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ESCAP
Economic and Social Commission for Asia and the Pacific

# Climate Change Risks and Impact on Mongolia's Financial Sector

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Cover design: Daniel Feary

This publication should be cited as: Bank of Mongolia, United Nations, Economic and Social Commission for Asia and the Pacific (2025). Climate Change Risks and Impact on Mongolia's Financial Sector.

# About this report

This report was developed as a knowledge product under the projected "Readiness Support to Greening the Bank of Mongolia" of the Partnership Action fund of the NDC Partnership. The report is the result of a collaboration between ESCAP and the Bank of Mongolia.

The report draws on nationwide surveys and key informant interviews with Mongolian banks, insurance companies, and financial and non-financial sector regulators, as well as information from specialized agencies in Mongolia. It also draws on information from development partners, the Mongolian Sustainable Finance Association and other actors involved in the climate finance ecosystem of Mongolia.

Preliminary findings were presented and validated at a series of high-level stakeholder workshops and public events held in Ulaanbaatar and online between Feb 2024 and May 2025.

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# Explanatory notes

Groupings of countries and territories/areas referred to are listed alphabetically as follows:

**ESCAP region:** Afghanistan; American Samoa; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; Cook Islands; Democratic People's Republic of Korea; Fiji; French Polynesia; Georgia; Guam; Hong Kong, China; India; Indonesia; Iran (Islamic Republic of); Japan; Kazakhstan; Kiribati; Kyrgyzstan; Lao People's Democratic Republic; Macao, China; Malaysia; Maldives; Marshall Islands; Micronesia (Federated States of); Mongolia; Myanmar; Nauru; Nepal; New Caledonia; New Zealand; Niue; Northern Mariana Islands; Pakistan; Palau; Papua New Guinea; Philippines; Republic of Korea; Russian Federation; Samoa; Singapore; Solomon Islands; Sri Lanka; Tajikistan; Thailand; Timor-Leste; Tonga; Türkiye; Turkmenistan; Tuvalu; Uzbekistan; Vanuatu; and Viet Nam.

**Least developed countries:** Afghanistan, Bangladesh, Cambodia, Kiribati, Lao People's Democratic Republic, Myanmar, Nepal, Solomon Islands, Timor-Leste, Tuvalu. Note: Bhutan, Maldives, Samoa and Vanuatu were part of the least developed countries prior to their graduation in 2023, 2011, 2014 and 2020, respectively.

**Landlocked developing countries:** Afghanistan; Armenia; Azerbaijan; Bhutan; Kazakhstan; Kyrgyzstan; Lao People's Democratic Republic; Mongolia; Nepal; Tajikistan; Turkmenistan; and Uzbekistan.

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**East and North-East Asia:** China; Democratic People's Republic of Korea; Hong Kong, China; Japan; Macao, China; Mongolia; and the Republic of Korea.

**North and Central Asia:** Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan, and Uzbekistan.

**Pacific:** American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

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**South-East Asia:** Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste and Viet Nam.

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References to dollars ($) are to United States dollars, unless otherwise stated. The term "billion" signifies a thousand million. The term " trillion" signifies a million million.

In the tables, two dots (..) indicate that data are not available or are not separately reported; a dash (–) indicates that the amount is nil or negligible; and a blank indicates that the item is not applicable.

In dates, an en dash (–) is used to signify the full period involved, including the beginning and end years, and a stroke (/) indicates a crop year, fiscal year or plan year.

# Acknowledgments

This publication was prepared under the overall direction of Hamza Ali Malik, Director of the Macroeconomic Policy and Financing for Development Division, and Suba Sivakumaran, Chief, Financing for Development Section, of the Macroeconomic Policy and Financing for Development Division, ESCAP. The publication was coordinated by Deanna Morris, Economic Affairs Officer, Financing for Development Section, of the Macroeconomic Policy and Financing for Development Division, ESCAP, Bayardavaa Bayarsaikhan, Director General, Monetary Policy Department and Urgamalsuvd Nanjid, Head of Monetary Policy Division of Bank of Mongolia.

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The work on NGFS scenario data was carried out under the guidance of Dr. Oliver Ritchers from the Potsdam Institute for Climate Impact Research.

Substantive contributions on data and case studies were provided by Javkhlan Ivanov and Haiwen Lei. The GIS map visualizations were supported by Haiwen Lei and Rahul Kumar Suman from ESCAP. Precious Akampumuza and Aneta Nikolova provided support on emissions research. Valuable research assistance was provided by Patchara Arunsuwannakorn and Jimin Oh.

The authors would like to express their gratitude to Altanzul Davaa-Orchir and Anudari Sharavdorj from the Mongolian Sustainable Finance Association for their strong partnership and collaboration throughout the development of this report.

The report also benefited from valuable information and guidance from Gomboluudev Purevjav from National Agency for Meteorology and Environmental Monitoring, Baasasuren Orchir from National Emergency Management Agency, Solongo Enkhtuvshin from Mongolian Mortgage Corporation, Tamir Enkh-Amgalan from Ministry of Environment and Climate Change.

Evshinkhorloo Lkhagva, Borkhuu Gotovsuren, Anujin M, and Munkhbayar Baatarkhuu, Bank of Mongolia, provided valuable comments to the report.

The manuscript was edited by Jonathan Bennett.

Graphic design and typesetting services were provided by Daniel Feary.

# Acronyms

| | |
|---|---|
| Average Annual Losses | AAL |
| Autorité de Contrôle Prudentiel et de Résolution | ACPR |
| Asian Development Bank | ADB |
| Asian Super Grid | ASG |
| Business-as-usual | BAU |
| Bank of Japan | BoJ |
| Bank of Mongolia | BoM |
| Climate Change Knowledge Portal | CCKP |
| Carbon Dioxide Removal | CDR |
| Coalition for Disaster Resilient Infrastructure | CDRI |
| Committee on the Elimination of Discrimination against Women | CEDAW |
| Climate Impact Explorer | CIE |
| Climate Risk Index | CRI |
| European Central Bank | ECB |
| Economic and Social Commission for Asia and the Pacific | ESCAP |
| Economic, Social and Governance | ESG |
| Environmental and Social Risk Management System | ESRMS |
| Financial Regulatory Commission | FRC |
| Foreign Exchange | FX |
| Gross Domestic Product | GDP |
| Greenhouse Gases | GHG |
| Gesellschaft fuer Internationale Zusammenarbeit | GIZ |
| Global Warming Potential | GWP |
| Gesellschaft für wirtschaftliche Strukturforschung | GWS |
| International Capital Market Association | ICMA |
| International Financial Reporting Standards | IFRS |
| International Panel on Climate Change | IPCC |
| Industrial Processes and Product Use | IPPU |
| The International Renewable Energy Agency | IRENA |
| International Sustainability Standards Board | ISSB |
| Key Performance Indicator | KPI |
| Loss Given Default | LGD |
| Loan-to-Value | LTV |
| Monetary Authority of Singapore | MAS |
| Multilateral Development Bank | MDB |

| | |
|---|---|
| Ministry of Environment and Tourism | MET |
| Mongolian Mortgage Corporation | MIK |
| Mongolian Tugruk | MNT |
| Ministry of Agriculture | MOFALI |
| Measurement, reporting, and verification | MRV |
| Mongolian Sustainable Finance Association | MSFA |
| Micro, Small and Medium Enterprises | MSMEs |
| National Agency Meteorology and Environmental Monitoring | NAMEM |
| National Action Program on Climate Change | NAPCC |
| Nature-based Solutions | NBS |
| Nationally Determined Contribution | NDC |
| National Emergency Management Agency | NEMA |
| Network for Greening the Financial System | NGFS |
| Non-performing Loan | NPL |
| National Statistics Office of Mongolia | NSO |
| Net Zero Banking Alliance | NZBA |
| Partnership for Carbon Accounting Financials | PCAF |
| Probability of Default | PD |
| Palmer Drought Index | PDI |
| Representative Concentration Pathways | RCP |
| Risk Exposure Amount | REA |
| Risk Management Association | RMA |
| Sustainable Banking and Finance Network | SBFN |
| Sustainable Development Goal | SDG |
| Task Force on Climate-related Financial Disclosure | TCFD |
| Trade and Development Bank of Mongolia | TDBM |
| Taskforce on Nature-related Financial Disclosures | TNFD |
| UN Convention to Combat Desertification | UNCCD |
| United Nations Economic Commission for Europe | UNECE |
| United Nations Environment Programme | UNEP |
| United Nations Framework Convention on Climate Change | UNFCCC |
| United States Dollar | USD |

# Executive summary

Climate change poses multifaceted risks to Mongolia's financial sector. Mongolia's exposure to acute and chronic climate risks and its reliance on the agriculture, mining and energy sectors make the country highly vulnerable to climate-induced disruptions. Ranked 19th out of 171 countries in the Global Climate Risk Index, Mongolia faces both physical and transition risks from climate change. A comprehensive analysis of these risks forms the basis for the recommendations in this report to the Bank of Mongolia (BoM), to assist in better preparing the financial sector.

Physical risks in Mongolia include acute events such as floods, droughts and *dzuds*, and chronic impacts such as shifting precipitation patterns and temperature fluctuations. Increased precipitation and snowmelt are leading to more frequent and intense floods, causing significant damage to infrastructure and livelihoods; droughts threaten pasture productivity and water availability; and *dzuds* – a combination of extremely low temperatures, heavy snow and land-surface ice cover – result in massive livestock losses.

Transition risks stem from efforts to move to a lower-carbon economy. They include policy and regulatory changes, technological advancements and shifts in market dynamics. The agriculture sector, which is dominated by livestock herding, is particularly vulnerable, as policies aimed at reducing emissions may reduce the income of herders if they are not carefully balanced. The mining sector, which is essential for Mongolia's exports and GDP, faces declining demand as global economies transition to low-carbon models, while Mongolia's energy sector, which is heavily reliant on coal, faces significant transformation challenges as it works to reduce emissions and to diversify the economy.

These climate risks translate into various financial risks, including increased default rates, market volatility, strained liquidity, operational disruptions and potential legal and reputational issues for financial institutions. The Mongolian financial sector must enhance its climate risk assessment and stress-testing frameworks, promote green financial products and strengthen international collaboration for capacity-building, while also promoting domestic peer-to-peer learning. Proactive management of these risks is essential for maintaining financial stability and promoting sustainable economic growth. These priorities are underscored by Mongolia's relatively low financial development index compared to the Asia-Pacific average, which indicates that broader improvements in financial depth, efficiency and access are also needed to enhance resilience.

This report emphasizes the importance of a comprehensive approach, balancing immediate adaptation needs with long-term mitigation strategies. By integrating climate risk management into their strategies and taking the specific local context into consideration, the Bank of Mongolia and other financial institutions can navigate the complexities of climate change and build a resilient financial system. This proactive approach will not only enhance the resilience of Mongolia's financial institutions and economy but also contribute to pursuing sustainable development ambitions.

# Introduction

Mongolia is significantly vulnerable to climate change and very susceptible to specific acute and chronic climate-related risks due to its geographical position, landscape and strongly continental climate. According to the Global Climate Risk Index (CRI) 2025, which analyses how badly countries have been affected by weather-related loss events, for the period 1993 to 2022 Mongolia was ranked the 19th worst affected country in the world.[1, 2]

Climate risk refers to the negative consequences of climate change, which is the result of increased levels of greenhouse gases (GHG) in the atmosphere due to human activity, particularly since the industrial revolution.[3] Climate risks can be classified into physical risks and transition risks.

Physical risks refer to the physical impacts of climate change. Acute physical risks are event-driven, and include cyclones, hurricanes, floods, heat or cold waves and other extreme weather events. Chronic physical risks result from long-term shifts in climate patterns, including sea level rise, changes in precipitation frequencies and patterns, temperature effects, changes to migration patterns, etc.

Transition risks arise from human efforts to address environmental and climate challenges by transitioning to a lower-carbon economy. They include changes in public policies and regulations, technology breakthroughs, shifts in investor or public sentiment, and disruptive business model innovations.

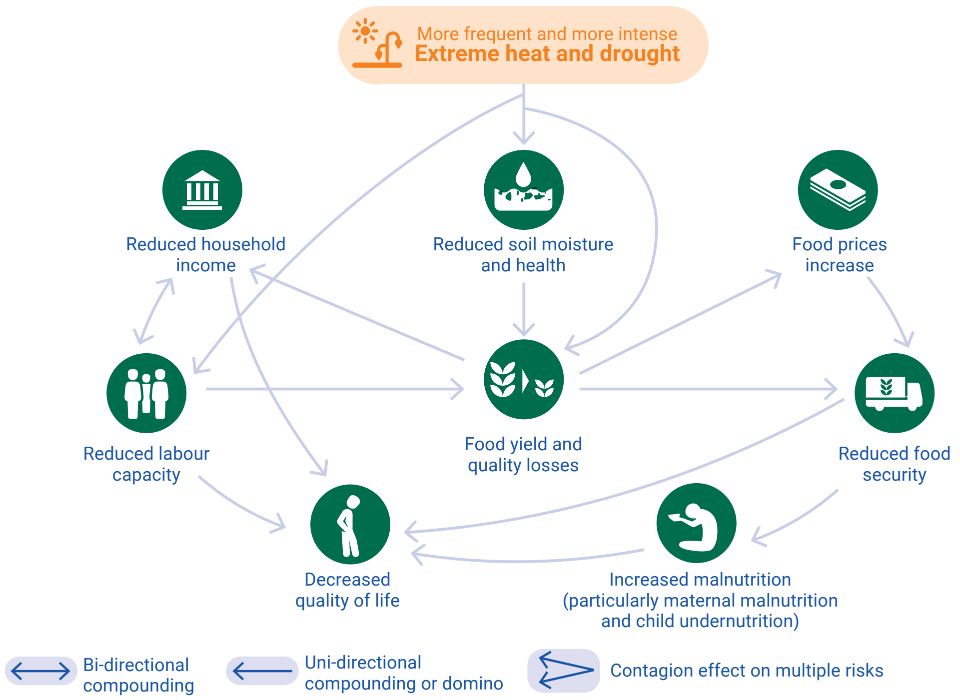
Despite the classification of climate risks into various risk categories and individual risks, climate risks should not be viewed in isolation, as their causes and effects are complex and correlated. For example, a combination of heat waves and drought can initiate a cascade of negative effects for multiple interrelated sectors across different regions[4] (Figure 1). Many climate risks and impacts cannot be quantified, creating significant uncertainty in analysing socioeconomic manifestations of climate change and related policies. Although uncertain, under-researched and unknown, these risks influence economic activity.[5]

Mongolia faces both physical and transition risks due to climate change. The primary physical risks include increased precipitation and flooding, rising temperatures, increased frequency and severity of droughts, and the possibility of worsening *dzuds*. *Dzuds* are a combination of extremely low temperatures, heavy snow and land-surface ice cover and a lack of pasture, leading to decreased availability of forage/pasture. *Dzuds* frequently occur in certain parts of Middle East Asia, in particular the republics of the former Soviet Union, Mongolia and northern parts of China. Given Mongolia's heavy dependence on agriculture and animal husbandry, these extreme weather events have a very significant impact on the population and the economy.[6]

Mongolia also faces persistent chronic effects of climate change, such as air pollution, the degradation of soil and pastureland and increasing desertification. There is therefore a strong need for Mongolia to move to a green, low-carbon economy. Its transformation to a greener economy is being supported by policy actions such as the introduction of a green and sustainable development goal (SDG) finance taxonomy and the implementation of the *Mongolia Sustainable Development Vision 2030* and *Vision 2050*, among other policies. However, policy action and technological and behavioural change associated with such a green transformation can itself lead to significant transition risks for the economy as well as for the financial sector.

1 Germanwatch, Climate Risk Index 2025: Who Suffers Most from Extreme Weather Events?. Available at https://www.germanwatch.org/en/node/93013
2 The CRI is a weighted average of ranking by number of deaths (weight 1/6), ranking by number of deaths per 100 000 inhabitants (weight 1/3), ranking by sum of losses in $ in purchasing power parity (PPP) (weight 1/6), and ranking by losses per unit of GDP (weight 1/3).
3 European Commission, "Causes of climate change". Available at https://climate.ec.europa.eu/climate-change/causes-climate-change_en
4 Intergovernmental Panel on Climate Change, Climate change 2023 : AR6 synthesis report : longer report. Available at https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf
5 UN ESCAP (2025) Economic and Social Survey of Asia and the Pacific 2025: Understanding the macroeconomic implications of climate change. Retrieved from: https://hdl.handle.net/20.500.12870/7956.
6 Lane, Clark & Peacock, Climate Change: A Primer for Pension Scheme Trustees. Available at https://www.lcp.com/media/1150177/climate-change-a-primer-for-pension-scheme-trustees.pdf

***Figure 1*** Example of complex risk, in which impacts from extreme climate events have cascading effects




*Source: Murat Türkeş, "The role of sustainability and sustainable development in climate change mitigation and adaptation", Sustainable Social Development, vol. 2 , No. 1, ID: 2407 (2024).*

Against this backdrop, it is essential to examine in greater detail how climate change risks materialize in the Mongolian context. A comprehensive assessment of both physical and transition risks provides the necessary analytical foundation to evaluate potential impacts on the economy and the financial sector, and to inform effective policy and regulatory responses.

This report is structured in three parts. Chapter 1 examines Mongolia's physical and transition risks, detailing three major climate hazards, their historical impacts, current exposures, and projected intensification. It also synthesizes national and partner studies, while outlining transition risks across key sectors, including the implications of carbon pricing under selected scenarios.

Chapter 2 examines climate-related risks in the Mongolian context and their potential impact on the Mongolian financial system over the next three decades. Building on the impact of climate change in Mongolia, macroeconomic and microeconomic transmission channels are discussed. How climate change-related risks could impact traditional risk categories such as credit, market, liquidity, operational and legal risks is analysed for the Mongolian context by drawing parallels from case studies and examples for other jurisdictions globally. The analysis is complemented by an assessment of the current state of readiness of the financial sector and a theoretical discussion on climate scenario analysis. Actionable recommendations for the Bank of Mongolia to better assess and manage these risks conclude part 2 of this report.

While climate change poses significant risks to the financial system, it also creates opportunities for Mongolia's banks to play a pivotal role in the transition to a low-carbon economy. Chapter 3 builds on the preceding risk-focused analysis to assess how Mongolia's banking sector can move from managing vulnerabilities to leveraging opportunities.

Finally, building on the analysis of climate risks, their transmission to the financial system, and the readiness of Mongolia's banking sector to respond, the report concludes with a set of targeted recommendations for the Bank of Mongolia. These are designed to strengthen resilience, guide supervisory practices and enable the financial sector to capture emerging climate finance opportunities.

*Chapter 1*

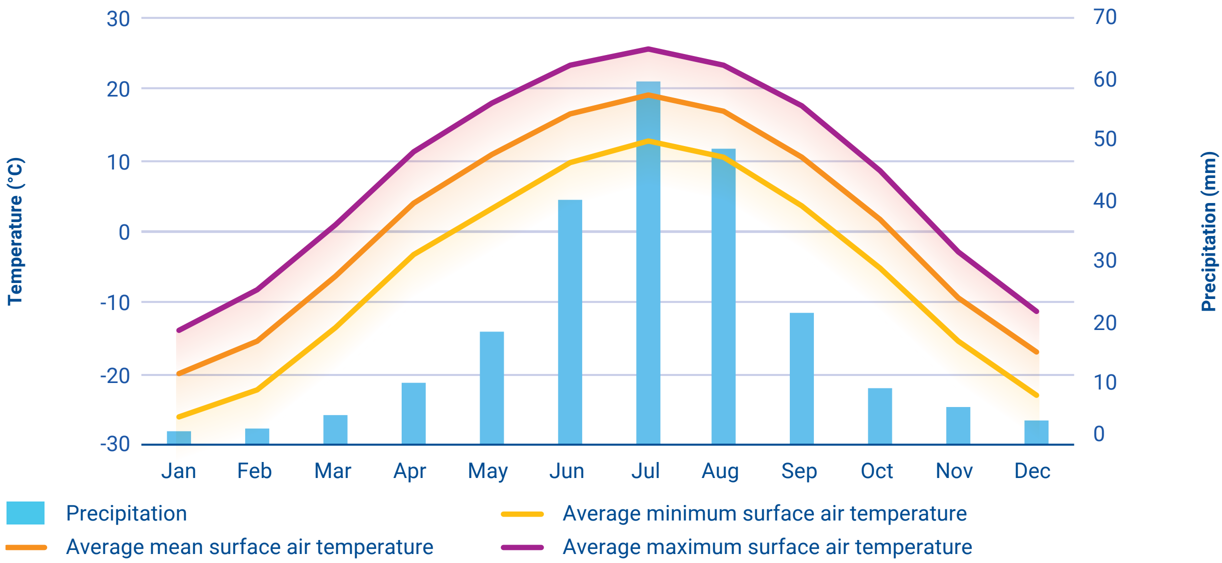
# Climate Change Impacts in Mongolia

# ▶Context

Mongolia's geographical and climatic characteristics make the country significantly susceptible to the physical impacts of climate change and the resulting physical and transition risks it brings. Extremes of temperature, high levels of rainfall and severe weather events are increasingly frequent, and together present a range of challenges.

Mongolia is landlocked and experiences extremes of weather, with cold winters and warm summers, and average mean surface air temperatures ranging from -20°C to +20°C (Figure 2).

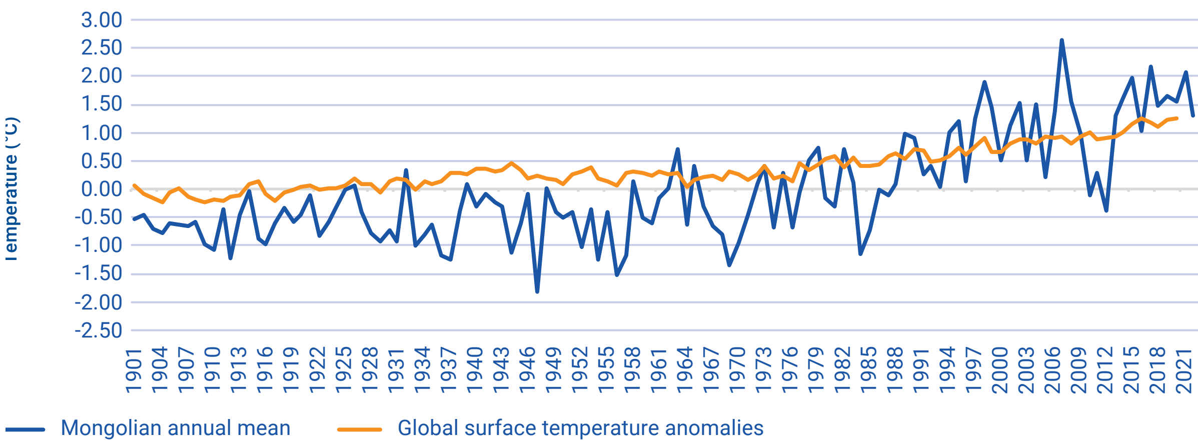
**Figure 2** Average monthly climatology for Mongolia, 1991-2003




*Source: Climate Change Knowledge Portal, World Bank, accessed July 2025.*

Between 1940 and 2015, the average temperature increased by 2.24°C,[7] higher than the global average (Figure 3). Particularly since 2015, the cyclical nature of the country's four distinct seasons has been significantly disrupted, leading to a rise in recurrent summer droughts and subsequent harsh winters.[8]

**Figure 3** Mongolia's observed annual average mean surface air temperature 1901-2022 and global surface temperature anomalies from observation, relative to 1850 to 1900




*Source: Climate Change Knowledge Portal, World Bank, accessed July 2025.*

7 World Bank, "Mongolia Climate Data Historical", Climate Change Knowledge Portal. Available at https://climateknowledgeportal.worldbank.org/country/mongolia/climate-data-historical (Accessed on 02 June 2024).

