areas with relatively low drought intensity, thus the banking sector has insignificant exposure to drought hazard. This suggests that the banking sector's exposure to drought hazard is limited and likely not a significant source of risk.

Chart 5: Share of Collateral Exposed to Drought



***Note**: Drought mean categories are equal bands in the range of 1 -9*
***Source**: Bank of Tanzania Computations*

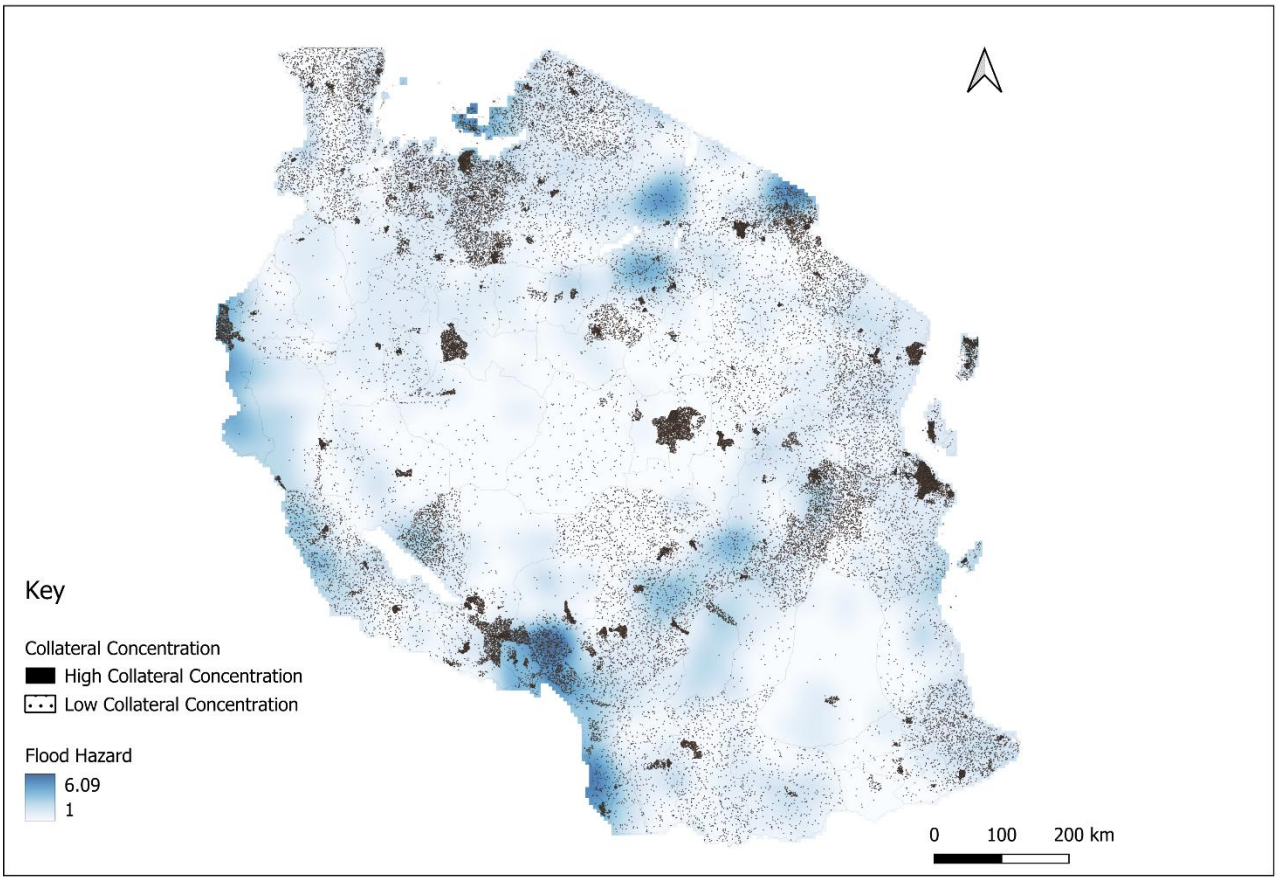
The analysis of collateral exposure to drought indicates that 78.9 percent of collateral falls in areas with low mean drought levels, 16.2 percent in areas with medium drought levels, and 4.9 percent in areas with high drought levels. Within the high drought category, the composition of exposed collaterals is relatively small and diversified: mortgages account for 3.7 percent, financial assets 0.8 percent, and landed properties 0.3 percent, with the remainder comprising cash, equipment, and other asset types. Overall, the types of collateral located in high-drought areas are generally less sensitive to drought, suggesting that the potential impact of drought on collateral values and, by extension, on the banking sector is limited.