8 United Nations Office for the Coordination of Humanitarian Affairs, *Mongolia: Dzud Early Action and Response Plan (Dec 2023-May 2024)* (United Nations Publication, 2024).

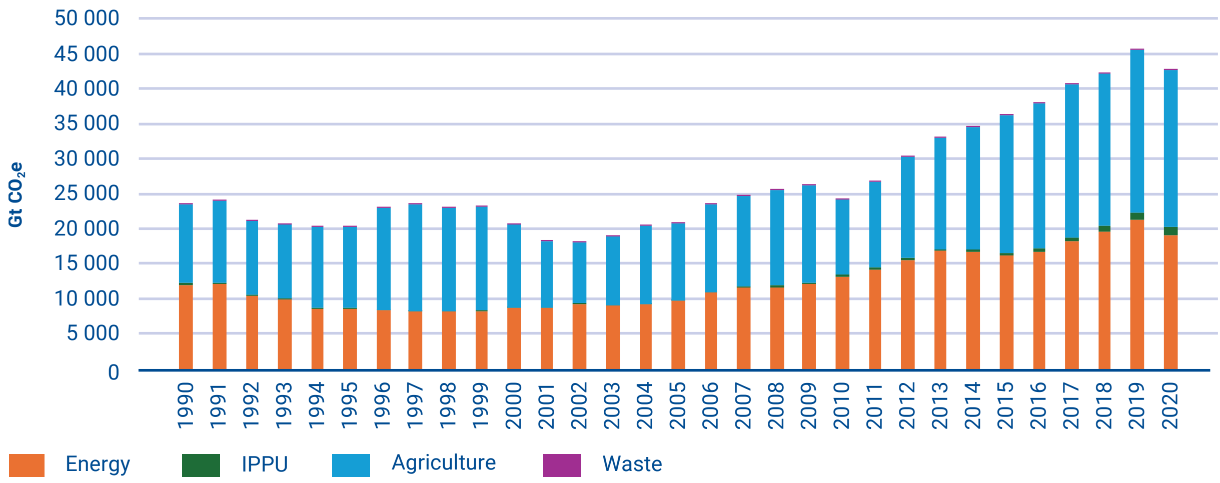
Rapid and unmanaged urbanization has also accelerated problems such as air pollution. In 2022, 70 per cent of the Mongolian population were living in urban areas, compared to 20 per cent in 1950 and the Asian average of 50 per cent in 2022.[9]

Mongolia contributes only 0.1 per cent to global emissions[10] but has very high per capita emissions, largely attributed to the agriculture and energy sectors. Between 1990 and 2020, Mongolia's population increased by 55.8 per cent, while total emissions increased by 82 per cent (from 23,648.78 Gg $CO_2$e to 43,081.62 Gg $CO_2$e). Per capita GHG emissions increased by 16 per cent, reaching 12.83 t$CO_2$e in 2020, higher than the average for developing countries and the world average.[11]

Mongolia's third nationally determined contribution (NDC), submitted to the United Nations Framework Convention on Climate Change (UNFCCC) under the Paris Agreement, sets a conditional emissions reduction target of 52.8 per cent and an unconditional emissions reduction target of 30.3 per cent by 2035 compared to business-as-usual (BAU), against a 2010 baseline.

However, the country is largely dependent on coal for energy production, and the livestock sector remains a key source of livelihood for a majority of the rural population. Together, these two sectors, energy and livestock, accounted for 96.75 per cent of total greenhouse gas emissions in the country in 2020[12] (Figure 4). These sectors are also key for the Mongolian economy, contributing significantly to GDP (agriculture and industry), exports (mining) and employment (agriculture). Transitioning to a low-carbon economy will require significant changes in these sectors, increasing the probability of transition risks.

**Figure 4** Historical emissions in Mongolia across all sectors



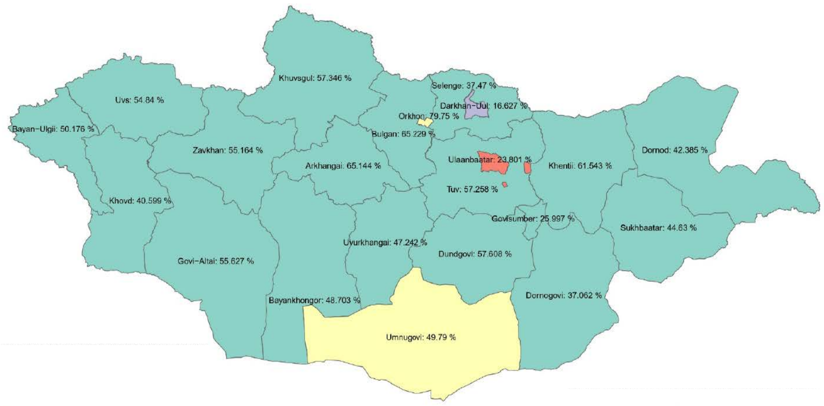

*Source: United Nations Framework Convention on Climate Change,* Mongolia. National Communication, NC 4. *(United Nations Publication, 2024).*
*Note: The emissions exclude land use, land use change and forestry (LULUCF) emissions.*

In the energy sector, which contributes 44.78 per cent to total emissions, coal remains the primary source of energy due to the country's high reserves, while renewables only have a 3.5 per cent share of power generation. The agriculture sector (dominated by livestock) is the cornerstone of rural Mongolian life and contributes ~52 per cent to total emissions (majority non-$CO_2$). On the other hand, the extraction and processing of fuel, primarily coal, which is critical for the Mongolian economy and Mongolian exports, contributes a small percentage to national emissions, due to accounting methodology.

9 Asian Development Bank, Mongolia: Urban Sector Fact Sheet. Available at https://www.adb.org/sites/default/files/publication/404296/mongolia-urban-sector-fact-sheet.pdf
10 International Energy Agency, "Mongolia". Available at https://www.iea.org/countries/mongolia/emissions
11 Mongolia, Ministry of Environment and Tourism, *Fourth National Communication of Mongolia* (Ulaanbaatar, 2024).
12 Mongolia, Ministry of Environment and Tourism, *Mongolia's National Inventory Report - 2023* (Ulaanbaatar, 2023).

The geographical distribution of key sectors also poses challenges. Economic activities other than agriculture and mining are concentrated around the capital, Ulaanbaatar, as are the population. In the rest of the country there is little economic diversification. The agriculture (livestock) sector is the major contributor to the GDP of most provinces, while other provinces are predominantly dependent on mining. Ulaanbaatar, where most of the commercial and service economy is based, depends significantly on service sectors such as trade, hotels and restaurants (Figure 5).

***Figure 5*** Sector contributing most to GDP across Mongolia's 21 provinces



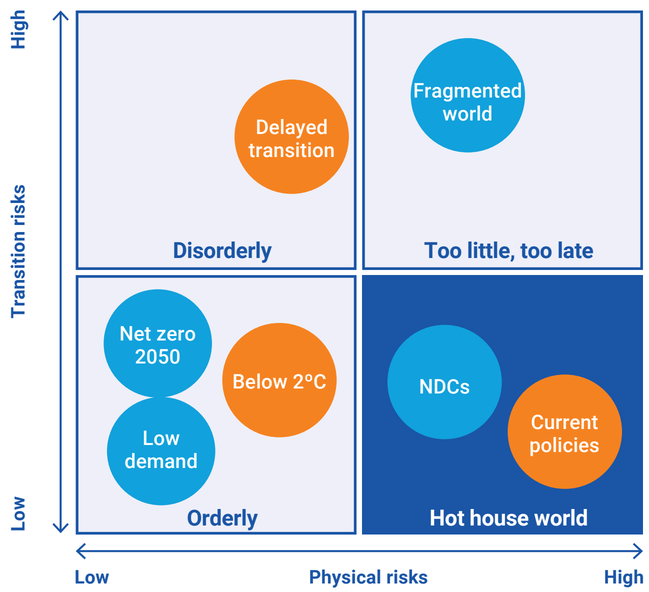

Agriculture Mining Other services Trade, hotels and restaurants

*Source: ESCAP based on data from NSO Mongolia.*

## ▶Scenarios, data and limitations

This report discusses physical and transition risks in Mongolia over a three-decade horizon using various climate scenarios. The Network for Greening the Financial System (NGFS) has made significant progress in developing several scenarios and associated data for policymakers. The seven NGFS long-term climate scenarios consider a global, harmonized set of transition pathways, physical climate change impacts and economic indicators. Each scenario represents different combinations of physical risks and transition risks that are contingent on the nature and timing of policy actions. They are grouped into four quadrants, based on the nature of the transition[13] (Figure 6).

***Figure 6*** NGFS Scenarios Framework




*Source: NGFS Scenarios Portal.*

13 Network for Greening the Financial System, NGFS Scenarios for central banks and supervisors. Available at https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-climate-scenarios-central-banks-and-supervisors

In consultation with the Bank of Mongolia and other stakeholders, three scenarios have been selected for this report, to examine the physical and transition risks they pose. The three scenarios are as follows, as defined by the NGFS:[14]

1. **Below 2°C:** This optimistic scenario gradually increases the stringency of climate policies, giving a 67 per cent chance of limiting global warming to below 2°C. Climate policies are introduced immediately and become gradually more stringent, though not as stringent as under *Net Zero 2050*. Deployment of carbon dioxide removal (CDR) is relatively low. Net zero $CO_2$ emissions are achieved after 2070. Physical and transition risks are both relatively low.
2. **Delayed Transition:** This is a disorderly transition scenario that assumes global annual emissions do not decrease until 2030. Strong policies are then needed to limit warming to below 2°C. Negative emissions are limited. This scenario assumes new climate policies are not introduced until 2030, and the level of action differs across countries and regions based on currently implemented policies, leading to a "fossil fuel recovery" out of the economic crisis caused by COVID-19. The availability of CDR technologies is assumed to be low, pushing carbon prices higher than under *Net Zero 2050*. As a result, emissions exceed the carbon budget temporarily and decline more rapidly after 2030 than under Below 2°C, to ensure a 67 per cent chance of limiting global warming to below 2°C. This leads to both higher transition and physical risks.
3. **Current Policies:** This scenario assumes that only currently implemented policies are preserved, leading to high physical risks. Emissions grow until 2080, leading to about 3°C of warming and severe physical risks. These include irreversible changes such as a higher rise in sea level. This scenario can help central banks and supervisors consider the long-term physical risks to the economy and financial system if we continue our current path to a "hothouse world".

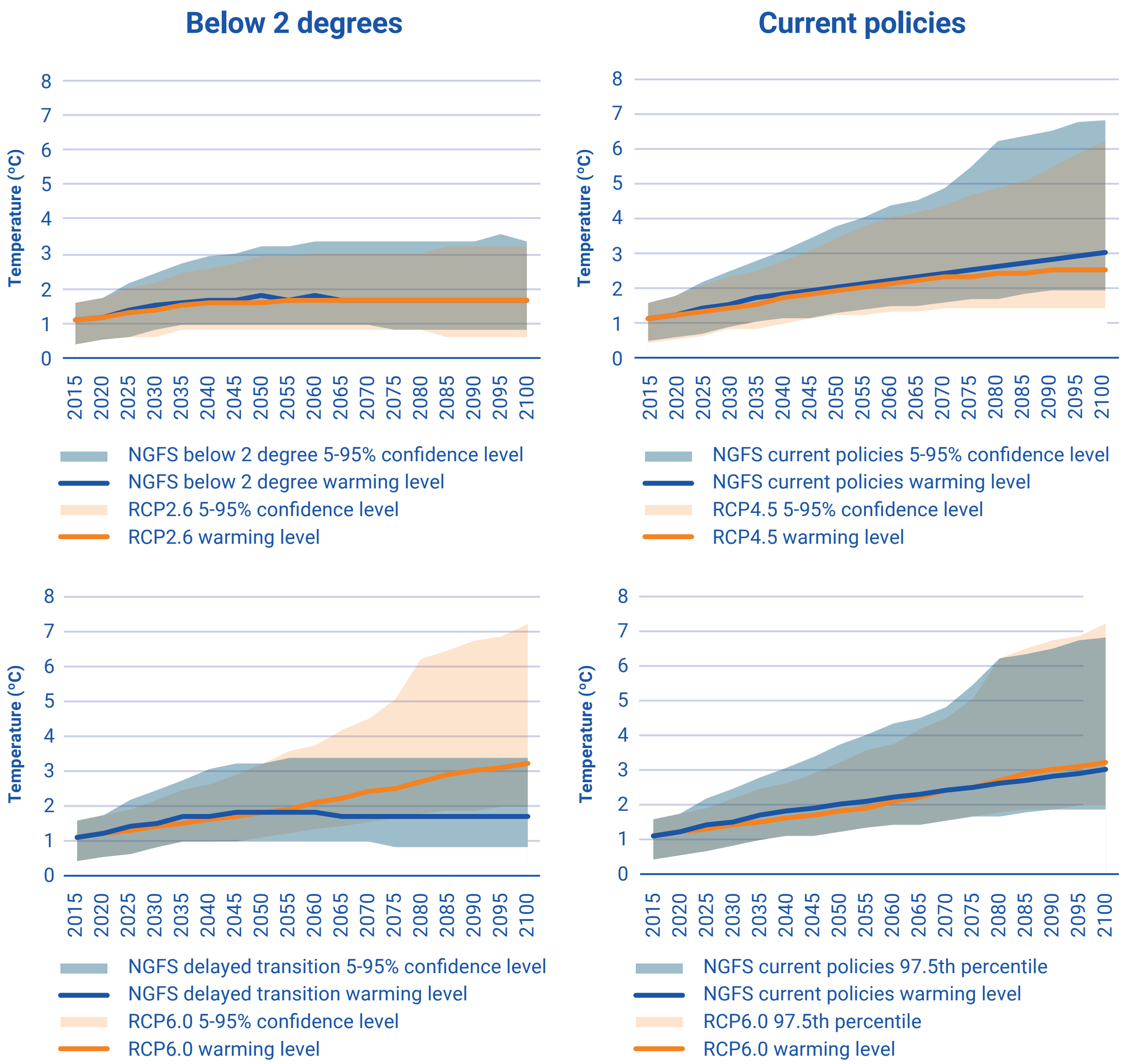
The NGFS scenarios portal provides a large array of macroeconomic variables for each scenario, incorporating impacts of physical and transition risks for countries and regions based on calculations from several different models that have been used for analysis in this study. However, it must be noted that the number of indicators and projections are dependent on the modelling methods used at the regional group level and the downscaling available for the country level. Data from the REMIND-MAgPIE downscaling model was used for this study. Current and historical economic data available from the National Statistics Office of Mongolia (NSO) and the Bank of Mongolia were also used.

To analyse the physical risks, data from the Climate Impact Explorer (CIE), which provides first-hand access to projections of physical climate risks at the continental, national and subnational levels, have been used.[15] Additional indicators have been taken from the World Bank Climate Change Knowledge Portal (CCKP). This report also draws on future projections of *dzuds*, droughts and floods in Mongolia estimated by the National Agency Meteorology and Environmental Monitoring (NAMEM), the National Emergency Management Agency (NEMA) and the Mongolian Mortgage Corporation (MIK). To understand the risk profiles and vulnerability to disaster of Mongolian provinces (*aimags*) and for historical occurrences and impacts, this report has also drawn on work by ADB, ICEM Asia, PwC India and Environ LLC. Economic and historical disaster data from the National Statistics Office (NSO) of Mongolia has also been used.

Since choice of scenario varies depending on the study, temperature pathways have been matched, so that the representative concentration pathway (RCP) scenarios issued by the Intergovernmental Panel on Climate Change (IPCC) can be analysed alongside NGFS scenarios (Figure 7).

14 NGFS, "Scenarios Portal". Available at https://www.ngfs.net/ngfs-scenarios-portal/
15 Climate Analytics, "Climate Impact Explorer". Available at https://climate-impact-explorer.climateanalytics.org/

***Figure 7*** Temperature pathways for the Mongolian context




*Source: NGFS Scenario Portal*

Projections of climate variables and their economic impact are subject to a high degree of uncertainty. The path of global temperatures over the next several decades will depend in large part on mitigation actions to help reduce emissions. For example, under pessimistic scenarios based on current mitigation policies, future anthropogenic greenhouse gas emissions are predicted to lead to warming of about 4.4°C by the end of the century.[16] Furthermore, climate risks involve complex dynamics that interact with each other through different aspects in the short, medium and long term. A forward-looking analysis of climate-related risks thus becomes a challenging task involving informed assumptions based on local contexts. Table 1 summarises the assumptions and limitations that have been identified with the data used in this study.

16 Intergovernmental Panel on Climate Change, *Global warming of 1.5°C* (Geneva, IPCC, 2018). Available at https://www.ipcc.ch/sr15/

***Table 1*** Limitations of climate risk analysis

| Limitation | Context |
|---|---|
| Macroeconomic data | • Disaggregation of macroeconomic data for GDP, employment, exports and imports is limited. GDP data by year with sectoral and sub-sectoral disaggregation is only available from 2015. Using current prices for observing GDP trends would introduce the price effect, which would be significant for a commodity-exporting economy like Mongolia. Hence 2015 constant price data have been used and, where possible, comparisons are analysed as percentage of GDP.<br>• To analyse the effect of climate change on microeconomic and macroeconomic transmission channels, the economic data must be examined geographically as well as temporally. The disaggregation of economic indicators at provincial, sectoral and commodity levels is not fully available.<br>• Sectoral disaggregation of emissions data from the EDGAR database (which provides data up to 2022) is not the same as the sectoral disaggregation used by the Ministry of Environment's national emissions inventory data, which is only available until 2020. However, for analysis, data from the National Inventory of the 4th National Communication to the UNFCCC has been used. |
| Financial sector data | • Loan data for banks is available at the economic sector level, and has been used to analyse the concentration of loans in key sectors. Classification of loans by current geographical classifications does not reflect the true risk concentration, as most businesses may be registered in Ulaanbaatar but with operations in other provinces. (This is particularly common in the mining and agricultural sectors).<br>• The granular data of loan portfolios of banks need to be analysed to understand financial sector risks and where they are concentrated. However, procuring data from individual banks at sectoral, geographical and counterparty levels encounters challenges of confidentiality, time and resources from the banks.<br>• Emissions data at the counterparty level is not available and is difficult to estimate. Some banks use PCAF methodology to estimate Scope 3 emissions, but the quality of data and the confidence level remain low. |
| Climate data | • Forward-looking climate data are available from CIE and CCKP. However, most of the indicators available for Mongolia-specific disasters are not the same as those that are publicly available, so this report uses certain proxy indicators to analyse forward-looking disaster risks.<br>• Socio-economic impacts of all disasters are not fully available in the national database. For example, the historical impacts and damage of *dzuds* are well reported, but the same depth of data are not available for droughts and floods. NEMA has also echoed the challenge in disaggregated quantification of damages for hazards. |
| Scenario data | • A country-level climate scenario model for Mongolia does not currently exist; instead it is grouped with other Asian or central Asian countries. The outputs are then downscaled at the country level, based on certain macroeconomic variables.<br>• Thus, the macroeconomic variables available for Mongolia at country level are not enough to fully quantify some financial risks.<br>• Forward-looking data at the sectoral level are not available. Additional modelling needs to be done for Mongolia to generate this data.<br>• Additional parameters such as inflation, interest rates, stock indices and commodity prices need to be modelled to develop a deeper understanding of climate-related risks. |

## ▶Climate risks in Mongolia

The frequency and severity of physical risk-driven events have increased over recent decades. Mongolia experiences higher temperatures in summer and lower temperatures in winter, combined with changing precipitation patterns that could result in increased floods, droughts and extreme winter events such as *dzuds* and heavy snowfalls. *Dzuds* alone have caused 45 million livestock deaths over the last 70 years.

At the same time, transition risks to Mongolia can arise from internal policy changes as the country moves towards its emission reduction targets and adopts new technology; or they may arise from external policy changes as countries across the globe transition towards a low emissions model. For example, as Mongolia's export partners transition to a low-carbon economy, this will lead to reduced demand for Mongolia's high-carbon commodity exports, which are major contributors to GDP.

Physical and transition risks are often negatively correlated. An increase in green policies and regulations is estimated to reduce physical risks but will increase transition risks. For example, the introduction of a carbon emissions trading system is expected to lead to decreased $CO_2$ emissions, but at the same time will increase the risk of stranded assets and credit risk.

The impact of climate change-related risks also translates to significant financial risks for the financial sector. This link between physical and transition climate risk drivers to financial risks is due to causal chains known as transmission channels. These can trigger financial implications in the form of financial risks such as compliance, conduct, credit, legal, liquidity, market, operational and reputational risks. More than 20 per cent of Mongolian bank loans are provided to mining, quarrying, manufacturing, construction and transport. These sectors are at high-risk of being left with stranded assets that will be written off, devalued or converted to liabilities.

The physical and transition risks specific to Mongolia are analysed in detail below.

## ▶Physical risks

Changes in precipitation and temperature due to climate change will lead to greater acute and chronic physical risks in Mongolia. Several scientific studies warn that the intensity and frequency of extreme events will increase as temperature increases. Predictions suggest that there is a high probability of this occurring in Mongolia, leading to higher acute physical risks.[17] Chronic physical risks will increase gradually in the long term, driven by longer-term shifts in climate patterns, including changing levels of precipitation and snowfall and increasing mean temperatures. Unlike acute risks, which are event-driven, chronic risks are best understood as processes rather than isolated events.

Historic observation of extreme climate-related events shows an increase in frequency,[18] with multiple climate change-related events occurring in recent decades (Figure 8). Mongolia is vulnerable to several different physical hazards due to its geographical heterogeneity. The large river basin network in the north of the country makes several regions highly vulnerable to floods caused by both heavy rainfall and rapid snowmelt in the spring and summer. For example, in July 2023 heavy rains and floods disrupted Ulaanbaatar City and the surrounding areas, directly affecting more than 100,000 people.[19]

The vast Gobi Desert in the south is highly vulnerable to dust and sandstorms. In March 2021, violent wind gusts and sandstorms swept across the country, leading to multiple fatalities and the loss of 1.6 million head of livestock. Sixty-nine buildings were severely damaged and 92 *gers* (Mongolian nomadic dwellings) were destroyed.[20]

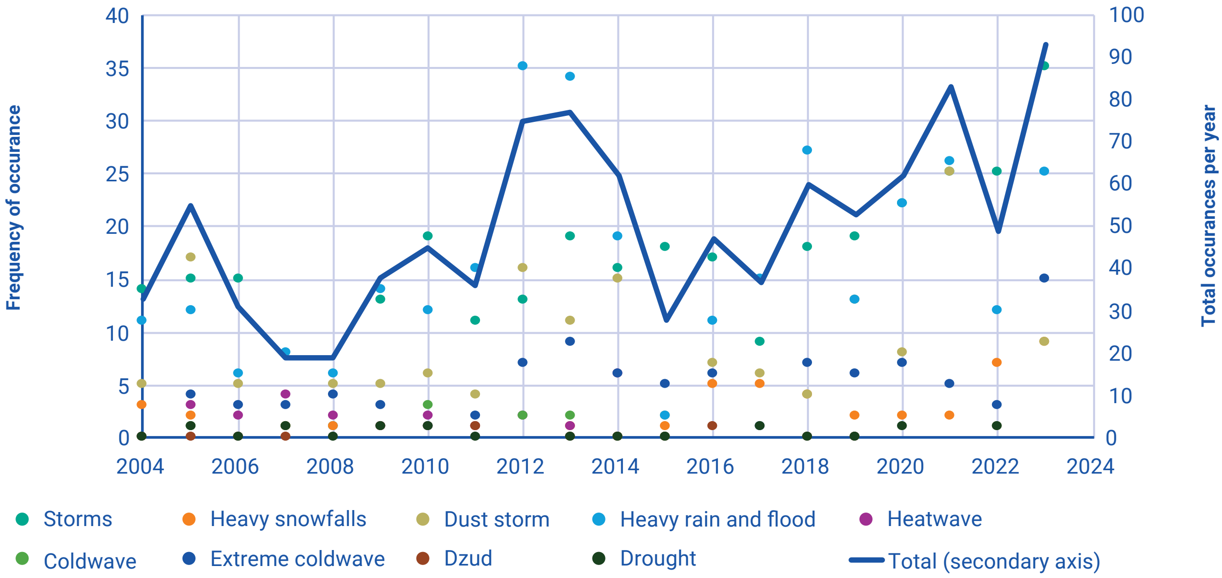
In addition to rapid onset hazards, Mongolia is also vulnerable to slow onset hazards such as droughts. For example, in 2020 drought conditions persisted for four months, from June to September, with varying degrees of severity across the country. A 10-day drought map in September 2020 showed bands of areas at risk of extreme drought in several central southern provinces.