5.2 Flood Hazard

The analysis assesses the exposure of bank collateral to flood hazards by integrating location-specific mean flood levels with the value of assets pledged as collateral. It examines how varying degrees of flood risk across different areas may affect the value and reliability of these assets. Flood events can damage crops, businesses, and residential properties, potentially reduce borrowers' repayment capacity, and increase credit risk for banks. By combining flood hazard data with the spatial distribution and value of collateral, the analysis identifies areas where potential losses to the banking sector may be more significant.

The analysis assesses the exposure of bank collateral to flood hazards by integrating location-specific mean flood levels with the value of assets pledged as collateral.

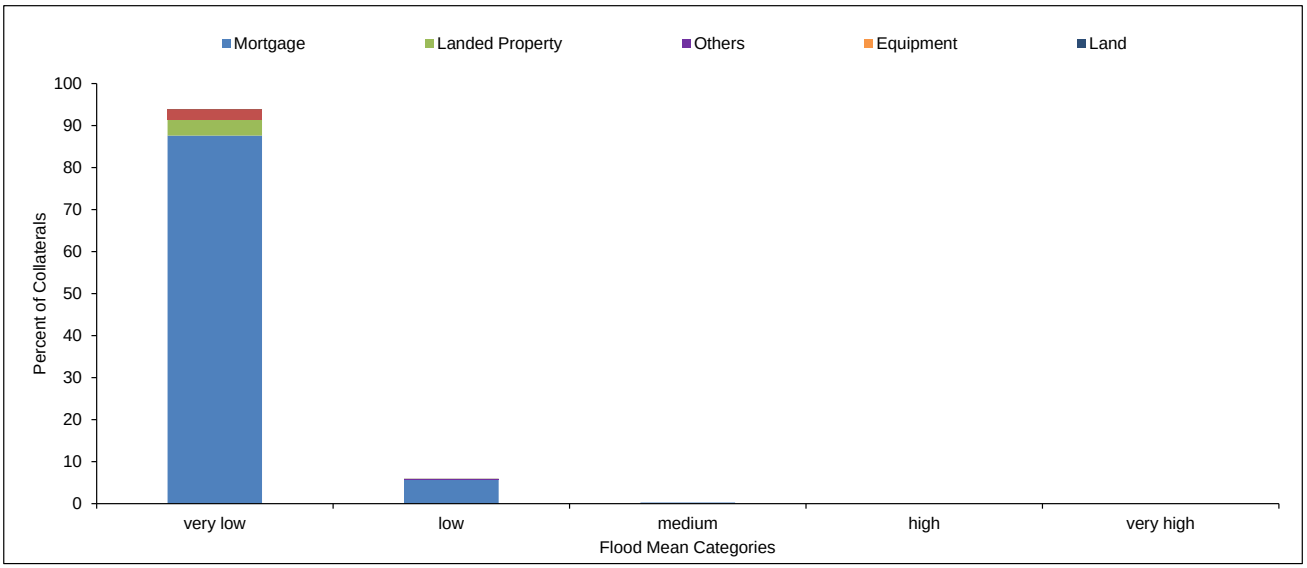
Figure 11: Flood Hazard and Collateral Exposure



Source: *Bank of Tanzania Computations*

Figure 11 illustrates the spatial distribution of flood hazard overlaid with the geographic locations of collateral exposures. The intensity of the color indicates flood depth; darker shades depict higher flood levels. Collateral locations are overlaid for visual assessment of the exposure of the banking sector's collateral to flood hazard. The distribution shows that collaterals are not concentrated in areas with higher flood depths, thus the banking sector is less exposed to flood hazard.