Mongolia is also uniquely vulnerable to *dzuds*, a cold, seasonal disaster in which extremely low temperatures, heavy snow and land-surface ice cover combine with a lack of pasture, leading to decreased availability of forage/pasture and ultimately high livestock fatalities.[21] A combination of *dzuds* and droughts can have particularly severe socio-economic as well as environmental impacts in Mongolia.

Other acute physical risk hazards include heatwaves, cold waves, surface flooding, snowstorms and steppe wildfires, which have also caused significant socio-economic damage in the past.

17 Seth Westra and others, "Future changes to the intensity and frequency of short-duration extreme rainfall", *Reviews of Geophysics*, vol. 52, Issue 3 (July 2014). Available at https://doi.org/10.1002/2014RG000464
18 The World Bank Group and the Asian Development Bank, *Climate Risk Country Profile: Mongolia* (2021).
19 Reliefweb, "Mongolia: Floods - Jul 2023". Available at https://reliefweb.int/disaster/fl-2023-000111-mng
20 Asian Disaster Reduction Center, *Country Report: Mongolia* (2022). Available at https://www.adrc.asia/countryreport/MNG/2022/Mongolia_CR_FY2022.pdf
21 Asian Disaster Reduction Center, *Country Report: Mongolia* (2022). Available at https://www.adrc.asia/countryreport/MNG/2022/Mongolia_CR_FY2022.pdf

***Figure 8*** Frequency of key disasters in Mongolia by year

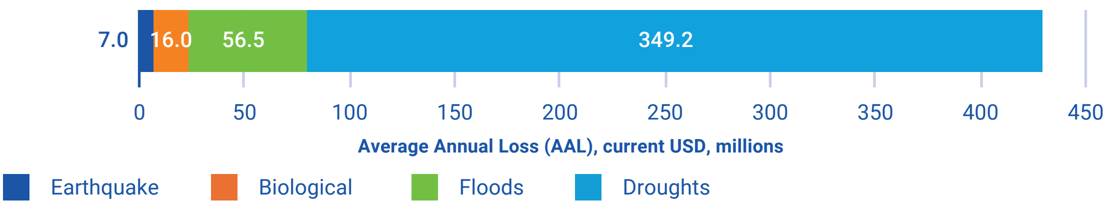



*Source: ESCAP based on data from NEMA.*

This increase in the severity and frequency of acute physical risk events will lead to significant losses. In Mongolia, the current annual average loss from all natural and biological hazards is an estimated $0.43 billion, which is roughly 3.3 per cent of the national GDP. Economic losses in Mongolia are highest from drought[22] (Figure 9).

In the long run, increased temperatures, more frequent droughts and reduced rainfall in several regions would lead to an increase in arid and hyper-arid land cover and would intensify desertification.[23] This would also impact the permafrost levels and could potentially lead to declines in biodiversity.[24] The socio-economic effects of these changes would have significant impacts on agriculture and herder populations and on productivity, and would consequently increase migration to urban centres. If not handled systematically, rapid urban migration would lead to greater risks of air pollution and increased health problems.

***Figure 9*** Average Annual Loses (AAL) by hazard type for Mongolia




*Source: ESCAP Risk and Resilience Portal*

The three key hazards of floods, *dzuds* and droughts are examined in detail below, with analysis of the effects of climate change and associated impacts on livelihoods, key sectors of the economy and various regions across the country over the next three decades. Chronic risks relevant to the Mongolian context are discussed in text boxes below. These include historical occurrence and impact, and a forward-looking analysis based on the three key NGFS scenarios described under *Methodology*, above.

22 United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), "Mongolia Country Profile", *Risk and Resilience Portal*. Available at https://rrp.unescap.org/country-profile/mng (accessed on 13 July 2025).

23 Jie Han and others, "Sandstorms and desertification in Mongolia, an example of future climate events: a review", *Environmental Chemistry Letters*, vol. 19, Issue 6 (July 2021). Available at https://doi.org/10.1007/s10311-021-01285-w

24 Juanle Wang and others, "Updatable dataset revealing decade changes in land cover types in Mongolia", *Geoscience Data Journal*, vol. 9, Issue 5 (February 2022). Available at http://dx.doi.org/10.1002/gdj3.149

### *The climate-nature nexus and the decline in biodiversity*

Encompassing one of the largest continuous temperate grasslands in the world, Mongolia has rich biodiversity and hosts a large variety of wildlife species, including many that are endemic. To date, 143 species of mammals, 469 species of birds, 22 species of reptiles, 8 species of amphibians, 74 species of fishes, and 3,000 species of vascular plants have been identified in the country.[1]

There are 16 different types of ecosystem, categorised into four ecoregions in order to increase integration between national conservation and development policies and plans: The Daurian Steppe (28.2 per cent of the total area), Khangai (16.4 per cent), The Central Asian Gobi Desert (16.4 per cent) and The Altai-Sayan (23.1 per cent).[2]

Loss of biodiversity is increasingly evident in Mongolia. The Mongolian rangelands in particular are at tipping points, and may be further pushed further due to a lack of stringent ecosystem protection policies and to ongoing mining activities.[3] Changes in temperature, precipitation patterns and water resources in Mongolia disrupt habitats and the ability of many species to survive, leading to a decline in biodiversity. This has far-reaching implications, not just for wildlife but also for the agricultural and herding communities that depend on these ecosystems.[4] According to the Mongolian Red List, 29 per cent of Mongolian mammal species are threatened or endangered.[5]

Biodiversity decline is closely linked to environmental changes resulting from climate change. The concept of the climate-nature nexus emphasizes the interconnected relationships between climate change and natural ecosystems. It acknowledges that climate and environmental challenges must be tackled simultaneously for sustainable outcomes. Livestock production, which is crucial for Mongolia's economy, is highlighted as a significant contributor to environmental degradation, underlining the urgency for integrated approaches to manage both climate and nature risks together.[6]

Increased frequency of droughts is expected to have negative effects on the geographical distribution of vegetation.[7] Steppe plant populations have already moved an estimated 100 metres upslope, according to Mongolia's Third National Communication.[8] Given the conflict of interest between economic interests in mining and the conservation interests of protected areas, there is a strong need for policies and regulations that can prevent the lifting of protected area status in favour of mining activities, as highlighted by the WWF.[9]

1 Chimed-Ochir B. and others, *Filling the Gaps to Protect the Biodiversity of Mongolia* (Ulaanbaatar, WWF Mongolia Programme Office, 2010). Available at https://wwfeu.awsassets.panda.org/downloads/gap_report_final_wwfmongolia20100917_low.pdf

2 Mongolia, Ministry of Environment, Green Development, and Tourism, *Mongolia National Biodiversity Strategy and Action Plan 2015-2025* (Ulaanbaatar, 2015).

3 Khishigbayar Jamiyansharav and others, "Mongolian rangelands at a tipping point? Biomass and cover are stable but composition shifts and richness declines after 20 years of grazing and increasing temperatures", *Journal of Arid Environments*, vol. 115 (April 2015). Available at https://doi.org/10.1016/j.jaridenv.2015.01.007

4 Wildlife Conservation Society, *Mongolia: Sustainable Grasslands Management for Climate-Resilient Livelihoods* (2024).

5 Chimed-Ochir B. and others, *Filling the Gaps to Protect the Biodiversity of Mongolia* (Ulaanbaatar, WWF Mongolia Programme Office, 2010). Available at https://wwfeu.awsassets.panda.org/downloads/gap_report_final_wwfmongolia20100917_low.pdf

6 FAIRR, Tackling the Climate-Nature Nexus. Available at https://ieeb.fundacion-biodiversidad.es/sites/default/files/2024_tackling_the_climate_nature_nexus_report_0.pdf

7 Meng Meng and others, "Vegetation change in response to climate factors and human activities on the Mongolian Plateau", *PeerJ*, vol. 7735 (September 2019). Available at 10.7717/peerj.7735

8 Mongolia, Ministry of Environment and Tourism, *Third National Communication of Mongolia* (Ulaanbaatar, 2024).

9 Chimed-Ochir B. and others, *Filling the Gaps to Protect the Biodiversity of Mongolia* (Ulaanbaatar, WWF Mongolia Programme Office, 2010). Available at https://wwfeu.awsassets.panda.org/downloads/gap_report_final_wwfmongolia20100917_low.pdf

# ▶Floods

***Figure 10*** Overview of flood risks and impacts

**Floods**

| | | | |
|---|---|---|---|
| **Sectoral impacts** | **Agriculture** | LOW | |
| | **Mining** | LOW | |
| | **Power** | HIGH | Damage to infrastructure |
| | **Other** | HIGH | Damage to real estate infrastructure |
| **Socio-economic impacts** | Human mortality | | |
| | Damage to property/gers | | |
| | High public contingent liabilities | | |
| **Key indicators** | Precipitation | | |
| | Snow melt | | |
| | Duration of rainfall | | |

Mongolia is not fed by any rivers from neighbouring countries, so precipitation is the key cause of flooding, along with snowmelt and flash floods. Flash floods can be caused by heavy rain or by meltwater from ice or snow. Riverine flooding is usually caused by snow melting in the spring (April and May) and heavy rainfall in summer (June to September). Rainfall-induced flooding is observed in most rivers from late June to September and is caused by rainfall precipitation of 30-40 mm or more per day. The duration of each flood lasts an average of 15-20 days, depending on the rainfall.

Extensive rainfall over 100 mm and lasting 12 or more hours may cause severe river flooding, damaging flood protection dams and affecting households, roads, railways and other lifeline infrastructures. This may paralyze livelihoods in large cities for several days at a time. Historical large-scale river floods in Mongolia have caused considerable numbers of human fatalities and extensive economic losses. Table 2 shows the intensity of riverine flooding based on precipitation and rainfall indicators.

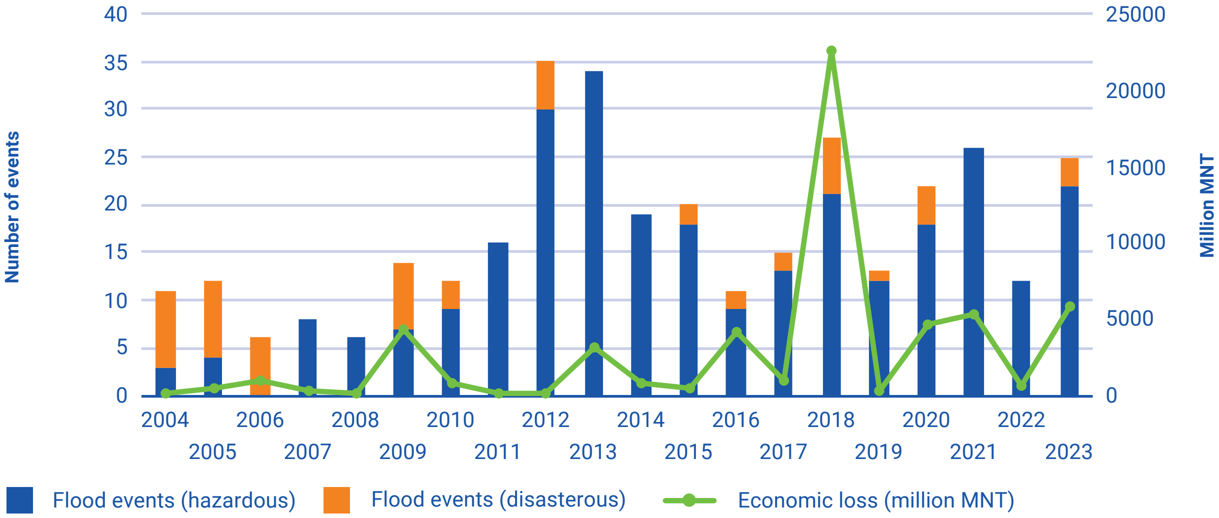
***Table 2*** Precipitation and rainfall indicators and flood characteristics in Mongolia

| Intensity Class | Max run-off depth (mm) | Flood Characteristics |
|---|---|---|
| Very high | >90 | Daily max. precipitation > 100 mm and duration of 12+ hours. River water level is above fixed flood level (a specific threshold value identified for each large river in Mongolia, subject to availability of a gauging station) |
| High | 60-90 | Daily max. precipitation > 50 mm and duration 12 hours or less. River water level reaches flood level |
| Medium | 30-60 | Daily max. precipitation: 30-50 mm and river water level close to flood level |
| Low | 10-30 | Daily max. precipitation: 20-29 mm and river water level below flood level |
| Very low | <10 | Daily max. precipitation < 19 mm; River water level well below flood level |

*Source: National Emergency Management Agency (NEMA).*

Between 2004 and 2023 there were 326 recorded incidents of hazardous and disastrous heavy rain and flood events, causing cumulative economic damage of MNT 54.3 billion[25] (Figure 11).

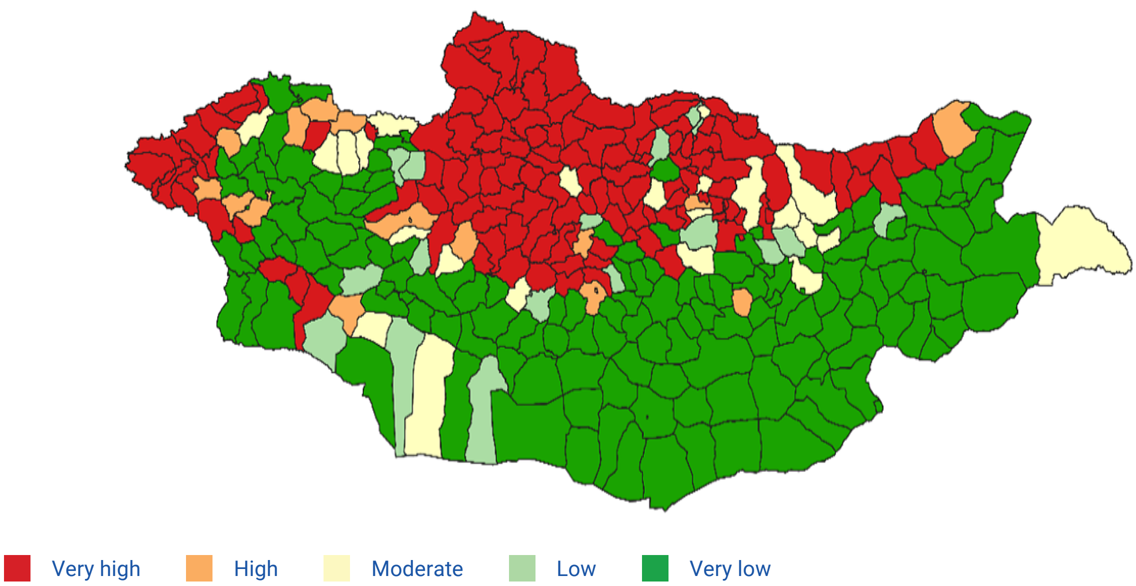
***Figure 11*** Overview of flood events and respective economic losses in Mongolia




*Source: ESCAP based on data from NAMEM*

Of the country's 339 *soums* (districts), 148 (43.7 per cent) have been identified as highly exposed to flood risks (>80 per cent of the *soum's* population exposed to high flood risk), especially in the northern and north western regions[26] (Figure 12).

***Figure 12*** Flood risk exposure across Mongolia




*Source: ESCAP visualization based on data from NEMA.*

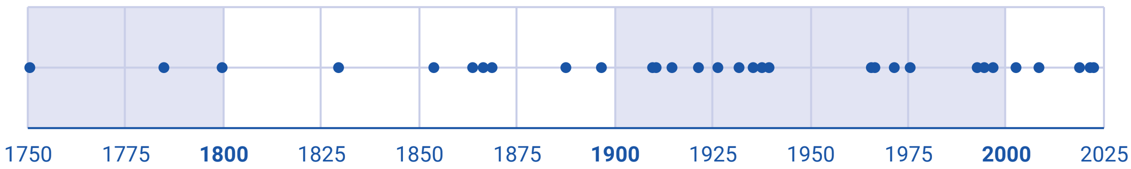
*Note: The map is a risk indicator reflecting flood risks to populations, households, house area, dwellings, education and health facilities, gas stations, warehouses and mining sites.*

25 Mongolia, National Agency Meteorology and Environmental Monitoring, *2024 Statistics* (Ulaanbaatar, 2024).

26 Asian Development Bank and the National Emergency Management Agency of Mongolia, National Disaster Risk Assessment of Mongolia 2023.

Occurrences of flooding have increased in the twentieth and twenty-first centuries. Only nine years between 1700-1900 saw significant flooding incidents, while there have already been 10 years with significant flooding since 1970 (Figure 13). This increase in the frequency of floods can be attributed to increases in precipitation due to climate change. When the change in annual mean precipitation is analysed against the occurrence of heavy rain and flood events between 2004 and 2023, a strong positive correlation (0.74) is observed.

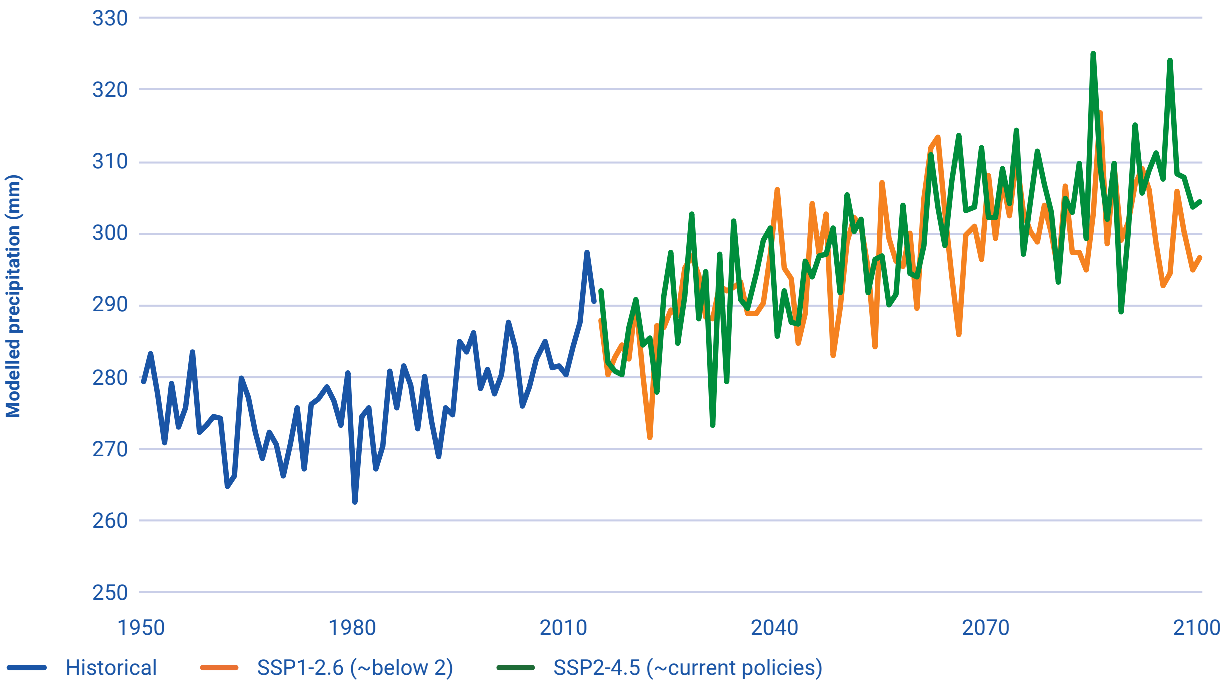
***Figure 13*** Recorded flood occurrences in Mongolia by year




*Source: ESCAP visualization based on data from NEMA.*

Under the IPCC's shared socioeconomic pathways (SSP) scenarios SSP1-2.6 to SSP1-8.5, average annual precipitation in Mongolia is projected to increase by 3-5 per cent by 2050, and by 2-15 per cent by 2100 (Figure 14), with the level of precipitation increasing as temperature levels increase, resulting in higher levels of average annual rainfall.

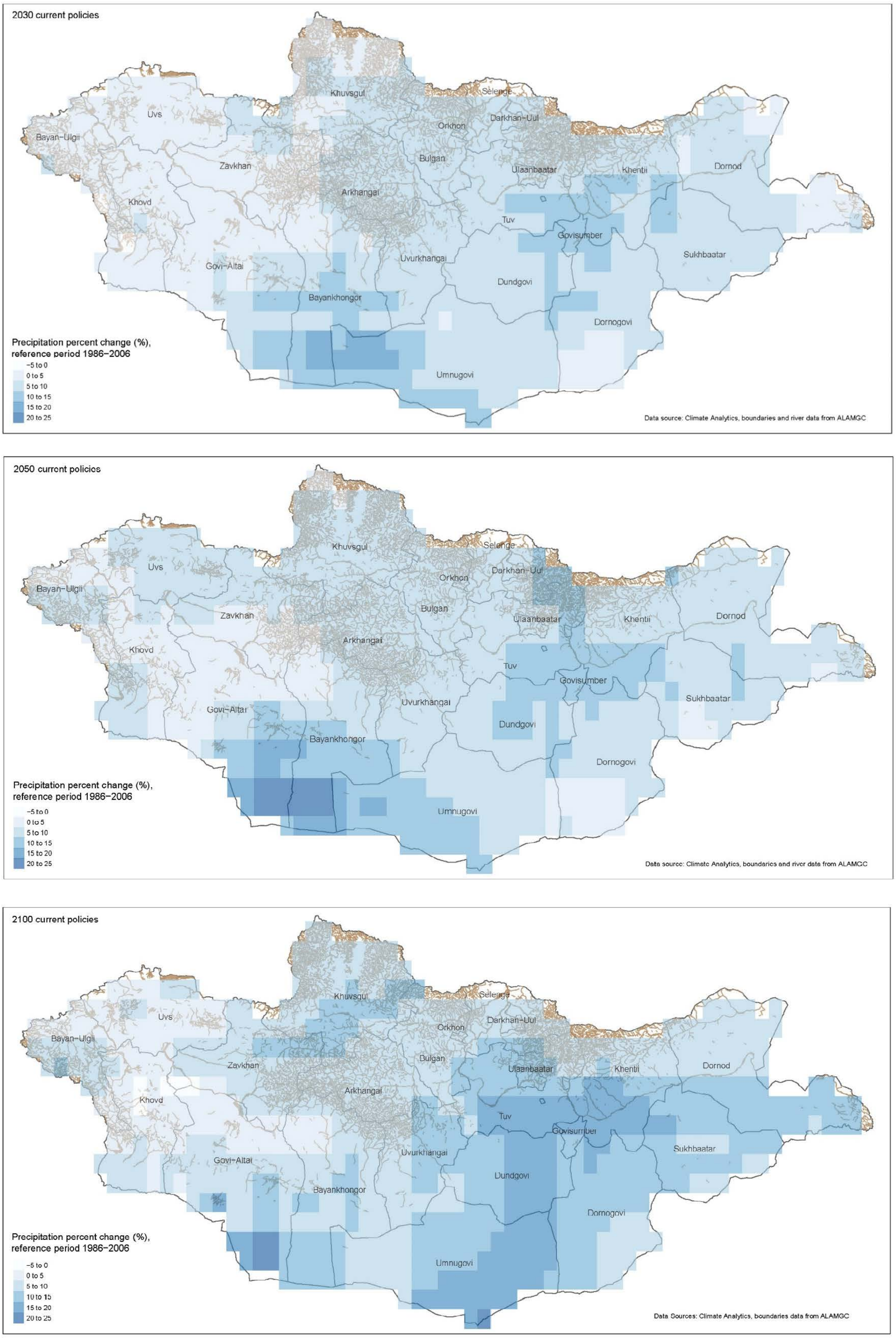
***Figure 14*** Modelled precipitation in Mongolia




*Source: World Bank Climate Change Knowledge Portal.*

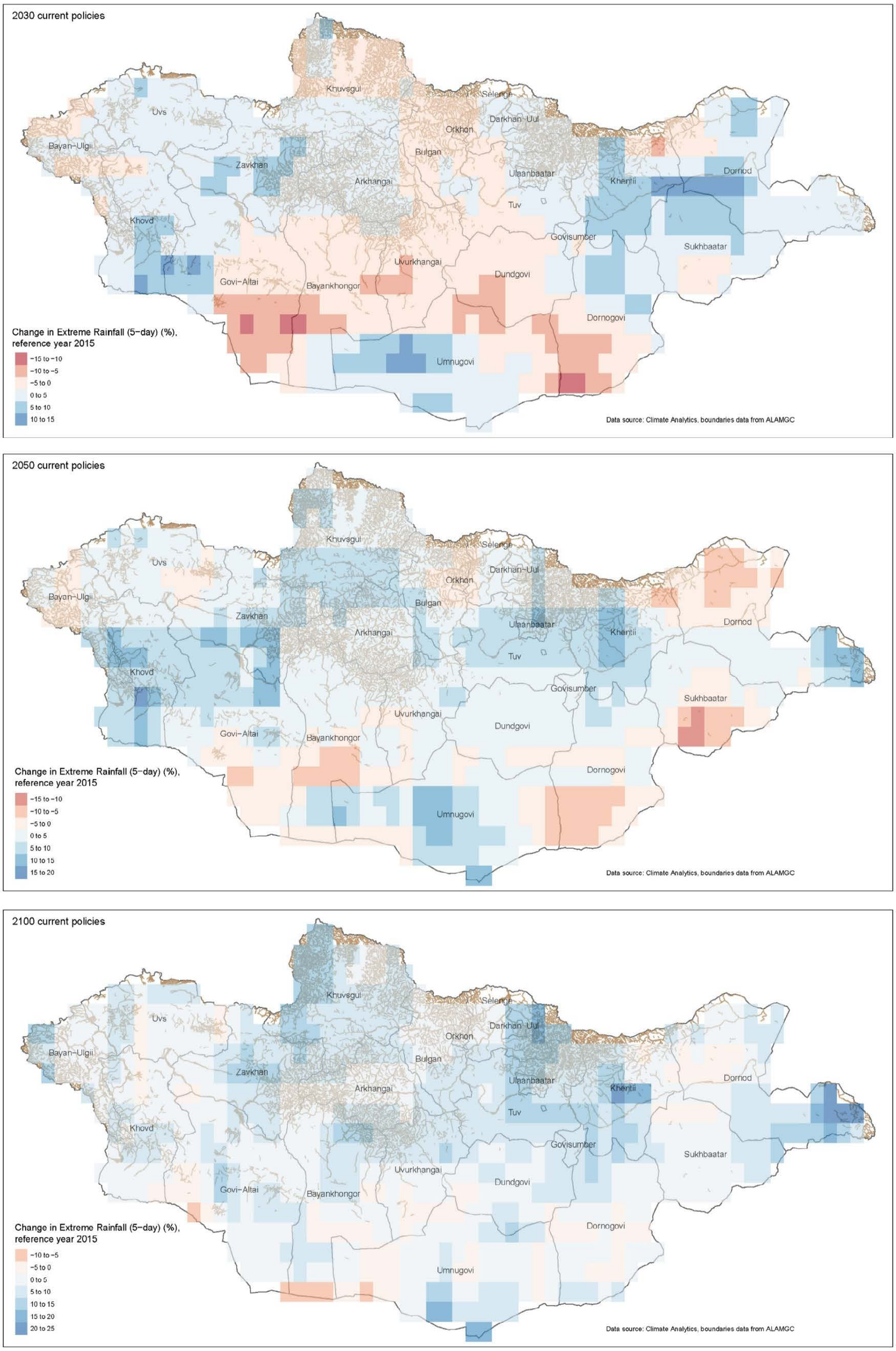
The precipitation indicator (Figure 15) and extreme rainfall (5-day) indicator (Figure 16) show future flood-related risks in Mongolia under the NGFS's Current Policies scenario. Both annual precipitation and short-duration extreme rainfall events are projected to increase across most of the country. While early projections for 2030 show moderate increases of around 5-15 per cent in some regions, the magnitude and geographical extent of these changes are expected to intensify over time. By 2100, and possibly by 2050, total precipitation may rise by up to 25 per cent, particularly in central and southern parts of the country, contributing to higher baseline flood risks. Similarly, extreme rainfall events – defined as the maximum 5-day rainfall – are projected to increase by up to 25 per cent in some areas, further amplifying the likelihood of intense, short-term flooding episodes.

***Figure 15*** Precipitation in Mongolia: Percentage change compared to reference period 1986–2006 under the NGFS Current Policies scenario




*Source: ESCAP visualisation based on data from NGFS Climate Impact Explorer and National Spatial Data Infrastructure of Mongolia.*

***Figure 16*** Extreme rainfall (5-Day) in Mongolia: Percentage change compared to reference period under the NGFS Current Policies scenario




*Source: ESCAP visualisation based on data from NGFS Climate Impact Explorer and National Spatial Data Infrastructure of Mongolia.*

These trends are expected to heighten the risks of multiple forms of flooding, including snowmelt floods, flash floods and urban flooding. Warmer spring temperatures will accelerate snowmelt, increasing runoff in areas not typically exposed to flood risks. Although overall annual snowfall may decline, more intense snowfall during peak winter months, combined with sharp spring temperature rises (potentially exceeding 10°C under some scenarios), is likely to contribute to sudden snowmelt and localized flooding. Overall, the combined impact of increased annual precipitation and more frequent extreme rainfall events signals a clear escalation in flood-related hazards across Mongolia over the coming decades.

This increase in extreme rainfall can cause severe damage to infrastructure and residential and commercial properties, as well as disrupting public services. In 2022, for example, 1,186 households (or approximately 4,269 people) were severely affected by flash floods, with 15 losing their *ger*. According to the National Emergency Management Agency (NEMA), around 900-1000 buildings were damaged.[27] In July 2023, six central districts and 26 locations in Ulaanbaatar were flooded. At least 199 apartments, houses or *gers* and 702 infrastructure units, including electricity substations, roads, dams, bridges and tunnels were affected. In other parts of the country, flash floods due to heavy rainfall occurred in four areas (*soums*) in Darkhan, Selenge and Tuv provinces.[28]

Ulaanbaatar is home to half of the country's population and is particularly vulnerable to floods. A study by the Mongolian Mortgage Corporation (MIK) on the effects on the capital city of floods due to climate change in two IPCC scenarios (SSP2-4.5 and SSP2-8.5) found that 153 subdistricts (*khoroo*) are at risk, 102 under the SSP2-4.5 scenario and 51 under the SSP5-8.5 scenario.[29] These impacts will increase risks to the financial sector through disruption of business, loss of livelihood and particularly the impact on collateral and repricing. Financial sector risks are discussed in detail later in this report.

### *Gendered impacts of climate change*

According to the World Economic Forum's *Global Gender Gap Report 2023*, Mongolia ranks 80th out of 146 countries in gender equality, down from 33rd out of 136 in 2013.[1]

Gender indicators for women in urban areas are better than most countries, with a 98.4 per cent female literacy rate, and women holding 42 per cent of managerial positions.[2] Since June 2024, women have held 25.4 per cent of seats in the parliament (higher than the Asian average).[3]

Given unequal asset ownership rates in Mongolia, with men twice as likely as women to be documented as owners of assets and property, women could also face the effects of climate change more severely, as resources become scarce and traditional livelihoods are disrupted. Among herder families, 58.5 per cent of household properties are registered under men's names and only 8.5 per cent under women's.[4] Women also engage more in un-paid work, with on average only 17 per cent of a day spent on paid labour, 19 per cent on unpaid labour and the remaining 62 per cent on other activities.

The position of herder families in Mongolia is distinct and exceptional. Weather-related hazards have a significant impact on their means of making a living. Given the gender wage gap and limited ownership of assets, Mongolian women are likely to face greater economic setbacks and longer recovery times in the event of disasters in rural areas. This can further exacerbate their unpaid workload of domestic and caregiving responsibilities in the aftermath of disasters.

1 The Gender Gap Index measures gender-related inequality across four criteria: economic participation and opportunity, educational attainment, health and survival and political empowerment.

2 United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), "Mongolia: Country Fact Sheet," *UN Women Data Hub*, n.d., available at https://data.unwomen.org/country/mongolia, accessed 18 September 2025.

3 United Nations Development Programme (UNDP), "Advancing human rights: Breaking Barriers of Women's Leadership in Decision Making in Mongolia," *UNDP Mongolia — Stories*, 27 April 2025, available at https://www.undp.org/mongolia/stories/advancing-human-rights-breaking-barriers-womens-leadership-decision-making-mongolia

4 Asian Development Bank, *Women's Resilience in Mongolia: How Laws and Policies Promote Gender Equality in Climate Change and Disaster Risk Management* (Metro Manila, Asian Development Bank, 2022). Available at https://dx.doi.org/10.22617/TCS220253-2

27 International Federation of Red Cross and Red Crescent Societies, Emergency Plan of Action (EPoA) Mongolia: Flash floods. Available at https://reliefweb.int/report/mongolia/mongolia-flash-floods-emergency-plan-action-epoa-dref-ndeg-mdrmn016

28 International Federation of Red Cross and Red Crescent Societies, Mongolia: Floods 2023 - DREF Final Report, MDRMN019. Available at https://reliefweb.int/report/mongolia/mongolia-floods-2023-dref-final-report-mdrmn019

29 Mongolian Mortgage Corporation, Estimation of flood risk impact on residential mortgage portfolio.

## ▶Droughts

***Figure 17*** Overview of drought risks and impacts

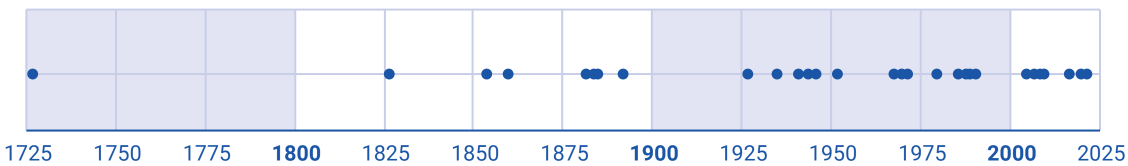
| Droughts | | | |
|---|---|---|---|
| **Sectoral impacts** | **Agriculture** | HIGH | Lack of fodder and water for herds |
| | **Mining** | MEDIUM | Water scarcity |
| | **Other** | HIGH | Herder and farmer incomes |
| **Socio-economic impacts** | Low yield can lead to food insecurity | | |
| | Reduced herder incomes | | |
| | Hinders preparation for winters | | |
| | Land degradation | | |
| **Key indicators** | Average air temp | | |
| | Max temp | | |
| | Number of hot days | | |

Drought in Mongolia has been associated with major social and environmental change, including migration of herders to the capital city, loss of lakes and declines in grassland productivity.[30] Over 90 per cent of Mongolia's territory is defined as arid and moisture deficient, with the Gobi Desert region accounting for 41.3 per cent of the country.[31] Given the high dependence of the rural economy on agriculture, the issue of drought and desertification is particularly significant.

Droughts result from a lack of precipitation (rainfall) coupled with excessive evaporation (prolonged high temperatures) leading to an excessive loss of soil moisture. On a chronic scale, successive drought years can lead to severe declines in the level of groundwater, which exacerbates loss of vegetation, degrades soil quality and accelerates desertification.

The frequency of drought years in Mongolia is increasing, doubling between the first and second halves of the twentieth century, while the first quarter of the 21st century saw an increase of 40 per cent compared to the first quarter of the 20th century (Figure 18). Among other factors, this can be attributed to the increase in temperature caused by climate change. Several data sources and studies point to increased frequency and severity of droughts in Mongolia under various scenarios.

***Figure 18*** Recorded flood occurrence per year in Mongolia




*Source: ESCAP visualization based on data from NEMA.*

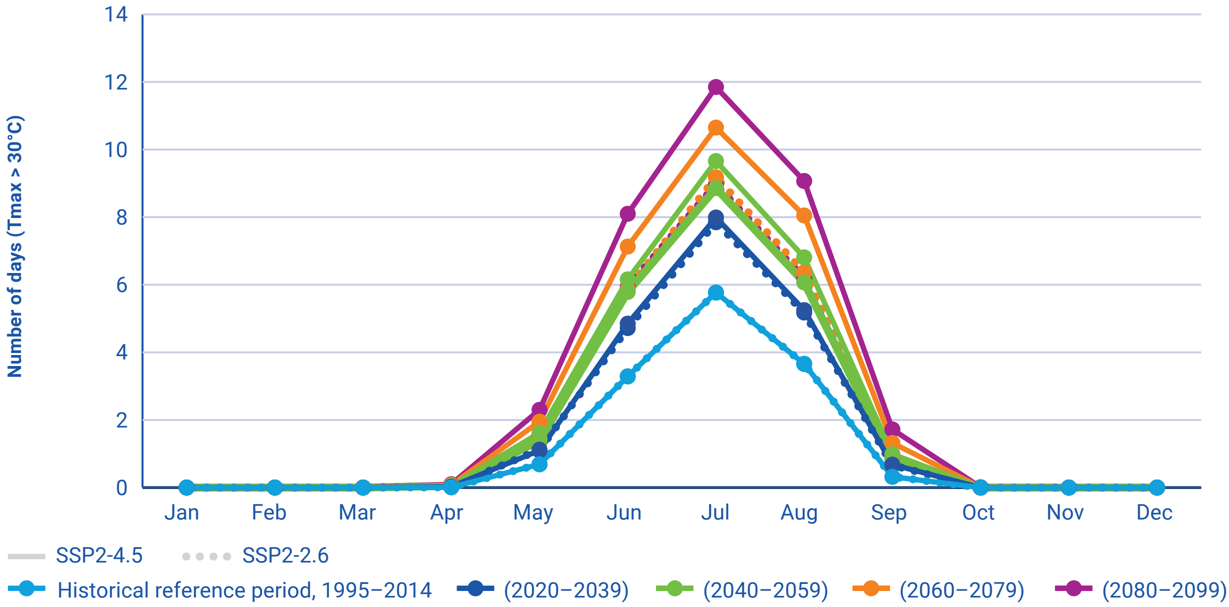
According to scenario projections developed by the IPCC, the number of hot days (>30°C) especially in peak summer (July) will increase progressively every two decades from the historical reference period (Figure 19). The magnitude of this increase in number of consequent hot days is 14 per cent higher under the pessimistic scenario (SSP2-4.5) than the optimistic scenario (SSP2-2.6).[32]

30 Amy E. Hessl and others, "Past and future drought in Mongolia", *Environmental Studies*, vol. 4, Issue 3 (May 2018). Available at https://doi.org/10.1126/sciadv.1701832

31 Jie Han and others, "Sandstorms and desertification in Mongolia, an example of future climate events: a review", *Environmental Chemistry Letters*, vol. 19, Issue 6 (July 2021). Available at https://doi.org/10.1007/s10311-021-01285-w

32 Intergovernmental Panel on Climate Change, Climate change 2023 : AR6 synthesis report : longer report. Available at https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf

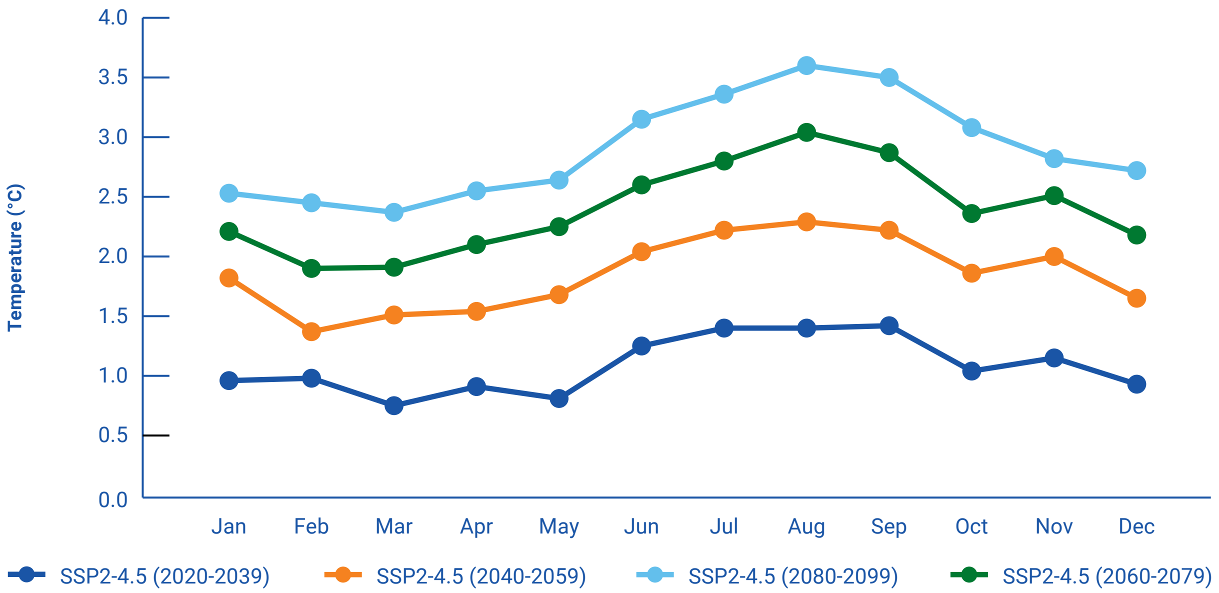
**Figure 19** Simulated and historical distribution of hot days in Mongolia across various scenarios




*Source: World Bank Climate Change Knowledge Portal.*

This increase in the number of hot days is also projected to be accompanied by average mean temperature increases of 1.4°C (July) in the period 2020-2039, rising to 3.36°C in the period 2080-2099 (Figure 20). At the same time, average precipitation increases in these months are projected to be low. These conditions could indicate a potential increase in the incidence of droughts.

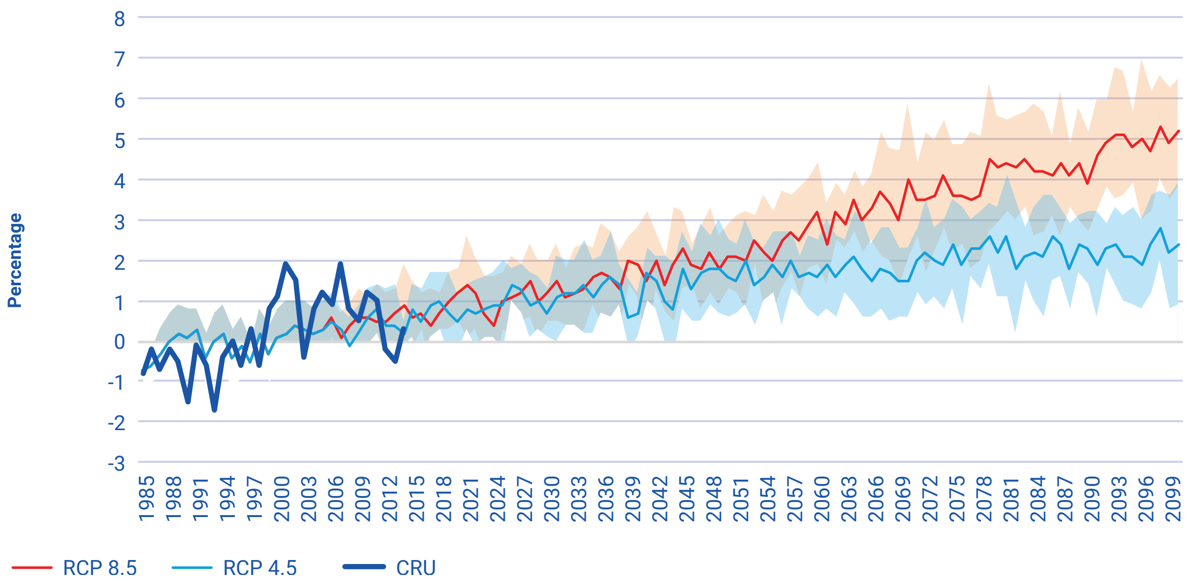
**Figure 20** Average mean surface air temperature change across various scenarios in Mongolia




*Source: World Bank Climate Change Knowledge Portal.*

The higher potential probability of droughts is also confirmed by a study conducted by the Information and Research Institute of Meteorology, Hydrology and Environment (IRIMHE) analysing the Palmer Drought Index (PDI). It finds that drought frequency in Mongolia is expected to increase by 5-15 per cent under moderate scenarios (Figure 21).

**Figure 21** Projected variations of PDI, WI and ZI (Ped) indices compared to 1986-2005 under different climate scenarios




*Source: NAMEM, Agriculture and drought in Mongolia (2018).*[33]

Future projections of drought frequency under the RCP-8.5 scenario indicate a country-wide average increase of 9 per cent by 2030 and 20 per cent by 2050. By 2080, some regions could see an increase ranging from 37-50 per cent (Figure 22).

Droughts can have significant socio-economic effects on herder communities and the livestock (agriculture) sector. The growing season in Mongolia is very short, extending from May to September. Pasture productivity varies widely depending on summer conditions. A dry summer or summer drought can decrease rangeland productivity by 12-48 per cent in the high mountains and by 28-60.3 per cent in the desert steppe. Furthermore, over the last 30 years, the total number of livestock has increased by 44 per cent while the volume of grassland has reduced by 20 per cent, putting strains on the limited pasture resources and exacerbating soil degradation due to overgrazing.[34]

A steep decline in land productivity (crop or pasture grasses) leads to starvation of livestock and consequently a lack of livestock products (dairy and meat) for people. It also has the potential to cause large-scale losses of livestock during winter because of a lack of pasture biomass and a lack of collected fodder for feeding. Especially in rural areas, this could lead to increased food insecurity due to decreased agricultural products in the locality.