Chart 6: Share of Collateral Exposed to Flood

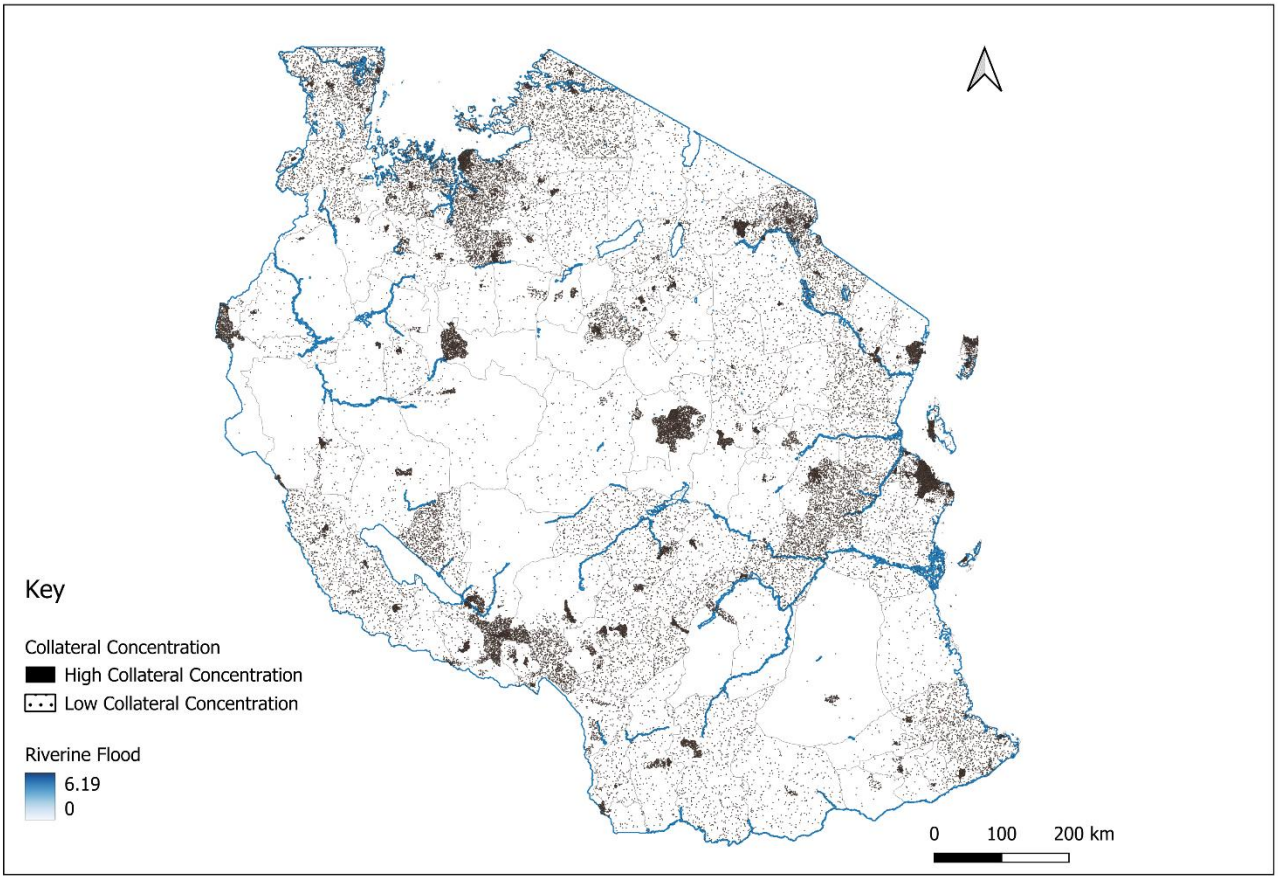


***Note**: Flood mean categories are equal bands in the range of 1 –9*
***Source**: Bank of Tanzania Computations*

The analysis of the share of collateral exposed to flood shows that 94.2 percent of collateral is exposed to very low flood mean levels, 5.5 percent low, and 0.3 percent medium flood mean levels, mostly being mortgages. This indicates that the vast majority of collateral, primarily mortgages, is exposed to minimal flood risk.