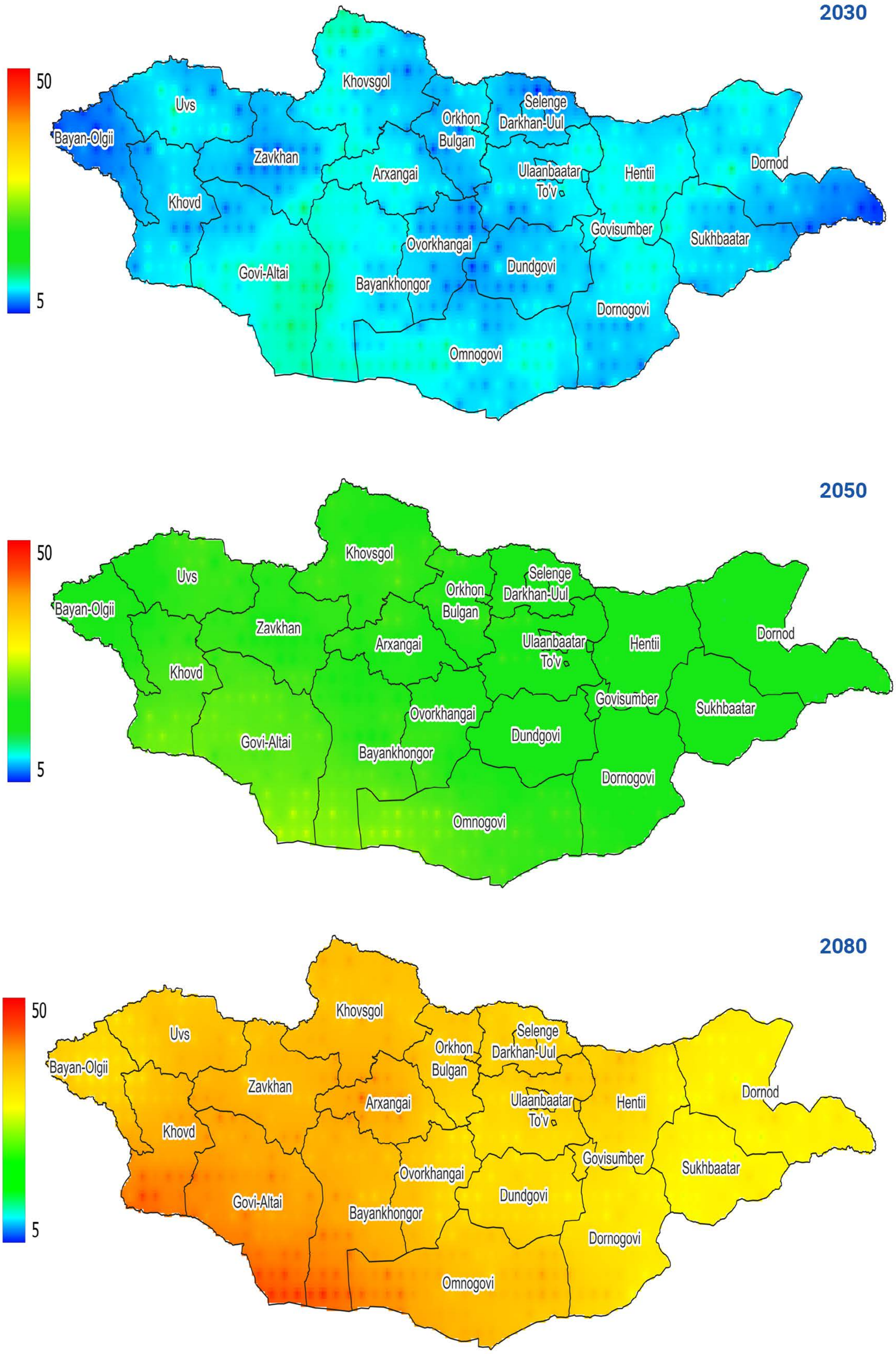
The cashmere sector is significantly exposed to drought. Almost 63 per cent of livestock nationally have been identified as highly exposed to droughts. Of this 63 per cent, 2.3 per cent are further classified as very high susceptibility, 46.6 per cent at high susceptibility, and ~51.1 per cent at moderate susceptibility/intensity levels.[35]

33 B. Ganbat and others, "Agriculture and Drought in Mongolia", document prepared for the regional workshop on understanding the operational aspects of the drought observation system in Mongolia, IRIMHE, Ulaanbaatar, September 2018.

34 Amy E. Hessl and others, "Past and future drought in Mongolia", *Environmental Studies*, vol. 4, Issue 3 (May 2018). Available at https://doi.org/10.1126/sciadv.1701832

35 Asian Development Bank and The National Emergency Management Agency, Strengthening Capacity on Disaster Risk Assessment, Reduction, and Transfer Instruments in Mongolia, TA-9880 MON.

***Figure 22*** Frequency changes of drought index, PDI estimated by ensemble mean of global climate models in different periods (2020, 2050 and 2080) for the RCP8.5 scenario

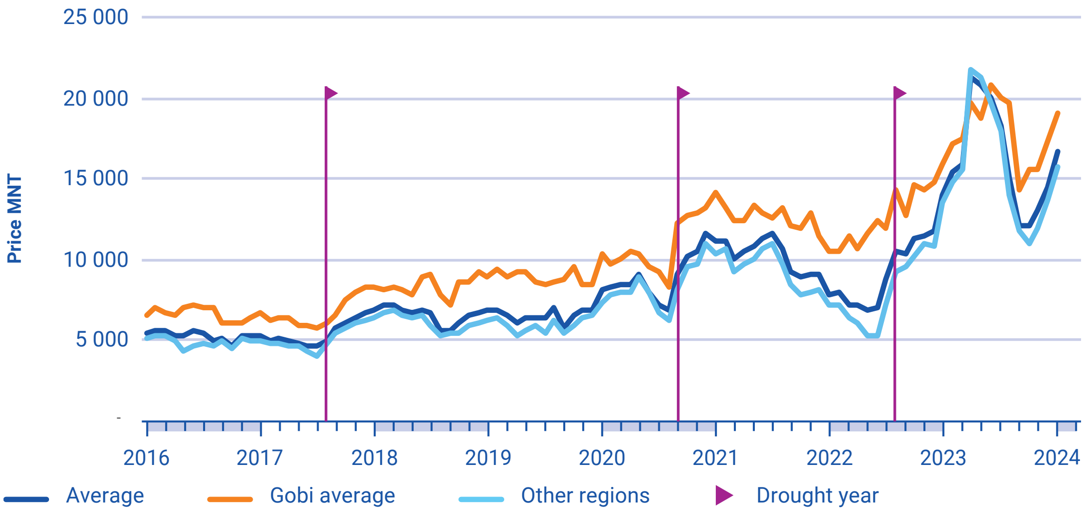



*Source: ESCAP based on data from NAMEM.*

The effect of lower earnings from cashmere sales depends on decisions that are contingent on pasture yields in summer and autumn. The herder's management of livestock is very much contingent on climatic factors. The Mongolian Gobi Desert is dry and experiences high levels of geographical and temporal variability in precipitation and temperature.[36, 37] This has a direct impact on pasture yields. Directly proportional to the pasture yield in the summer-autumn period is the ability of herders to collect hay. In a "bad year" (dry summer or drought), herders must buy hay bales to supplement feed for the winter. Geographical variation in forage production also affects the ability of some pastoralists to use hay collection as a risk management tool.

Hay bale prices can be seen to increase sharply in drought years (Figure 23), with higher average prices in the Gobi Desert provinces than any other provinces, indicating the effect on pasture in the Gobi Desert region. Studies also reveal that one of the key factors driving sensitivity to *dzuds* at the household level is the availability and use of forage and hay reserves, especially during the spring, and adequate shelter and cover.[38] However, more data, going back to other drought years, is needed to ascertain causality.

***Figure 23*** Average price of hay bale (MNT)




*Source: ESCAP based on data from National Statistics Office of Mongolia.*

Drought consequently impacts several key decisions over the year. Availability of fodder determines herd management practices such as whether to overwinter goats or sell/cull and mate them (to increase herd size and milk production) or to limit herd size to conserve fodder and reduce the need to purchase fodder for the winter.[39] Herders need to prepare for the winter, and the profitability of the cashmere sector becomes contingent on climatic factors such as *dzuds* and cold waves. In 2024, the global cashmere supply chain experienced an unanticipated challenge due to the natural climate disaster that struck large regions of Mongolia. This disaster led to a notable increase in raw cashmere prices due to reduced volume and delayed harvests. During the cashmere season of 2024, the price for raw cashmere fibre rose to 185,000 MNT per kg (approx. £40-£45), up from 165,000 MNT per kg (approx. £36-£38) the previous year. This price hike resulted in lower purchase quantities by some producers.[40]

36 Bezsuren, S. and others, "Livestock responses to droughts and severe winter weather in the Gobi Three Beauty National Park, Mongolia", *Journal of Arid Environments*, vol. 59, Issue 4 (December 2004). Available at https://doi.org/10.1016/j.jaridenv.2004.02.001

37 Henrik von Wehrden and others, "Inter-annual rainfall variability in Central Asia – A contribution to the discussion on the importance of environmental stochasticity in drylands", *Journal of Arid Environments*, vol. 74, Issue 10 (October 2010). Available at https://doi.org/10.1016/j.jaridenv.2010.03.011

38 María E. Fernández-Giménez and others, "Cross-boundary and cross-level dynamics increase vulnerability to severe winter disasters (dzud) in Mongolia", *Global Environmental Change*, vol. 22, Issue 4 (October 2012). Available at https://doi.org/10.1016/j.gloenvcha.2012.07.001

39 Jane Addison and Colin G. Brown, "A multi-scaled analysis of the effect of climate, commodity prices and risk on the livelihoods of Mongolian pastoralists", *Journal of Arid Environments*, vol. 109 (October 2014). Available at https://doi.org/10.1016/j.jaridenv.2014.05.010

40 Sustainable Fibre Alliance. (2024). *Climate disaster impact on Mongolian cashmere supply: 2024 market overview*. Sustainable Fibre Alliance website. Available at: https://sustainablefibre.org/climate-disaster-impact-on-mongolian-cashmere-supply-2024-market-overview/

Drought also has cascading effects that exacerbate the probability of *dzuds* occurring. *Dzuds* often have their origins in episodes of drought (occurring in summer) and anomalously cold winters. The occurrence of a dry summer means that large numbers of livestock are unable to graze sufficiently, becoming underweight and consequently less able to withstand the subsequent harsh winter. In the Gobi region, average annual livestock mortality for years that have a combination of drought and *dzuds* (18 per cent) was 4.8 per cent greater than in the years with *dzuds* alone, and 7 per cent greater than in years with only drought.[41]

The impacts of slow-onset disasters such as drought are transmitted to various interconnected elements of the economic system, including those populations that depend on agriculture, businesses that depend on agricultural products, and the export performance of the economy. This can cause risks to the financial system through several transmission channels, as discussed further below.

### *Desertification*

The combination of rising temperatures, less rainfall and greater soil degradation has led to continuing drying patterns, affecting about 75 per cent of the country with drought and desertification, with 23 per cent being severely degraded. The degradation of pastureland also has negative effects on livestock health, which is a cornerstone of the Mongolian economy. Crop yields are also affected, threatening food security.[1] Limited availability of pastureland combined with increased numbers of livestock (from 45.1 million in 2013 to 64.7 million in 2023)[2] means that during the summer, livestock have limited opportunity to gain weight, which could lead to lower livestock survival rates during *dzud* events.

A further increase in temperature, as projected under various scenarios, will exacerbate the risks of desertification and droughts.[3] Human actions such as overgrazing, irresponsible mining and the development of unpaved rural roads have worsened the situation by disturbing the soil and reducing its fertility.[4] This has socio-economic effects especially on food security.

To mitigate desertification, Mongolia has implemented several strategies like the National Plan of Action to Combat Desertification in Mongolia, submitted to the UN Convention to Combat Desertification (UNCCD)[5] and the Billion Trees campaign. The campaign aims to increase forest cover and promote ecological restoration by planting and nurturing 1 billion trees by 2030. This ambitious project also incorporates afforestation and agroforestry to support biodiversity and improve food security. Furthermore, Mongolia plans to allocate at least 1 per cent of its GDP annually towards environmental protection and climate change mitigation efforts.[6]

The forthcoming 17th Conference of the Parties of the UNCCD, which Mongolia will host in 2026, represents a critical platform for the country to enhance its global cooperation and to secure support for its environmental strategies. These combined efforts reflect Mongolia's commitment to reversing the damaging effects of desertification and establishing sustainable development practices for the future.

1 Jie Han and others, "Sandstorms and desertification in Mongolia, an example of future climate events: a review", *Environmental Chemistry Letters*, vol. 19, Issue 6 (July 2021). Available at https://doi.org/10.1007/s10311-021-01285-w
2 National Statistics Office, "Number of herdsmen, by region, bag, soum, aimags and the Capital". Available at https://www.1212.mn/en/statistic/statcate/48171307/table-view/DT_NSO_1001_022V1 (accessed on July 2024).
3 Jie Han and others, "Sandstorms and desertification in Mongolia, an example of future climate events: a review", *Environmental Chemistry Letters*, vol. 19, Issue 6 (July 2021). Available at https://doi.org/10.1007/s10311-021-01285-w
4 Xinhua, "Explainer: Why large parts of Mongolia are affected by desertification", 10 May 2023. Available athttps://english.news.cn/20230510/0286878b2b04421780ff49cb4f36a4a1/c.html
5 Mongolia, Ministry of Nature and Environment, *National Plan of Action to Combat Desertification in Mongolia* (Ulaanbaatar, 1997).
6 Khurelbaatar Chimed and Pamela Coke-Hamilton, "Trees: Why nature's tech is vital to combatting desertification", 25 July 2023. Available at https://www.weforum.org/stories/2023/07/why-nature-s-tech-trees-are-key-to-combatting-desertification/

41 Bezsuren, S. and others, "Livestock responses to droughts and severe winter weather in the Gobi Three Beauty National Park, Mongolia", *Journal of Arid Environments*, vol. 59, Issue 4 (December 2004). Available at https://doi.org/10.1016/j.jaridenv.2004.02.001

## ▶*Dzuds*

***Figure 24*** Overview of *dzud* risks and impacts

| *Dzuds* | | | |
|---|---|---|---|
| Sectoral impacts | Agriculture | VERY HIGH | Livestock mortality |
| | Mining | MEDIUM | Closure of transport channels |
| | Power | MEDIUM | Closure of transport channels |
| | Other | HIGH | Herder livelihood<br>Transport channels<br>Infrastructure damage |
| Socio-economic impacts | Very high livestock mortality | | |
| | Urban migration | | |
| | Loss of livelihoods | | |
| | Public contingent liabilities | | |
| Key indicators | Snow intensity | | |
| | Minimum temperature | | |
| | Wind speed | | |

*Dzuds* are Mongolia's most significant climate-related hazard, and significantly affect socio-economic conditions. A *dzud* can result from various combinations of climatic conditions including lack of snowfall, heavy snowfall, extreme cold and strong winds. They can lead to large-scale loss of livestock due to starvation and extreme cold.[42, 43]

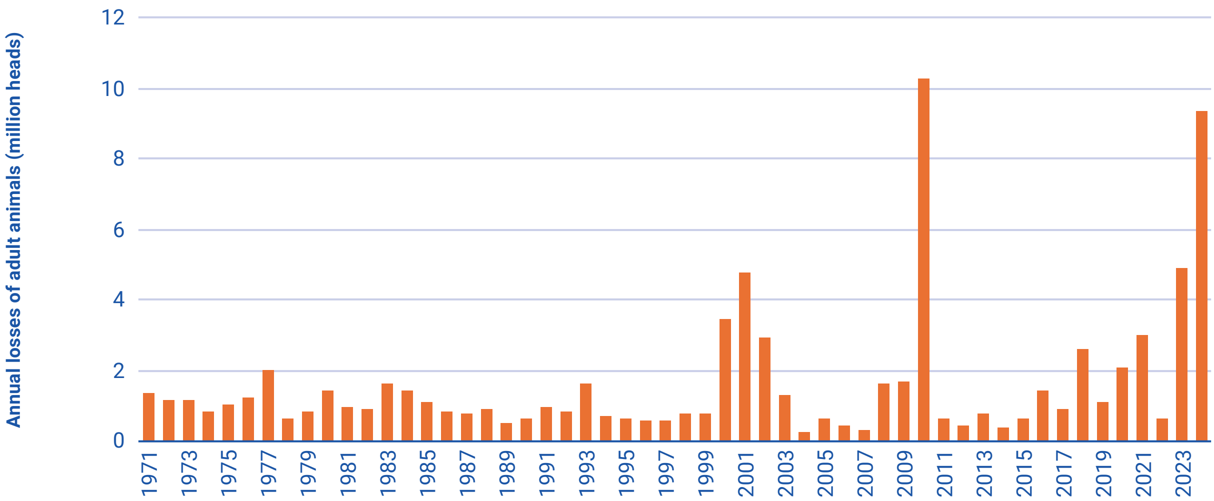
As the agriculture, forestry and fishing sector is dominated by livestock herding and employs 22 per cent of the employed population,[44] *dzuds* are detrimental not just for the herder population but for the wider economy.

Herders with small herds and limited resources suffer the most when they cannot afford animal feed or do not have adequate access to winter shelter. Heavy snowfall and extreme temperatures can also cause damage to electricity and transport infrastructure, making relief measures in hard-to-reach rural areas difficult. In 2023, approximately 37.6 per cent of all livestock in Mongolia was identified as highly exposed (at major susceptibility/intensity levels) to *dzuds* and almost 10 per cent of herder households were identified as highly vulnerable to *dzuds*.[45]

In the last 70 years, a total of 45 million livestock in Mongolia have died due to 13 *dzuds*.[46] Between 2000 and 2002, *dzuds* claimed ~8.13 million head of cattle[47] over three years. One of the worst recorded *dzuds* hit the country in the winter of 2009/10 (Figure 25). The severe *dzud* event covered 90 per cent of the country and led to the deaths of around 8.5 million livestock, equivalent to 20-25 per cent of the national herd, resulting in economic losses of over $287 million (~4 per cent of 2009 GDP).[48]

42 Chogsom, D., *Some aspects of dzud studies: Geographical aspects in Mongolia 2* (Ulaanbaatar, 1964) available at МУИС-ийн номын сан
43 Natsagdorj, L. and Dulamsuren, J., "Some aspects of assessment of the dzud phenomena", *Meteorology and Hydrology*, Vol. 23, Issue 3 (2001).
44 National Statistics Office, "Number of herdsmen, by region, bag, soum, aimags and the Capital". Available at https://www.1212.mn/en/statistic/statcate/48171307/table-view/DT_NSO_1001_022V1 (accessed on 13 August 2025).
45 Asian Development Bank and The National Emergency Management Agency, Strengthening Capacity on Disaster Risk Assessment, Reduction, and Transfer Instruments in Mongolia, TA-9880 MON.
46 Mongolia, Ministry of Food, Agriculture and Soft Industry, Ministry of Finance and Ministry of Justice and Internal Affairs, *Objectives of the draft law on mitigating the negative impacts of climate change on traditional livestock farming* (Ulaanbaatar, 19 April 2024). Available at https://legalinfo.mn/mn/detail?lawId=17140159421231
47 ESCAP calculations based on data from NSO Mongolia.
48 World Society for the Protection of Animals, The economic impacts of losing livestock in a disaster. Available at https://www.worldanimalprotection.ca/siteassets/reports-pdfs/livestock_disaster_economics_2011.pdf

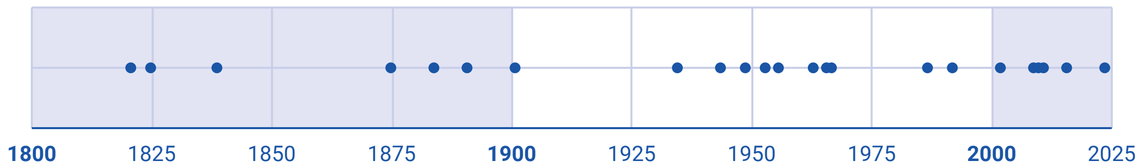
***Figure 25*** Livestock deaths in Mongolia (million heads)




*Source: ESCAP calculations based on data from National Statistics Office of Mongolia.*

*Dzud* disasters have become more frequent and more severe over the past four decades (Figure 26).[49] The most recent *dzud* occurred in 2023/24 and claimed approximately 8 million livestock[50] (11 per cent of the national total). By 17 April 2024, 4,816 households had lost 70 per cent or more of their livestock and 509 households had lost 100 per cent.[51]

***Figure 26*** Recorded *dzud* occurrences per year in Mongolia




*Source: ESCAP visualization based on data from NEMA.*

One of the critical social consequences of *dzuds* is increased poverty and mass migration from rural to urban settings, and from remote to central regions,[52] particularly to the capital region of Ulaanbaatar. Most new migrants end up in unplanned and informal *ger* settlements on the outskirts of the capital. A marked increase in the number of people migrating to Ulaanbaatar is observed in the years following a *dzud* year (Figure 27), especially in years when livestock losses are significant (such as 2002/03 and 2010). However, it must be noted that several other factors can contribute to urban migration. For example, depending on their original geographical location, the affected population might migrate to other urban centres, or a move to the capital might take more than one year. More robust data collection and monitoring is needed for planning comprehensive response and relief measures.

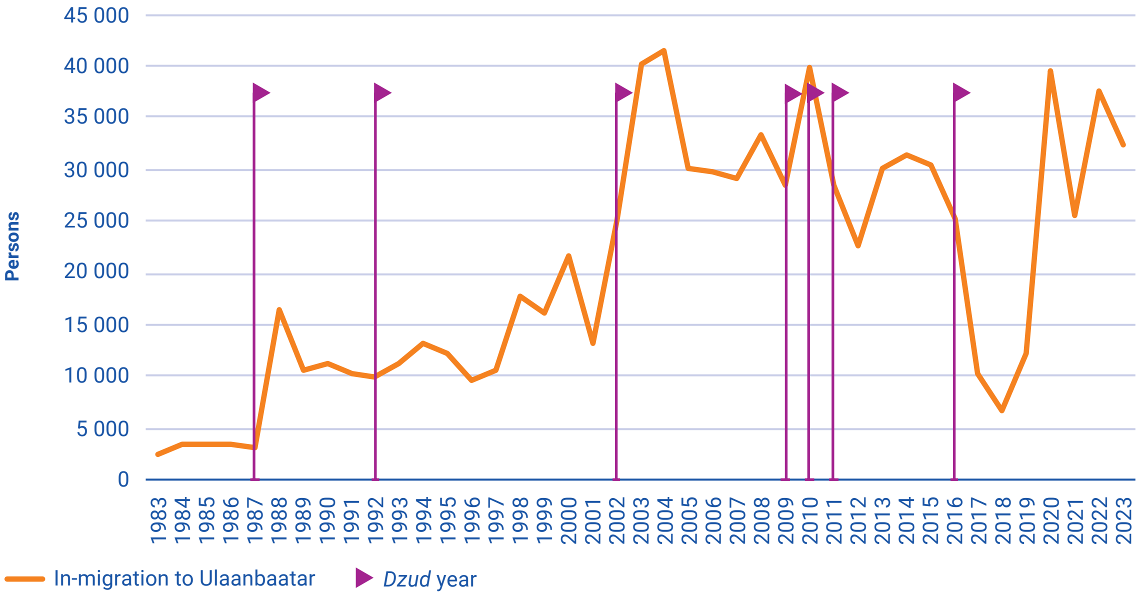
49 Benoît Mayer, "Managing "Climate Migration" in Mongolia: The Importance of Development Policies" in *Climate Change in the Asia-Pacific Region*, Walter Leal Filho, ed., (Basel, Springer International Publishing, 2015). Available at https://link.springer.com/book/10.1007/978-3-319-14938-7

50 National Emergency Management Agency, "The task of destroying animal carcasses has been ordered to be completed by May 1st", 18 April 2024. Available at https://nema.gov.mn/post/154950

51 National Emergency Management Agency.

52 Christopher B. Field and others, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, (Cambridge, New York, Cambridge University Press; Geneva, Intergovernmental Panel on Climate Change, 2012). Available at https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf

***Figure 27*** Effects of *dzuds* on migration to Ulaanbaatar




*Source: ESCAP calculations based on data from National Statistics Office of Mongolia.*

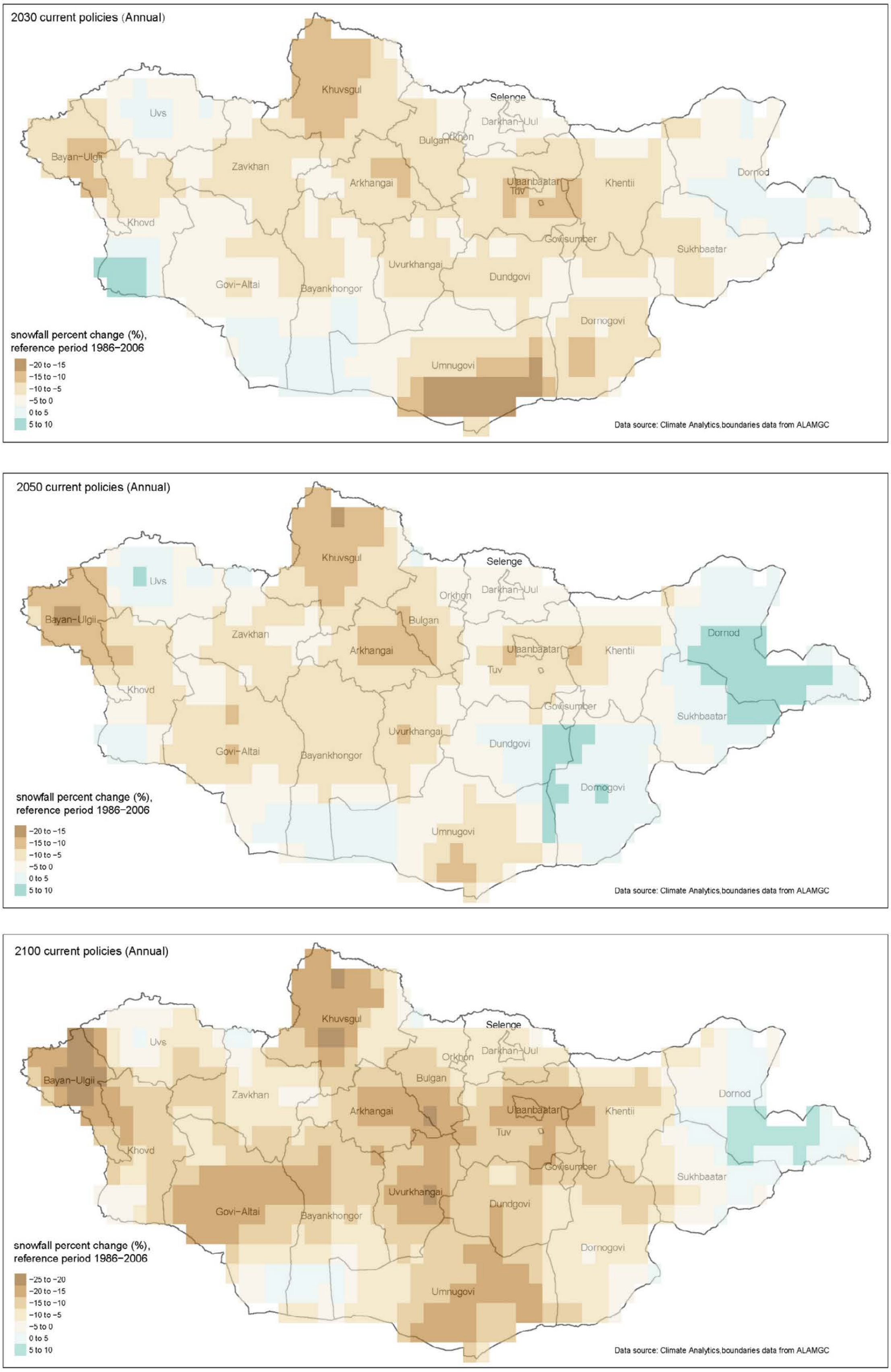
Forecasting *dzuds* is a complex task as their occurrence is usually a combination of several factors. Moreover, the severity of their impact can vary. For example, the summer of 2023 was initially favourable, with abundant rainfall, but the months that followed saw an abrupt, severe drop in temperature and substantial snowfall in early November, followed by an unusually rapid rise in temperature, causing a snow thaw. Subsequently, an extended period of extreme cold, dipping below -40°C, persisted through the second half of December. By January 2024, 74 per cent of the country was facing *dzud* or near-*dzud* conditions.[53]

The National Disaster Management Agency uses the parameters of snow intensity, 10-day air temperature, minimum air temperature, and wind speed as indicators to define the intensity class of *dzuds*.[54] Several projections from various sources show that both the intensity and frequency of *dzuds* is set to increase under all scenarios. While the intensity of *dzuds* has increased since the 1990s, under the RCP-4.5 scenario their frequency is projected to increase further, by 5-20 per cent by 2080. This is because, despite the trend towards global warming, winter snow is projected to increase by 10-14 per cent in the near future.[55]

The average annual snowfall indicator, which shows regional variation across the country, was analysed under the NGFS's Current Policies scenario (Figure 28). Despite annual average snowfall showing a declining trend across much of Mongolia, with reductions particularly evident in central and southern regions, the projections for peak winter months (December to February) present a sharp contrast (Figure 29). Snowfall intensity in these months is projected to increase across many regions, with some areas expected to experience up to 40 per cent more snowfall compared to the 1986-2006 baseline.

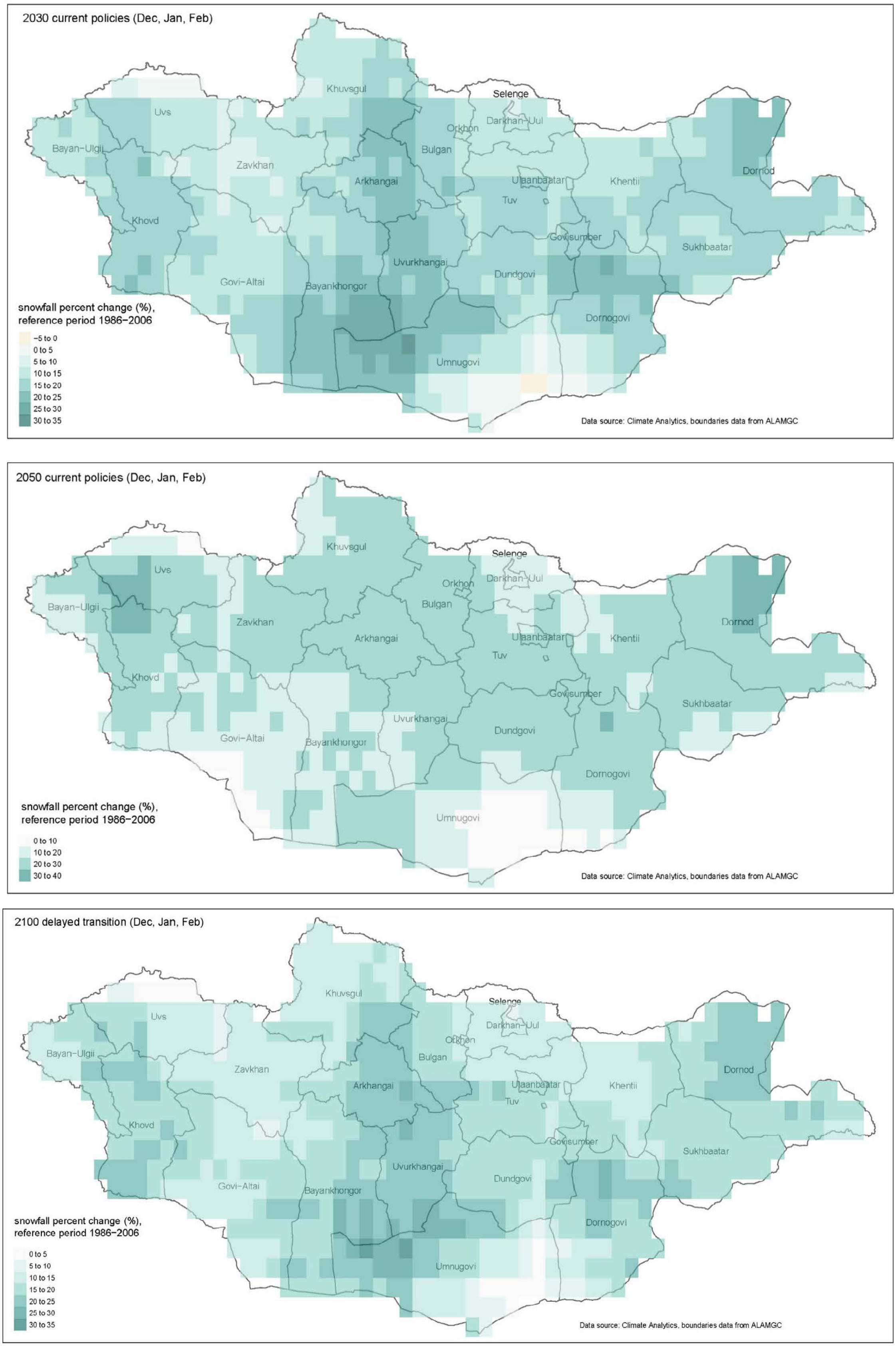
53 Ibid.
54 Mongolia, *GoM Resolution #286 of 2015: Regulation for Drought and dzud Assessment* (Ulaanbaatar, 2015).
55 Mongolia, Ministry of Environment and Tourism, *Third National Communication of Mongolia* (Ulaanbaatar, 2024).

## *Figure 28* Average snowfall intensity across regions in Mongolia




*Source: ESCAP Visualisation based on data from NGFS Climate Impact Explorer and National Spatial Infrastructure Data of Mongolia.*

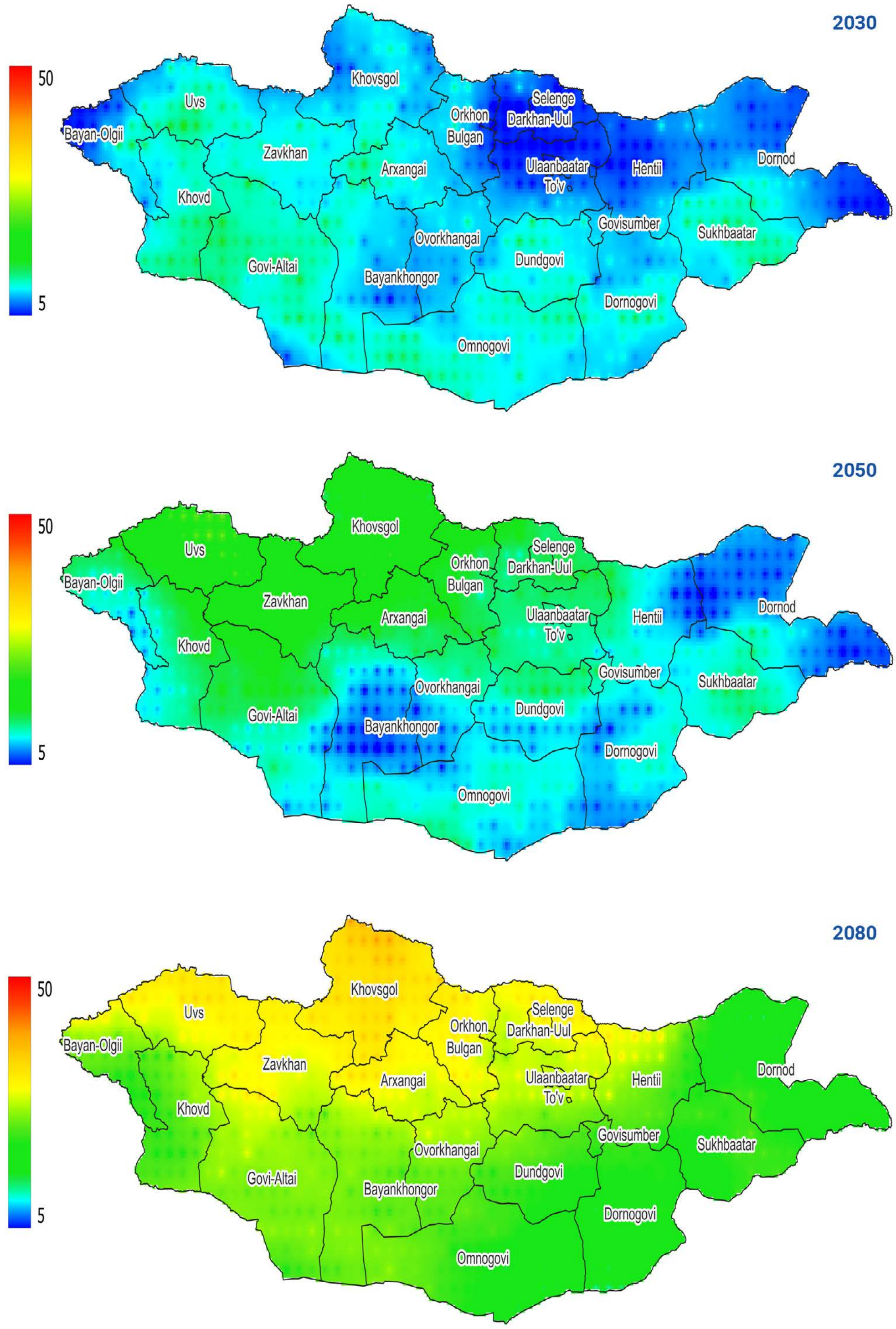
***Figure 29*** Change in average snowfall (December to February) from the reference period 1986-2006 under NGFS Current Policies scenario




*Source: ESCAP Visualisation based on data from NGFS Climate Impact Explorer and National Spatial Infrastructure Data of Mongolia.*

This projected increase in peak winter snowfall heightens the risks of *dzud* events. While annual snowfall may decline, the concentration of intense snowfall during winter months is likely contribute to more severe *dzud* risks. An increase in the frequency of *dzuds* over coming years is also demonstrated in an analysis by NAMEM using the RCP-8.5 scenario. It shows that *dzud* frequency nationally will increase by an average of 9 per cent by 2030, 12 per cent by 2050 and 25 per cent by 2080.[56] Under this scenario, the frequency in some regions is projected to increase by up to 40 per cent by the end of the century (Figure 30).

***Figure 30*** Increase in *dzud* frequency across regions in Mongolia

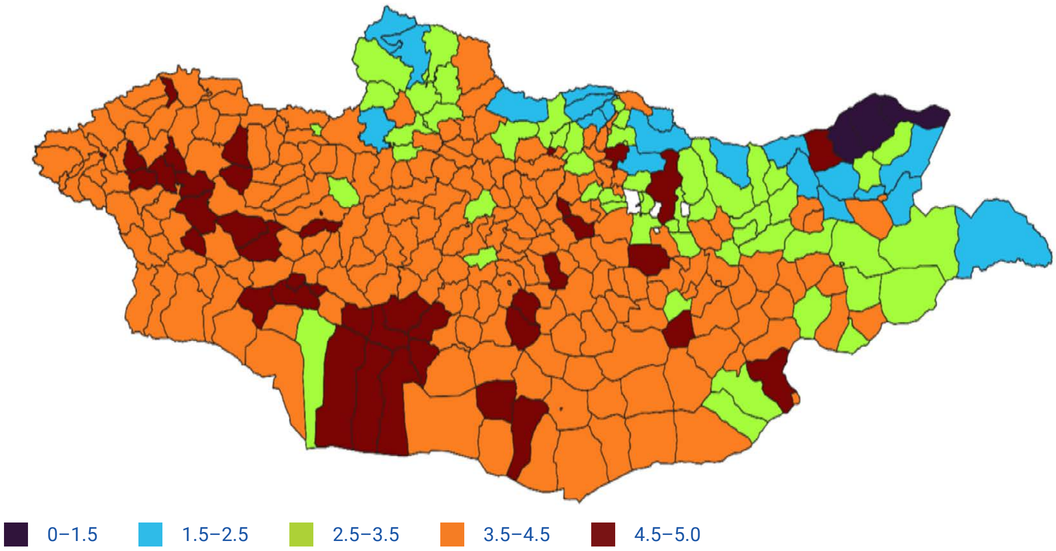



*Source: Author's visualizations based on data from NAMEM.*

56 Enkhjargal Natsagdorj and others, "Long-term soil moisture content estimation using satellite and climate data in agricultural areas of Mongolia", *Geocarto International*, vol. 34, Issue 7 (January 2018). Available at https://doi.org/10.1080/10106049.2018.1434686

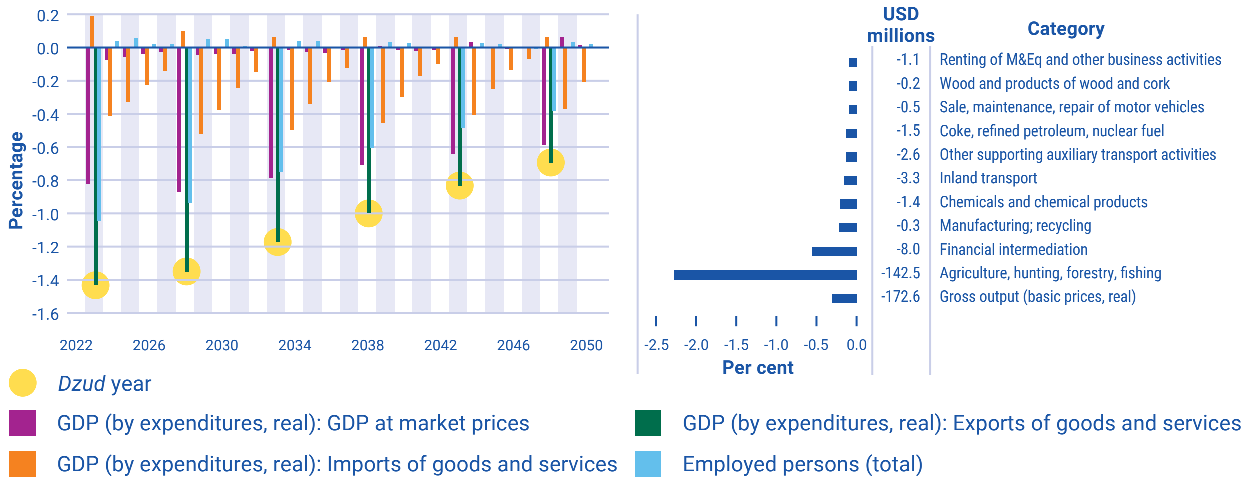
The *dzud* index[57, 58] at *soum* level for 2050 as estimated by NAMEM shows that the majority of *soums* are at high risk of *dzuds*, while a significant number are at very high risk (Figure 31).

**Figure 31** *Dzud* index by *soum* for 2050




Given their widespread impact on people, livestock and livelihoods, *dzuds* have direct economic impacts on the agriculture sector, and second/third order impacts on other sectors. A demonstration study published by Gesellschaft für Internationale Zusammenarbeit (GIZ) assumes that *dzuds* will occur every five years, and thus twice as often as in the past. Livestock losses may increase by 50 per cent by 2050[59] and are expected to double by 2100 compared to the present loss rate. Using the Gesellschaft für wirtschaftliche Strukturforschung (GWS) E3 model,[60] a study estimated that there is a loss of GDP in all *dzud* years, ranging from a loss of 1.2 per cent of GDP in 2027 to 0.8 per cent in 2042 and 0.7 per cent in 2047 (Figure 32). The model also estimates indirect losses in other sectors. The consequent impacts on energy use, emissions and employment are also modelled.[61]

**Figure 32** Impact of *dzuds* under high frequency scenario




*Source: GIZ.*

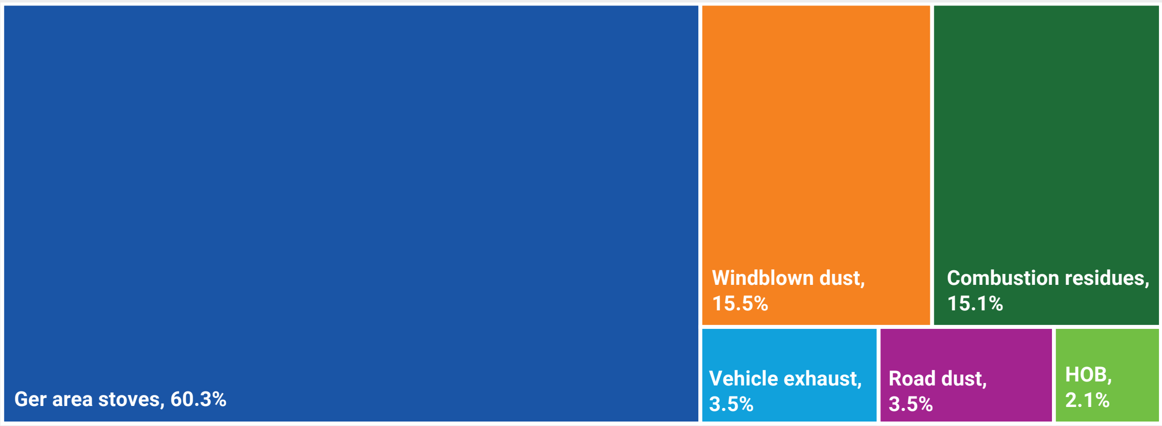
57 Dzud and aridity indexes show the impact of climate change on animal husbandry and crop agriculture in terms of potential hazards.
58 See Appendix 1: Enkh Amgalan, "Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia", ADAPT (Ulaanbaatar, UNDP, 2023).
59 Mongolia, Ministry of Environment and Tourism, *Third National Communication of Mongolia* (Ulaanbaatar, 2024).
60 Anett Großmann and Frank Hohmann, "Macroeconomic Modelling for Climate Policy Planning", Global Programme on Climate Resilient Economic Development (Bonn, GIZ, 2022). Available at https://downloads.gws-os.com/giz-2022-EN-CRED-macroeconomic-modelling-for-climate-policy-planning.pdf
61 GIZ, "Economy-wide impacts of climate change and adaptation in Mongolia", Global Programme on Climate Resilient Economic Development (Bonn, GIZ, 2023). Available at https://www.giz.de/en/downloads/giz2023-en-macro-impacts-e3-mongolia.pdf

The severity of *dzuds* and their socio-economic impacts cannot be understated. *Dzuds* have economy-wide impacts, and these are transmitted to the financial system through various channels. The transmission channels and the risks posed to the financial system are discussed in the section *Climate risks to the financial sector*.

### *Health and air pollution*

A decline in air quality is also a significant concern, especially in the capital, Ulaanbaatar, which is home to half of the country's population. According to the Global Air Quality Index, Mongolia is ranked 28th of 131 countries for air quality, with a PM2.5 (airborne particulate matter) concentration of 62 μg/m³ in 2019, 12.4 times greater than the WHO annual air quality guideline value of 5 μg/m³.[1] Raw, unrefined coal is one of the major causes in Ulaanbaatar, with coal and other combustion accounting for about 75 per cent of air pollution in the capital (Figure 33). Low-income households, particularly, use unrefined coal and timber for heating and cooking, for economic reasons.[2] These families live in the so-called *ger* districts of the city, having moved to the capital as a result of economic decline in the regions and the negative effects of climate change.