5.2.1. Riverine Flood Hazard

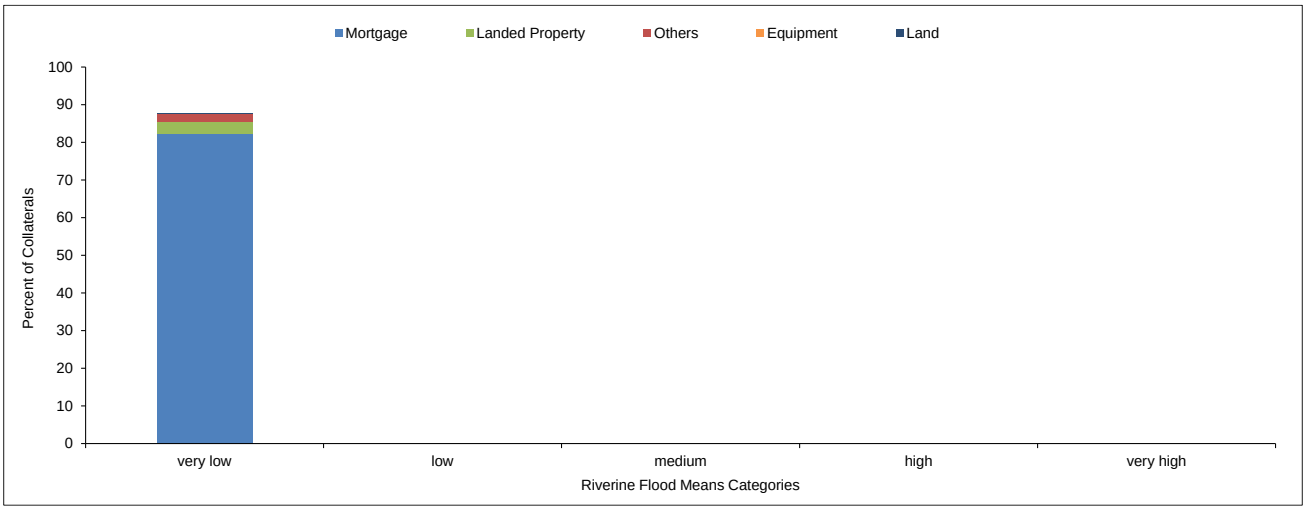
Figure 12: Riverine Flood Hazard and Collateral Exposure



***Source**: Bank of Tanzania Computations*

Figure 12 illustrates the spatial distribution of riverine flood hazard overlaid with the geographic locations of collateral exposures. The river flow channels indicate paths of the water bodies. Collateral locations are overlaid to depict a visual evaluation of the exposure of the collaterals to riverine flood hazard. The distribution shows less concentration of collateral along the river paths, indicating that the banking sector has insignificant exposure to riverine flood hazard.