***Figure 33*** Sources of air pollution in Ulaanbaatar




*Source: ADB, adapted from World Bank, Air Quality Analysis of Ulaanbaatar: Improving Air Quality to Reduce Health Impacts (2011).*

*Note: CHP = combined heat and power plant, HOB = heat-only boiler, PM2.5 = particulate matter 2.5 microns or less in diameter. Notes: Share of PM2.5 concentrations attributed to each source. PM2.5 emissions contribute 0.04% to population exposure and are too small to show on the CHP figure.*

There is also a high risk of food insecurity and malnutrition in the country due to the compound effects of the changing climate allied with Mongolia's dependency on animal-sourced foods. The decrease in watering locations and the drying up of grazing areas in certain regions of the country might lead to a decline in income and employment options for herders, which may have further negative effects on food security and nutrition. These acute physical risks also add burdens to human health, with evidence showing that extreme climate events, specifically *dzuds*, affect household food security and can lead to low birth weight and stunting of the children of pastoralists.[3]

A recent report by the World Economic Forum quantifies the impact of climate change and pollution on human health and the resulting financial burden for society, projecting an additional 14.5 million deaths and $12.5 trillion in economic losses worldwide by 2050. Healthcare systems are expected to face an additional $1.1 trillion burden due to climate-induced impacts. The economic losses stem not only from direct healthcare costs but also from lost productivity, particularly in sectors heavily affected by climate-sensitive diseases and extreme weather events.[4]

1 IQAir, "Air quality in Mongolia". Available at https://www.iqair.com/mongolia (accessed on 10 June 2024).
2 World Health Organization, "Air pollution in Mongolia", *Bulletin of World Health Organization*, vol. 97, Issue 2 (February 2019). Available at https://doi.org/10.2471/BLT.19.020219
3 UNICEF and FAO, Climate change, nutrition, and Mongolia: A risk profile. Available at https://www.unicef.org/mongolia/media/4921/file/English.pdf
4 World Economic Forum. Quantifying the Impact of Climate Change on Human Health. Geneva: World Economic Forum, 2024. Available at https://www3.weforum.org/docs/WEF_Quantifying_the_Impact_of_Climate_Change_on_Human_Health_2024.pdf

## ▶Transition risks

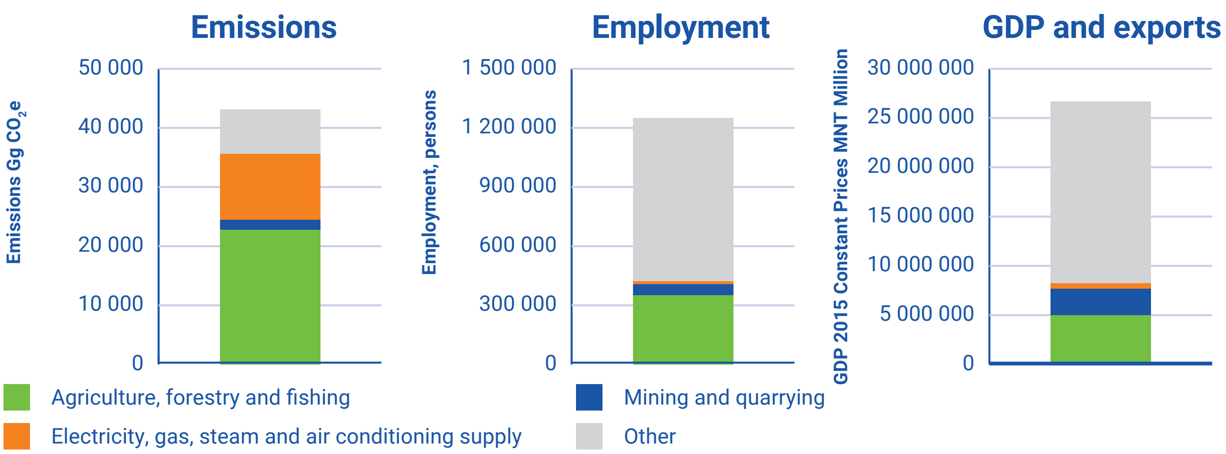
Transition risks can result from a range of policy, technology and behavioural changes (Table 3), and can impact a country's economic and financial systems depending on the structure of its socioeconomic systems. Mongolia is vulnerable to transition risks due to several structural reasons. As a lower-middle-income, commodity-driven economy, its GDP growth, employment and exports rely heavily on a few key sectors such as agriculture, mining, power generation and industry. Its energy system is coal-dependent, both for domestic use and exports, while most transportation fuels are imported. These factors increase Mongolia's exposure to both domestic transition pressures and external shifts in global energy and climate policies.

***Table 3*** Potential internal and external transition risks drivers

| Energy transition | Sustainable industry and infrastructure | Agriculture, food systems, and livestock | Pollution and resource management | Nature and ecosystem-based approaches |
|---|---|---|---|---|
| Scaling up of renewable energy | Green buildings | Sustainable and resource-efficient animal husbandry | Pollution control regulation | Nature-based solutions (NBS) implementation |
| Energy pricing policies | Energy efficient buildings | Limitation of livestock production | Policies on resource conservation | Shift towards nature positive |
| Green fuels/electric mobility | Industrial processes and product use (IPPU) | Improvement in livestock manure management | Improved waste management | Land conservation and restoration policies |
| Carbon tax on energy imports/exports | Urbanization | Shift towards sustainable food systems | Shift towards water efficiency | Biodiversity conservation |

In 2020, Mongolia's agriculture sector accounted for 15 per cent of GDP, employed 28 per cent of the workforce and generated 3.4 per cent of exports, while contributing around 53 per cent of total national emissions, making it both a major emitter and highly vulnerable to climate impacts. The mining sector, the country's leading export activity, contributed 14 per cent to GDP, 4 per cent to employment and 4 per cent to emissions, so although it has a low emissions footprint domestically, the future prospects for the sector depend on the climate policies of trade partners. The power industry is responsible for 2 per cent of GDP, 1 per cent of employment and 26 per cent of emissions, and remains heavily coal-dependent, with coal providing 96 per cent of national energy production, suggesting that decarbonizing this sector will be central to meeting emissions targets but will also pose significant transition risks to Mongolia's economy and financial system (Figure 34; Figure 35).

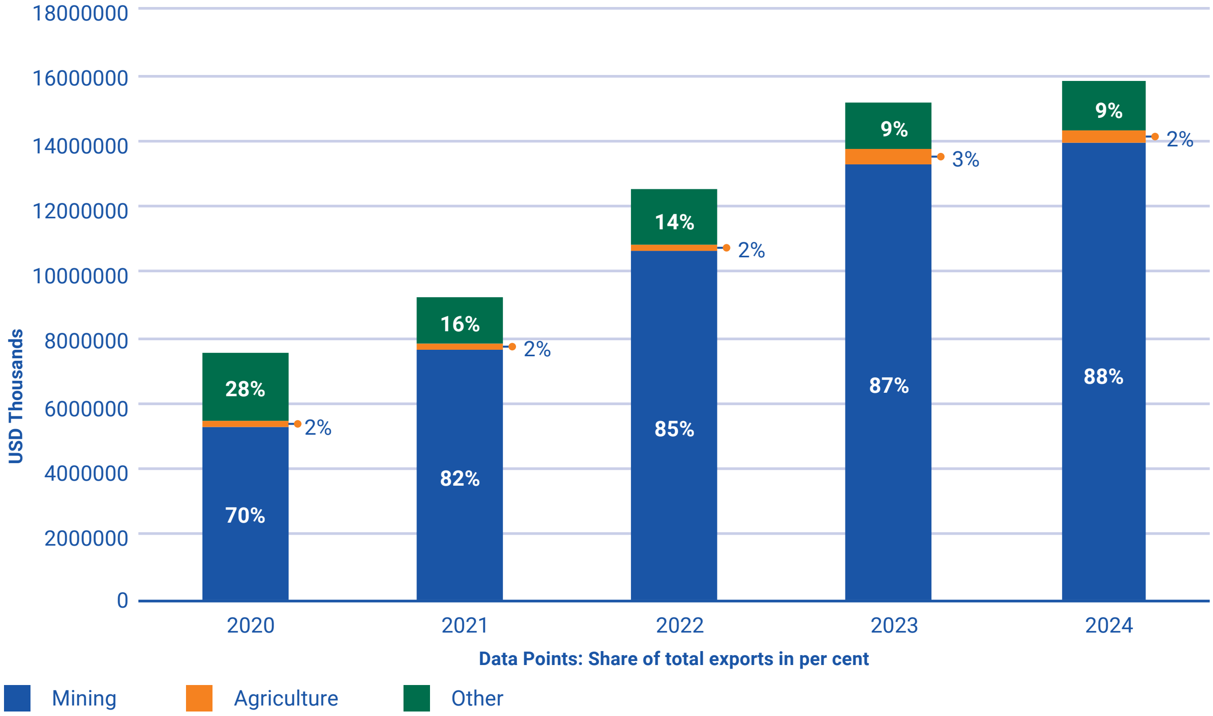
***Figure 34*** Sectorial shares of emissions, employment, GDP and exports




*Source: National Statistics Office of Mongolia; and United Nations Framework Convention on Climate Change,* Mongolia. National Communication, NC 4. *(United Nations Publication, 2024).*

*Note: For emissions, the most recent data available from the national inventory is for 2020.*

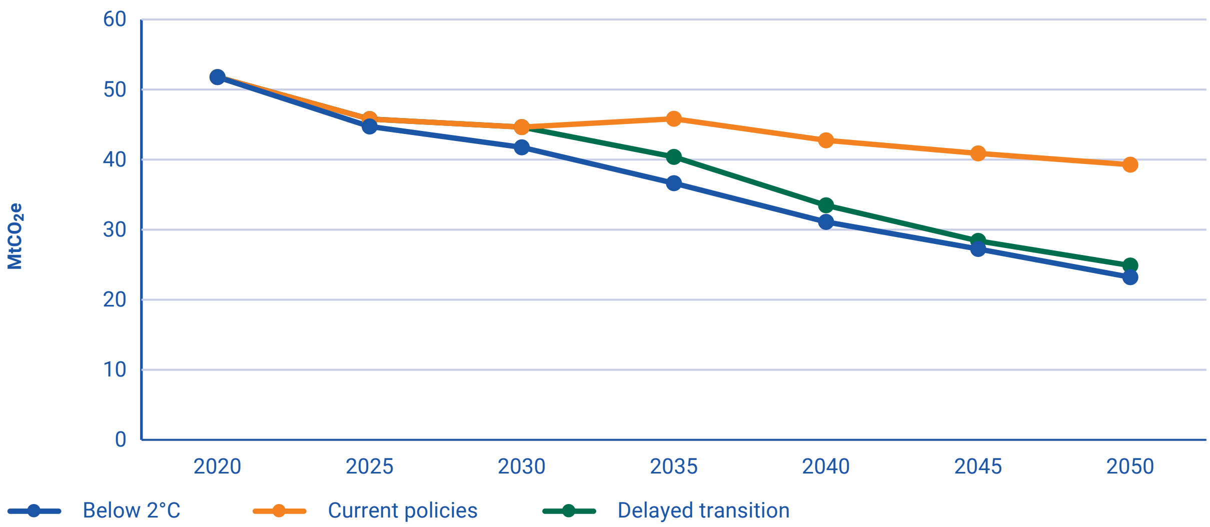
***Figure 35*** Total exports 2020-2024




*Source: ESCAP based on data from National Statistics Office of Mongolia.*

Transition risks specific to these three sectors are discussed in detail under selected NGFS scenarios. Each scenario considers a combination of policy and technology changes implemented within a given timeframe to achieve a certain temperature target. Each scenario, therefore, models a certain emissions pathway based on the timing and stringency of the policies implemented (Figure 36). The impact of the policies on the prices of commodities, fuel, energy, etc., and consequently on the economy, is modelled through a carbon price effect.[62]

***Figure 36*** Emissions pathways under selected NGFS scenarios




*Source: ESCAP based on NGFS data.*

62 See box on Shadow Carbon Prices (page 33).

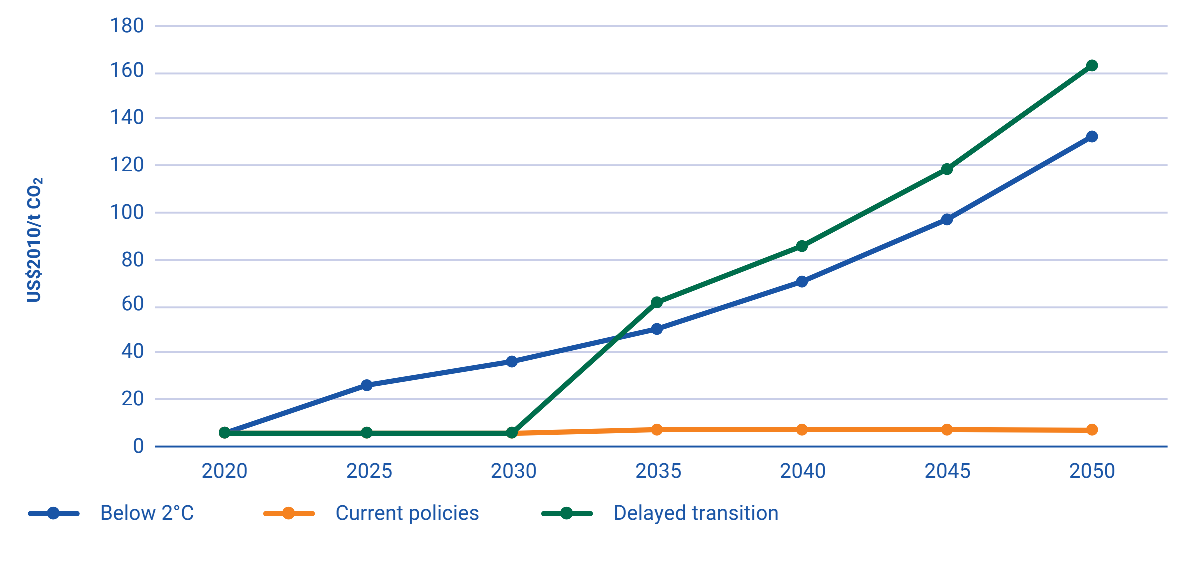
### *Shadow carbon prices*

*"A key indicator of the level of transition risk is the shadow emissions price, a proxy for government policy intensity and changes in technology and consumer preferences. A higher level of ambition to mitigate climate change translates into higher emissions prices. Models suggest that a marked increase in the (shadow) carbon price would be needed in the next decade to incentivize a transition towards net zero by 2050. Higher emissions prices are needed in the medium- to long-term if action is delayed."*[1]

The introduction of "shadow carbon prices" reflects the nee d for additional climate-related policies to meet emissions targets under various scenarios. These scenarios aim to show potential transition pathways to decarbonization, supported by climate-related policies and regulations, and by innovation and technological progress, which can also play a key role in the transition process.

Under all NGFS scenarios, carbon prices increase over the coming decades (Figure 37). Under the Current Policy scenario, reflecting no additional policy action, the price increase for Mongolia is not significant. The Below 2°C scenario assumes an immediate and gradual increase in carbon prices, signifying that immediate policy action is needed to limit warming to 1.6°C. Under the Delayed Transition scenario, there is no policy shift until 2030, hence the carbon price does not increase. However, after 2030 the delayed policy response results in a steeper price increase, with carbon prices that are 23.5 per cent higher than under a Below 2°C scenario.

***Figure 37*** Carbon price pathways under selected NGFS scenarios




*Source: ESCAP based on NGFS data.*

One way to implement carbon pricing is through carbon taxes. These are not a new idea in the region, with carbon taxes or carbon exchange trading systems in place in China, Japan, Republic of Korea, New Zealand and Singapore. Similarly Brunei Darussalam, Indonesia, the Philippines, Malaysia, Thailand and Viet Nam are also considering such instruments. However, carbon taxes will have different distributional impacts on different countries. In Mongolia, due to higher prices and lower labour income, a carbon tax of $50 per ton would lead to substantial loss of welfare for households, amounting to around 10 per cent of initial consumption. Additionally, carbon taxes may not be politically feasible in some countries. China, for example, has opted to implement an emissions trading scheme.[2]

1 International Monetary Framework, "Transition Pathways". Available at https://climatedata.imf.org/pages/ngfs (Accessed on 13 August 2025).
2 International Carbon Action Partnership, "China National ETS". Available at https://icapcarbonaction.com/en/ets/china-national-ets

# Agriculture

## Context

Policies designed to achieve net zero or net negative emissions to stabilize the global climate by the end of the 21st century[63, 64] may further limit the potential for food and livestock production, as well as limiting the continued support of rural livelihoods in the decades ahead.[65, 66] As Mongolia transitions to a low emissions economy, transition policies will impact livestock sectors and herders in various ways, such as through carbon pricing, changes in domestic and international demand for goods such as meat and cashmere, and a shift towards sustainable herding practices. Mitigation policies in the livestock sector could lead to reduced prices for animal products, while carbon or ecosystem services may result in lower incomes compared with a "no intervention [i.e. Current Policies] scenario".[67] However, since emissions from the sector are non-$CO_2$ (methane and nitrous oxides), the direct effect of carbon pricing remains uncertain. This is due to several reasons:

- Carbon pricing policies need to be evaluated based on taxing carbon emissions against taxing carbon-equivalent emissions. Predominant greenhouse gases in livestock systems include $CO_2$, $CH_4$ and $N_2O$. Methane ($CH_4$) is a powerful greenhouse gas but has a short atmospheric lifetime (~12 years), compared with 120 years for $N_2O$ and well over 500 years for $CO_2$.[68] Alternative indicators such as global warming potential (GWP)[69] have been proposed. However, this metric may penalize growth in livestock numbers, as is anticipated in low- and middle-income countries, where livestock is critical to food security. It would also give a negative $CO_2$-equivalent value in contexts with a static or declining livestock population (e.g. Australia), which would suggest cooling, which is not the case. The use of global warming potential as a metric to inform mitigation policy is thus contested, and raises concerns over how equitable it is.[70]
- There are also concerns about the applicability of existing GHG emissions mitigation strategies across livestock farming systems (e.g. intensive industrialized livestock production vs. extensive rangeland grazing systems), regions and demographics. The livestock sector in Mongolia consists of nomadic herders (with varying sizes of herds) who operate on a vast territorial scale with complex land ownership regulations. The context of the livestock sector in Mongolia differs from farmland systems in most other countries. While GHG emissions from ruminant livestock are greatest in low- and middle-income countries, with 66 per cent of emissions produced by Latin America and the Caribbean, East and South-East Asia and South Asia, the majority of mitigation strategies are designed for developed countries.[71]
- The dependence on livestock of millions of rural inhabitants globally suggests that climate change mitigation policies involving livestock must be designed with extreme care.[72] A carbon tax unsupported by distributional policies would have a regressive impact on Mongolia. Consumers in the poorest quintile would experience a loss of around 11.2 per cent compared to initial consumption, whereas households in the highest quintile would see a reduction of around 7.8 per cent.[73]

63 Intergovernmental Panel on Climate Change, AR5 Climate Change 2014: Mitigation of Climate Change. Available at https://www.ipcc.ch/report/ar5/wg3/

64 Carl-Friedrich Schleussner and others, "Differential climate impacts for policy-relevant limits to global warming: the case of 1.5°C and 2°C", *Earth System Dynamics*, vol. 7, Issue 2 (April 2016). Available at https://doi.org/10.5194/esd-7-327-2016

65 Pete Smith and others, "How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals?", *Global Change Biology*, vol. 19, Issue 8 (May 2013). Available at https://doi.org/10.1111/gcb.12160

66 Tomoko Hasegawa and others, "Scenarios for the risk of hunger in the twenty-first century using Shared Socioeconomic Pathways", *Environmental Research Letters*, vol. 10, No. 1 (January 2015). Available at https://iopscience.iop.org/article/10.1088/1748-9326/10/1/014010

67 Matthew Tom Harrison and others, "Carbon myopia: the urgent need for integrated social, economic and environmental action in the livestock sector", *Global Change Biology*, vol. 27, No. 22 (July 2021). Available at: https://doi.org/10.1111/gcb.15816

68 Intergovernmental Panel on Climate Change, "Anthropogenic and Natural Radiative Forcing" in *Climate Change 2013 – The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change, ed. (Cambridge, Cambridge University Press, 2014).

69 Global warming potential compares CO2 emissions to date with the current rate of emissions of short-lived climate pollutants (SLCPs). To calculate it requires two emissions measurements over a period of time (Δt), which in the case of CH4 is usually 20 years.

70 Joeri Rogelj and Carl-Friedrich Schleussner, "Unintentional unfairness when applying new greenhouse gas emissions metrics at country level", *Environmental Research Letters*, vol. 14, No. 11 (November 2019). Available at https://iopscience.iop.org/article/10.1088/1748-9326/ab4928

71 Matthew Tom Harrison and others, "Carbon myopia: the urgent need for integrated social, economic and environmental action in the livestock sector", *Global Change Biology*, vol. 27, No. 22 (July 2021). Available at: https://doi.org/10.1111/gcb.15816

72 Petr Havlík and others, "Climate change mitigation through livestock system transitions", *PNAS*, vol. 111, No. 10 (February 2014). Available at: https://doi.org/10.1073/pnas.1308044111

73 Cristian Alonso and Joey Kilpatrick, *The Distributional Impact of a Carbon Tax in Asia and the Pacific*, IMF Working Paper, 2022/116 (Washington, D.C., IMF, 2022) Available at: https://doi.org/10.5089/9798400212383.001

## Policies supporting transition

To tackle challenges in the livestock sector and align with global sustainability efforts, Mongolia's Ministry of Agriculture (MOFALI) implemented the *Mongolian Sustainable Livestock Development Plan (2018-2020)*,[74] aiming to address issues in the livestock sector at an adequate level, ensure consistency with approved programmes, and increase Mongolia's contribution to the *Global Agenda for Sustainable Livestock Action Plan*.[75] This plan complements the *Law on Crop Farming (2016)*,[76] which focuses on soil health, for a more comprehensive approach to sustainable agriculture. In addition, the following government resolutions were approved: *The Mongolia Vegetable Project*,[77] *The National Programme on Fruits and Berries*[78] and *The Atar-IV Campaign*.[79] The newly approved policy documents regarding the mitigation of emissions in the agriculture sector are: *Vision-2050*,[80] *The Nationally Determined Contribution to the Implementation of the Paris Agreement*, *State Policy on Forests*,[81] Mongolia's *Five-Year Development Guidelines for 2021-2025*,[82] and the *Action Plan for the Implementation of the Green Development Policy 2016-2030*.[83] The main objectives of such interventions in the livestock sector are to establish upper limits on the number, type and structure of animals in accordance with natural ecology and grazing capacity, and to reduce the number of livestock; to implement animal manure management; to promote the protection of animal health; and to increase the level of agricultural products for processing and animal export.[84]

## Indirect price effects and change in demand

Pastoralists in Mongolia's Gobi Desert are particularly exposed to fluctuating commodity prices.[85] Shocks such as the outbreak of COVID-19 can have a negative effect on cashmere prices – the Mongolian cashmere industry experienced a significant price drop from $38/kg in 2019 to $24-$27/kg in 2020.

As stringent emission reduction policies are implemented, sectors such as transportation (important for fodder and livestock), machinery imports and fuel (for energy and transport) would be increasingly impacted by rising carbon prices. For example, a 2018 study into the direct and indirect impacts of carbon pricing on Canadian beef producers found there was a substantial loss of revenue and producer surplus due to the introduction of carbon taxes, and that producers have limited ability to pass on the increases through input prices.[86]

Under the Below 2°C scenario, the carbon prices required to abate emissions would increase gradually, which could lead to increased input prices for the livestock sector. Under the Delayed Transition scenario, carbon prices would need to increase by a larger magnitude and more steeply from 2030. Under the Below 2°C scenario, the price of fuel increases by 37 per cent by the end of the century compared to the Current Policy scenario (Figure 38). Short and medium-term effects under the current model are not significant. However, the cost of fuel would directly translate to higher transportation costs for herders, as they depend on transportation directly to move their animals to the point of sale. For those who can afford transport costs, geographical variation in commodity prices changes how pastoralists sell their livestock or livestock products. Commodity prices at different provincial centres vary depending on their

74 Asian Development Bank, Sector Assessment (Summary): Agriculture, Natural Resources, and Rural Development. Available at https://www.adb.org/sites/default/files/linked-documents/53038-001-ssa.pdf

75 Food and Agriculture Organizations of the United Nations, "Global Agenda for Sustainable Livestock". Available at https://www.fao.org/partnerships/livestock-dialogue

76 Mongolia, *Law of Mongolia on crop farming*, chap. 1 (29 January 2016).

77 Swiss Confederation, "Mongolian Vegetable Project Celebrates Success in Sustainable Agriculture", 08 November 2023. Available at https://www.dfae.admin.ch/countries/mongolia/en/home/news/news.html/content/countries/mongolia/en/meta/news/2023/VEGI

78 Food and Agriculture Organizations of the United Nations, Improving fruit and berry production in Mongolia. Available at https://openknowledge.fao.org/server/api/core/bitstreams/b3eb1285-a657-4bc6-b8d0-9d4f965010a2/content

79 The state great hural / parliament/ of Mongolia, "MPs submit a bill to continue the exemption of agricultural machinery and supplies from Customs Duty and VAT", 26 January 2021. Available at https://www.parliament.mn/en/nn/13779/

80 Vision 2050 Mongolia, "Vision 2050". Available at https://vision2050.gov.mn/eng/index.html

81 Jamsran Tsogtbaatar, "Forest Policy Development in Mongolia ", CDR Law working papers (New York City, Sabin Center for Climate Change Law, 2004). Available at https://cdrlaw.org/resources/forest-policy-development-in-mongolia/

82 Mongolia, Cabinet Secretariat of Government of Mongolia, *Mongolia's five-year development guidelines for 2021-2025* (Ulaanbaatar, 2020).