Chart 7: Share of Collateral Exposed to Riverine Flood

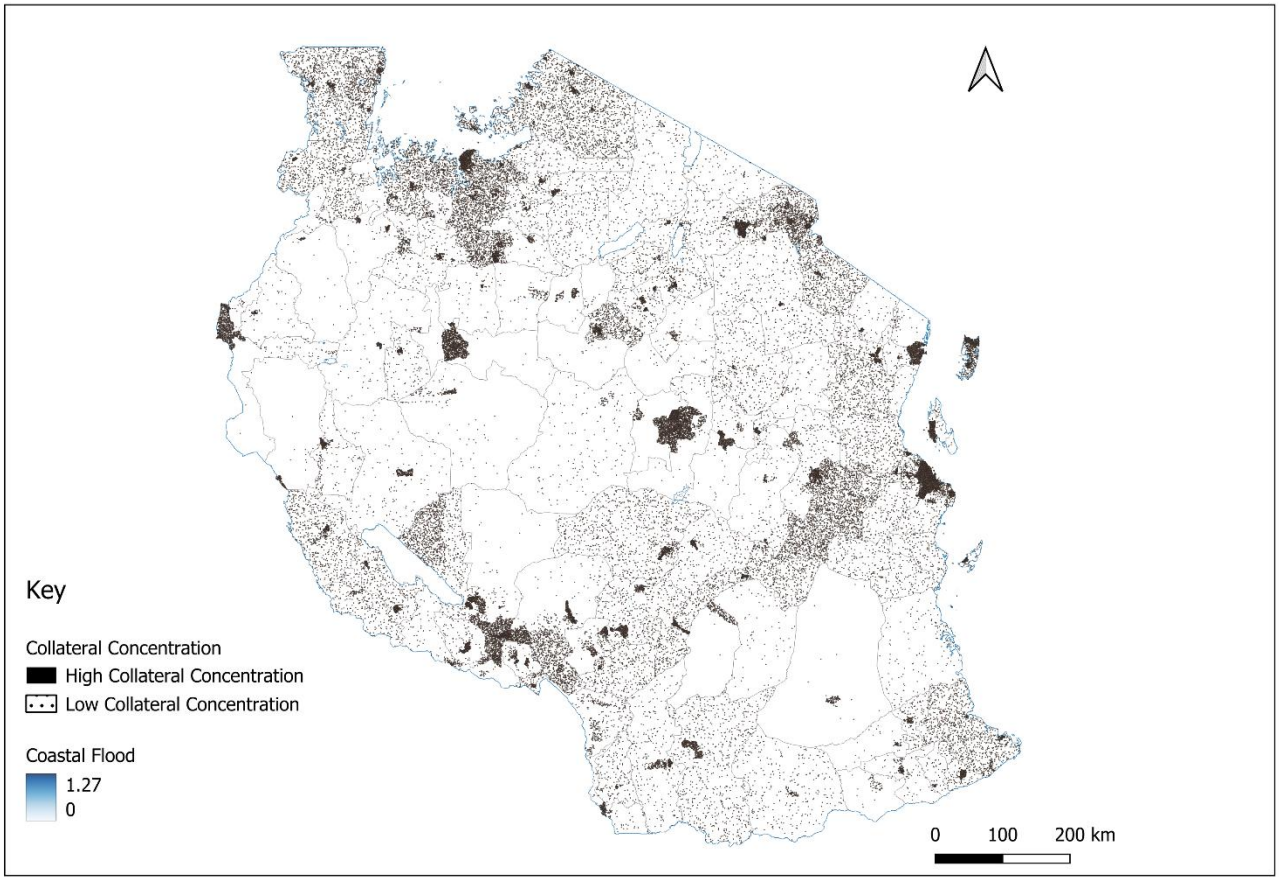


***Source**: Bank of Tanzania Computations.*

The figure indicates that mortgages constitute a significant proportion of the banking sector's collateral, followed by financial assets. However, the analysis shows that a large percentage of collaterals across various economic activities is exposed to very low riverine flood mean levels, implying that the banking sector's exposure to riverine flood hazard is insignificant.

5.2.2. Coastal Flood Hazard

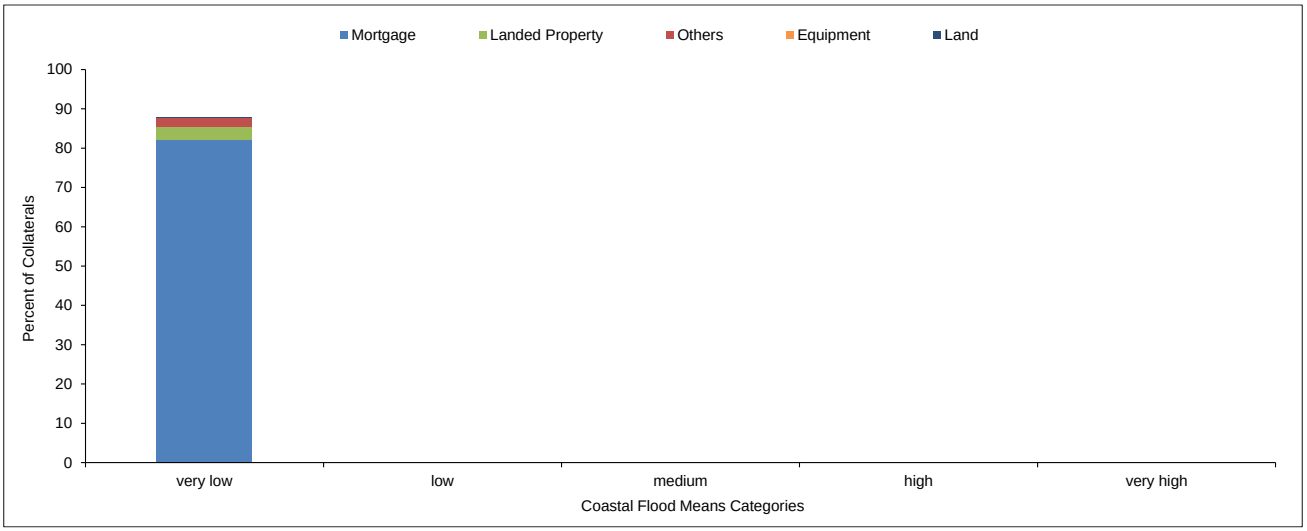
Figure 13: Coastal Flood Hazard and Collateral Exposure



***Source**: Bank of Tanzania Computations*

Figure 13 illustrates the spatial distribution of coastal flood hazard overlaid with the geographic locations of collateral exposures. Collateral locations are overlaid to depict a visual evaluation of the exposure of the banking sector's collateral portfolio to riverine flood hazard. Despite the concentration of collaterals in the coastal zone, the associated coastal flood hazard is low.

Chart 8: Share of Collateral Exposed to Coastal Flood

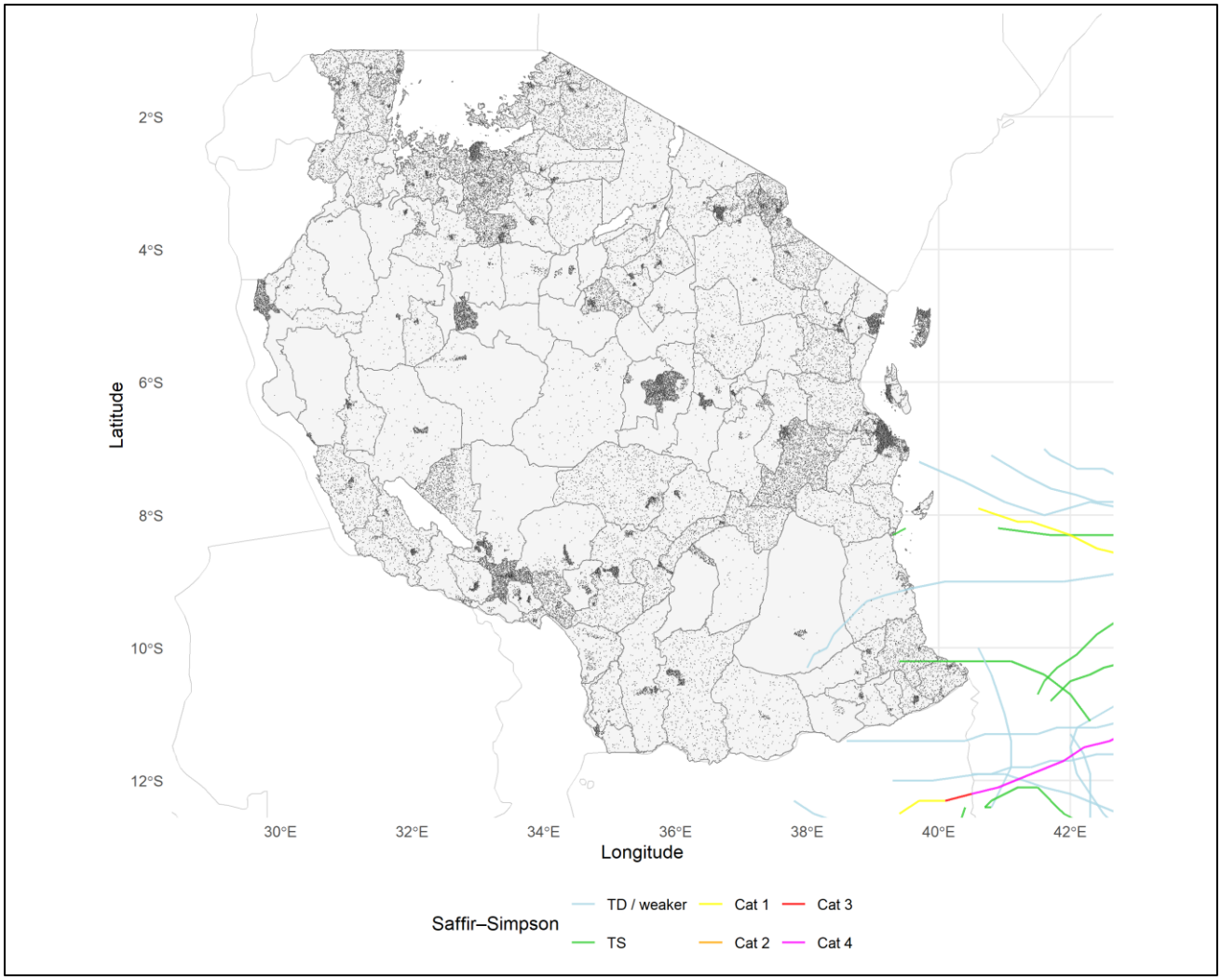


Source: *Bank of Tanzania Computations*

The figure indicates that mortgages compose the largest proportion of the banking sector's collateral, followed by financial assets. However, the analysis depicts that a large percentage of collaterals across various economic activities is exposed to very low coastal flood mean levels, implying that the banking sector's exposure to coastal flood hazards is insignificant.

5.3 Tropical Cyclone Hazard

Figure 14: Tropical Cyclone Hazard and Collateral Exposure



Source: *Bank of Tanzania Computations*

Figure 14 illustrates the tropical cyclone overlaid with collateral exposure, cyclones evident in the eastern coastline. The figure depicts that the weak categories of tropical cyclones impact the eastern coastline, thus having minimal impact on the banking sector.

IMPLICATIONS TO BANKING SECTOR STABILITY AND RECOMMENDATIONS

6.1 Implications for Banking Sector Stability

In general, the analysis of the banking sector's exposures to physical climate hazards, measured by loans and collateral, indicates that the sector has relatively limited exposure to drought and flood risks under the SSP2-4.5 climate scenario with the time horizon 2020-2039. Further, certain geographic areas and economic sectors remain more vulnerable to specific hazards, including a considerable portion of loans exposed to mild drought conditions. Most of these loans are concentrated in sectors that are less sensitive to drought risk, such as personal lending. Nevertheless, agricultural loans accounting for 3.6 percent of total loans are exposed to high drought mean which calls for continuous monitoring and risk management.

Furthermore, the analysis indicates that the banking sector's climate-related financial risk is largely influenced by the geographic distribution of loans across urban, coastal, and economically active areas, which hold substantial loan portfolios and collateral. In highly exposed areas, collateral concentration amplifies financial risk, as losses affecting multiple borrowers simultaneously can create significant vulnerabilities. Even when hazard intensity is moderate, the overlap of high-value collateral with climate-prone areas increases the likelihood of defaults and potential liquidity pressures.

6.2 Way Forward

Following the analysis of the banking sector exposure to climate hazards, the way forward for the Bank is to:

i) Continue monitoring and strengthening supervision of banks and financial institutions with the high concentration of loans and collateral in areas vulnerable to climate hazards;

ii) Conduct regular climate-related risk assessments to estimate potential credit and collateral losses from floods, droughts, and coastal inundation;

iii) Ensure banks and financial institutions continue improving the data quality by collecting geographical coordinates for collateral and loan locations, to enable more effective quantification of climate risks;

iv) Maintain ongoing capacity-building initiatives in collaboration with banks and financial institutions to better understand and assess climate-related financial risks;

v) Strengthen ongoing oversight of adherence of the banks and financial institutions' guidelines on climate-related financial risks and disclosures;

vi) Maintain collaboration with other stakeholders, the Bank should work toward preparing a Green Taxonomy Framework to standardize green financing efforts aimed at mitigating climate risks; and

vii) Continue collaborating with government ministries, departments, and agencies, as well as private sector players, to strengthen national climate resilience and align with emerging international regulatory standards.

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