83 Mongolia, Ministry of Environment, Green development, and Tourism, *Action plan, green development policy of Mongolia* (Ulaanbaatar, 2014).

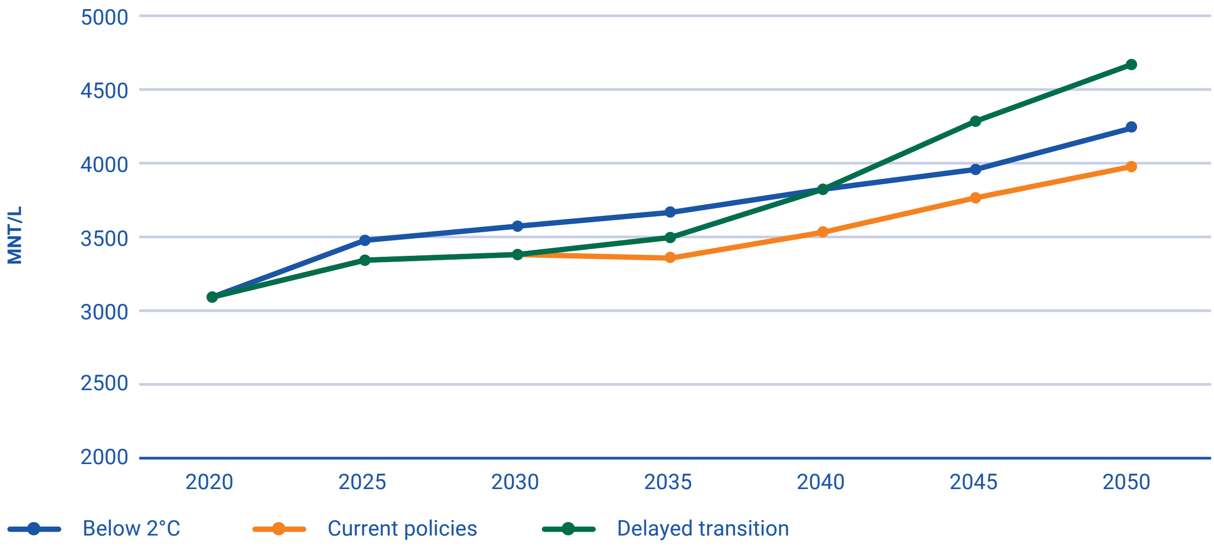
84 Mongolia, Ministry of Environment and Tourism, *Fourth national communication of Mongolia* (Ulaanbaatar, 2024).

85 Jane Addison and Colin G. Brown, "A multi-scaled analysis of the effect of climate, commodity prices and risk on the livelihoods of Mongolian pastoralists", *Journal of Arid Environments*, vol. 109 (October 2014). Available at https://doi.org/10.1016/j.jaridenv.2014.05.010

86 Brandon Schaufele, "Carbon Taxes and Cattle: Evidence From Canadian Feedlots", *SSRN Research Paper Series* (May 2018). Available at https://dx.doi.org/10.2139/ssrn.3165735

proximity to the major markets. This may reflect the easier access of some markets to the Ulaanbaatar market, which is both larger and more competitive than the markets of any *aimag*. In contrast, cashmere prices can be higher closer to the Chinese border.[87] At the same time, mobility over longer distances also involves upfront costs and, sometimes, difficult pastoralist-to-pastoralist negotiations, so the relative economic trade-offs of mobility with other risk management tools need to be assessed.[88]

**Figure 38** Price of secondary energy liquids (oil and biomass) pathways under selected NGFS scenarios




*Source: ESCAP calculations based on data from NGFS.*

The price and availability of hay bales in years with low pasture yields could also be impacted by higher fuel and transportation costs due to carbon pricing, since commercial fodder available to Gobi Desert pastoralists is largely produced in northern Mongolia and delivered to *soum* and *aimag* centres throughout the country.[89]

Higher input prices could drive livestock prices higher in general, which is reflected in the livestock price index for Mongolia. Livestock price volatility can be seen across different scenarios (Figure 39). Higher prices of livestock could impact the overall demand for Mongolian livestock products in both domestic and export markets. For Mongolia, which is a price taker, higher costs of products such as cashmere can make exports less competitive on international markets, especially when competing with other production centres such as China.

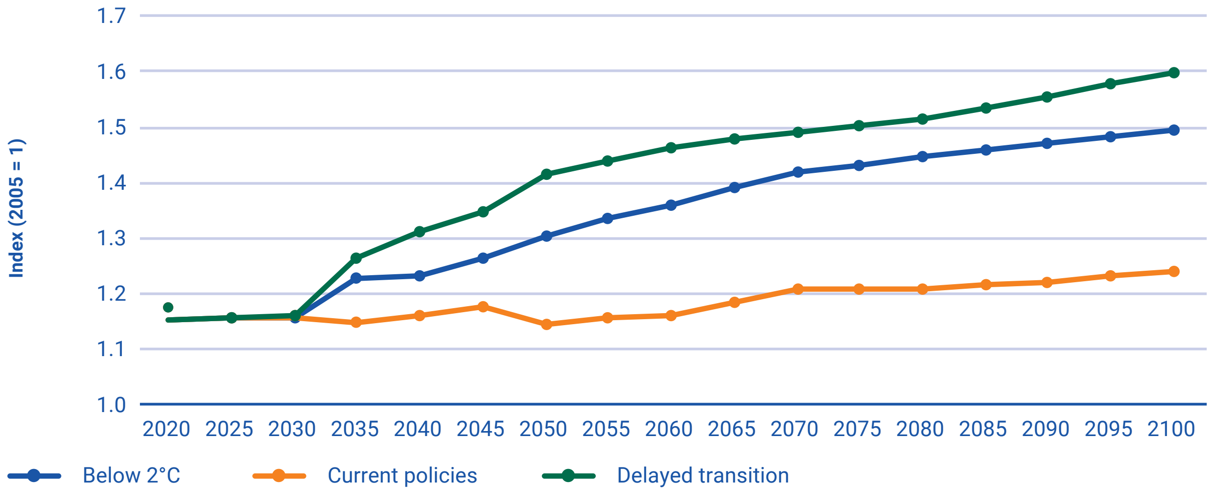
Thus, the transition risks to the Mongolian agriculture sector can be seen to depend on the indirect costs of carbon and emissions. Higher costs to herders and lower demand could impact the profitability of livestock products and hence herders' income. The profitability of the livestock sector would also determine its sustainability. If the livestock sector is not able to provide sustainable livelihoods for the herder population, there are also risks of higher urban migration.

87 Eiichi Kusano and Izuru Saizen, "Spatial Market Integration of Livestock Products and Road Conditions in Mongolia", *Japan Agricultural Research Quarterly*, Vol. 47, No. 4 (2013). Available at https://doi.org/10.6090/jarq.47.423

88 Jane Addison and Colin G. Brown, "A multi-scaled analysis of the effect of climate, commodity prices and risk on the livelihoods of Mongolian pastoralists", *Journal of Arid Environments*, vol. 109 (October 2014). Available at https://doi.org/10.1016/j.jaridenv.2014.05.010

89 Idem.

***Figure 39*** Agriculture and livestock price pathways under selected NGFS scenarios



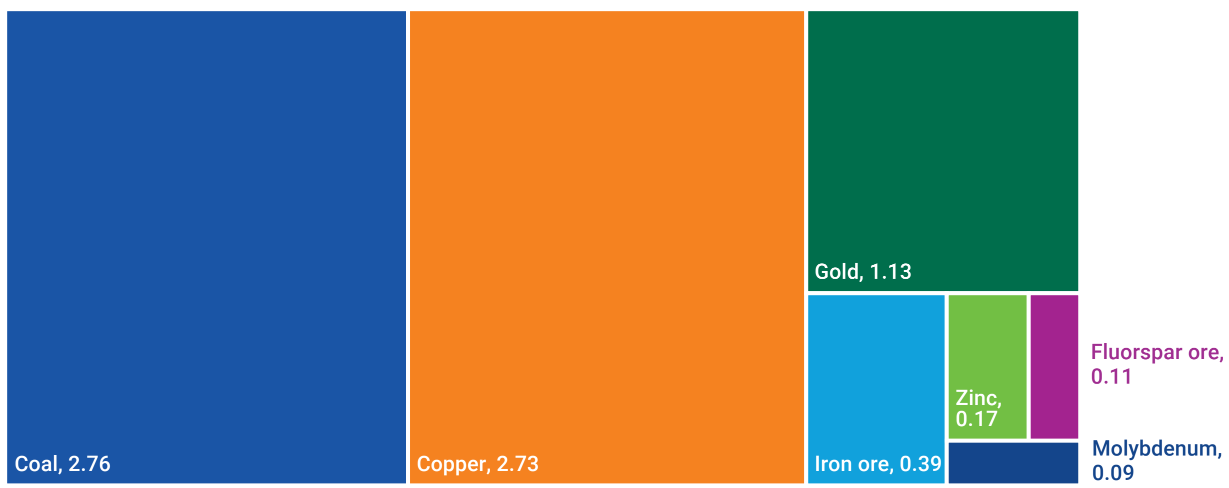

*Source: ESCAP calculations based on data from NGFS.*

# ▶Mining

## Context

Early economic development following the collapse of the Soviet Union primarily depended on nomadic herding across Mongolia's vast lands. However, since the 2000s the key driver of growth has been the mining industry, with 8 of Mongolia's 21 regions contributing to GDP through mining. The mining industry in Mongolia is driven by coal, copper, gold and iron, (Figure 40) which together account for 240 out of 432 operating mines.[90]

***Figure 40*** Export of key mining products in $ billion in 2022[91]




*Source: ESCAP Visualization based on data from National Statistics Office of Mongolia.*

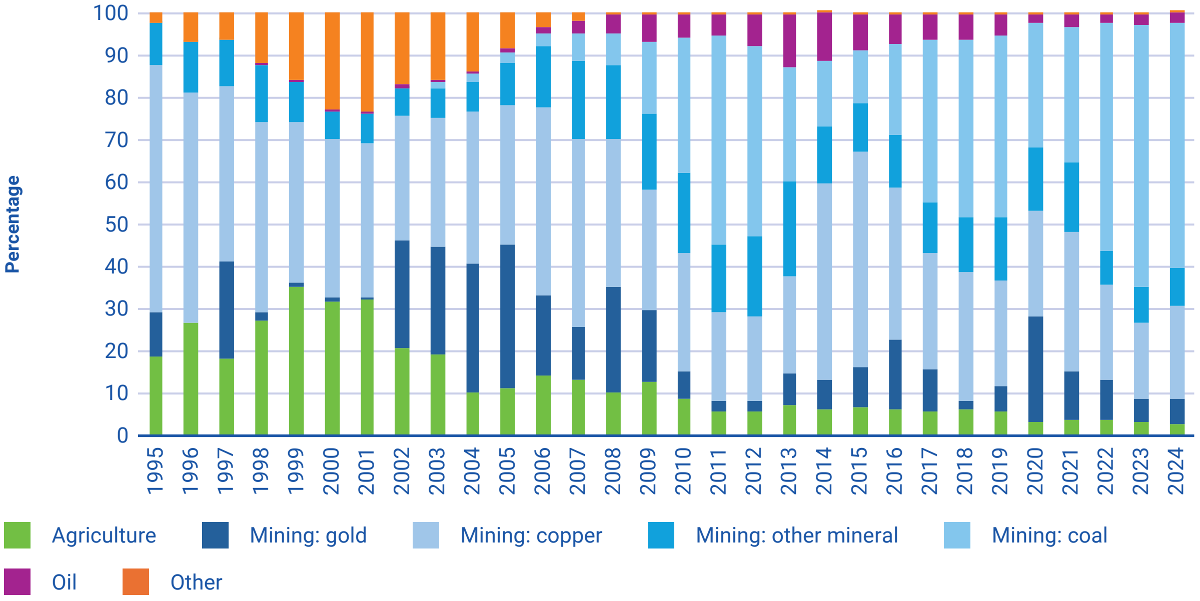
Mining employs 5.7 per cent of the total working population and has a male-dominated workforce (86 per cent). In 2023, mining exports (copper, coal, gold, unrefined crude oil, iron ore, etc.) accounted for 87 per cent of total exports, equivalent to 65 per cent of GDP. However, while exporting goods and services accounted for 75.4 per cent of GDP, in 2023 Mongolia also imported goods and services equivalent to 65.9 per cent of its GDP.[92]

90 East Asia Forum, "Mongolia's unsustainable mining bonanza", 09 September 2022. Available at https://eastasiaforum.org/2022/09/09/mongolias-mining-bonanza-is-unsustainable/

91 OEC, "Mongolia". Available at https://oec.world/en/profile/country/mng

92 National Statistics Office, Government database (accessed on 4 June 2024).

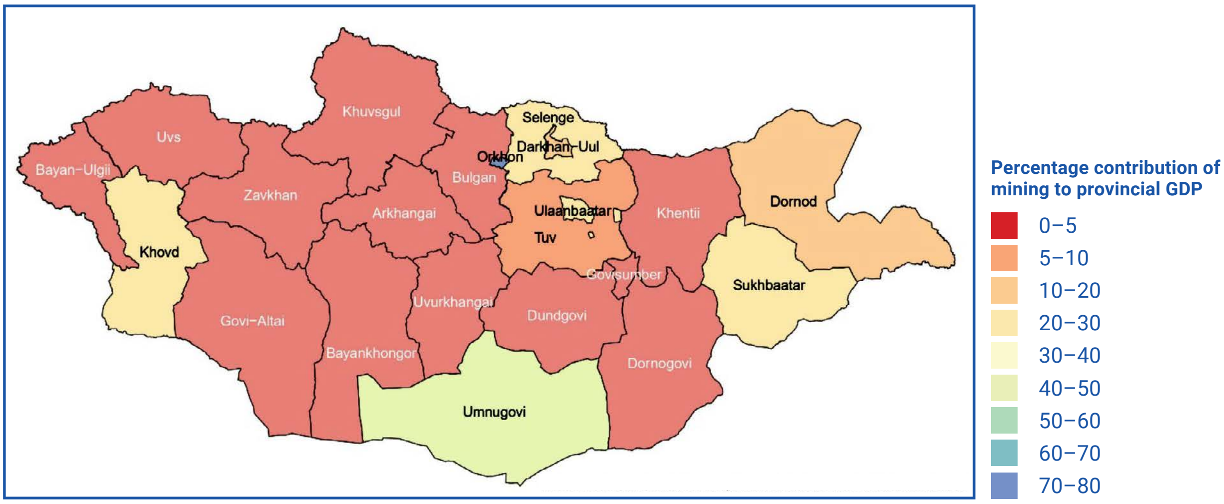
***Figure 41*** Percentage of exports of key commodities




*Source: ESCAP based on data from National Statistics Office of Mongolia.*

From 1995 to 2007, mineral exports accounted for nearly all of Mongolia's export earnings, reflecting the country's heavy reliance on the extractives sector (Figure 41). From 2008, coal exports expanded significantly, becoming a key export alongside minerals, and further reinforcing Mongolia's dependence on mining. This trend underscores Mongolia's persistent vulnerability to global commodity markets and the limited diversification of its export base beyond the mining sector.

***Figure 42*** Percentage contribution of mining to provincial GDP




*Source: ESCAP based on data from National Statistics Office of Mongolia.*

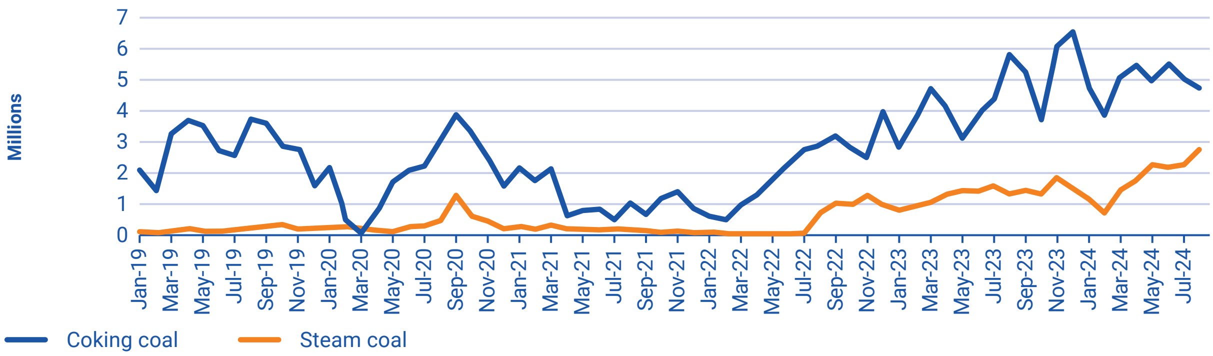
The mining sector is concentrated in a few provinces (Figure 42). In Orkhon and Umnugovi provinces, mining remains the main contributor to provincial GDP. Orkhon is home to three large copper mines that contribute 80 per cent to its provincial GDP and 6.22 per cent to national GDP. Umnugovi, in the South Gobi Desert region bordering China, has 32 mines, including the Oyu Tolgoi copper mine, and contributes 5.34 per cent to national GDP. Apart from mining, which contributes almost 50 per cent to the province's GDP, key sectors are mining services (36.34 per cent) and trade, hotels and restaurants (15.7 per cent). All the other provinces have less than a 2 per cent share of mining.[93]

93 World Bank, The Role of the State in Mongolia's Mining Sector, 169994. Available at https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099440103302228061/p173631074c7de069090eb01f85e276b405

The majority of the coal extracted in Mongolia is exported, Mongolia being among the top 10 coal exporters of the world, and the fifth largest seaborne metallurgical coal supplier. One third of Mongolia's coal is coking coal, which is an essential raw material for steelmaking and currently the only commercially viable method to produce new steel.

China is Mongolia's largest trading partner, with Mongolian coking coal accounting for a large share. Following a slump during the COVID pandemic, coal exports to China have bounced back, returning to pre-COVID levels by 2022, surging by 125 per cent to 70 million tonnes in 2023, and continuing to grow in 2024. Approximately 75 per cent of coal exports to China are coking coal, making Mongolia China's largest supplier of this resource – in 2023, 53 per cent of China's coking coal imports came from Mongolia. (Figure 43).

***Figure 43*** Coal imports to China from Mongolia




*Source: How China's New Silk Road is Impacting Maritime Coal Transport, Veson Nautical 2024.*

## Policies supporting transition

The main policy documents addressing the growing emissions produced by Mongolia's rapidly expanding industrial sector are the following: *Green Development Policy 2014-2030*,[94] *State Industrial Policy of Mongolia*,[95] *Mongolia Sustainable Development Vision-2030*,[96] *Government Action Programme 2016-2020*,[97] *State Policy on the Construction Industry of Mongolia 2018-2029*,[98] *Vision–2050*,[99] *National Programme for the Development of Heavy Industry*[100] and Mongolia's *Five-Year Development Guidelines for 2021-2025*.[101] Additionally, newly implemented programmes and measures are also in place: *Action Plan for the Implementation of the Green Development Policy 2016-2030*,[102] *National Programme for the Reduction of Air and Environmental Pollution 2017-2025*, *Industrialization 21:100 (2018-2021)*,[103] *Action Plan for the Implementation of Nationally Determined Contribution*,[104] *Implementation of the Government Action Plan 2020-2024*,[105] and *National Programme for the Development of Heavy Industry*.[106] All of the newly introduced policies aim for dry technology in cement production, increasing productivity through advanced technology, and meeting demand through domestic production.[107]

94 Green Finance Platform, "Mongolia's Green Development Policy and Action", 2016. Available at https://www.greenfinanceplatform.org/policies-and-regulations/mongolias-green-development-policy-and-action-plan
95 Battogtokh Dorjgotov, *The industry policy of Mongolia* (Ulaanbaatar, Ministry of Industry, 2015). Available at https://www.cieca.org.tw/v_comm/inc/download_file.asp?re_id=2998&fid=33668
96 Food and Agriculture Organization of the United Nations, "Mongolia", FAOLEX Database. Available at https://www.fao.org/faolex/results/details/en/c/LEX-FAOC184386/ (accessed on 4 June 2024).
97 Mongolia, *Government Action Programme 2016-2020* (Ulaanbaatar, 2016). Available at https://policy.asiapacificenergy.org/sites/default/files/Government%20Action%20Programme%202016-2020%20%28EN%29.pdf
98 Mongolia, *Law on Construction*, chap. 1 (05 February 2016). Available at https://legalinfo.mn/en/edtl/16230949269721
99 Vision 2050 Mongolia, "Vision 2050". Available at https://vision2050.gov.mn/eng/index.html
100 Ministry of Mining and Heavy Industry, "Heavy Industry Policy Department". Available at https://mmhi.gov.mn/en/section-and-department/heavy-industry-policy-department/
101 Mongolia, Cabinet Secretariat of Government of Mongolia, *Mongolia's five-year development guidelines for 2021-2025* (Ulaanbaatar, 2020).
102 World Economic Forum, Quantifying the Impact of Climate Change on Human Health. Available at https://www3.weforum.org/docs/WEF_Quantifying_the_Impact_of_Climate_Change_on_Human_Health_2024.pdf
103 Swiss Agency for Development and Cooperation SDC, Cooperation Strategy Mongolia 2018–2021. Available at https://www.fdfa.admin.ch/content/dam/deza/en/documents/laender/swiss-cooperation-strategy-mongolia-2018-2021_EN.pdf
104 Mongolia, *Mongolia's nationally determined contribution to the United Nations framework convention on climate change* (Ulaanbaatar, 2022). Available at: https://unfccc.int/sites/default/files/NDC/2022-06/First%20Submission%20of%20Mongolia%27s%20NDC.pdf
105 Erdenejargal.E, "Implementation of government's 2020-2024 action plan is 48.9 percent", Montsame, 17 August 2022. Available at https://montsame.mn/en/read/302265
106 Unurzul.M, "Program on Heavy Industry Development approved", Montsame, 29 May 2019. Available at https://montsame.mn/en/read/191059
107 Mongolia, Ministry of Environment and Tourism, *Fourth national communication of Mongolia* (Ulaanbaatar, 2024).

Mongolia's *Development Guidelines for 2021-2025*[108] are aligned with its development policy and legislation, and outline specific measures, monitoring and evaluation criteria and investment strategies to drive economic growth. A key focus is on supporting exports of the country's most abundant mineral resources, including coal, copper concentrate, iron ore and crude oil, as well as plans to expedite the development and launch of heavy industries such as coal-chemical processing, copper concentrate refinement and metallurgy.

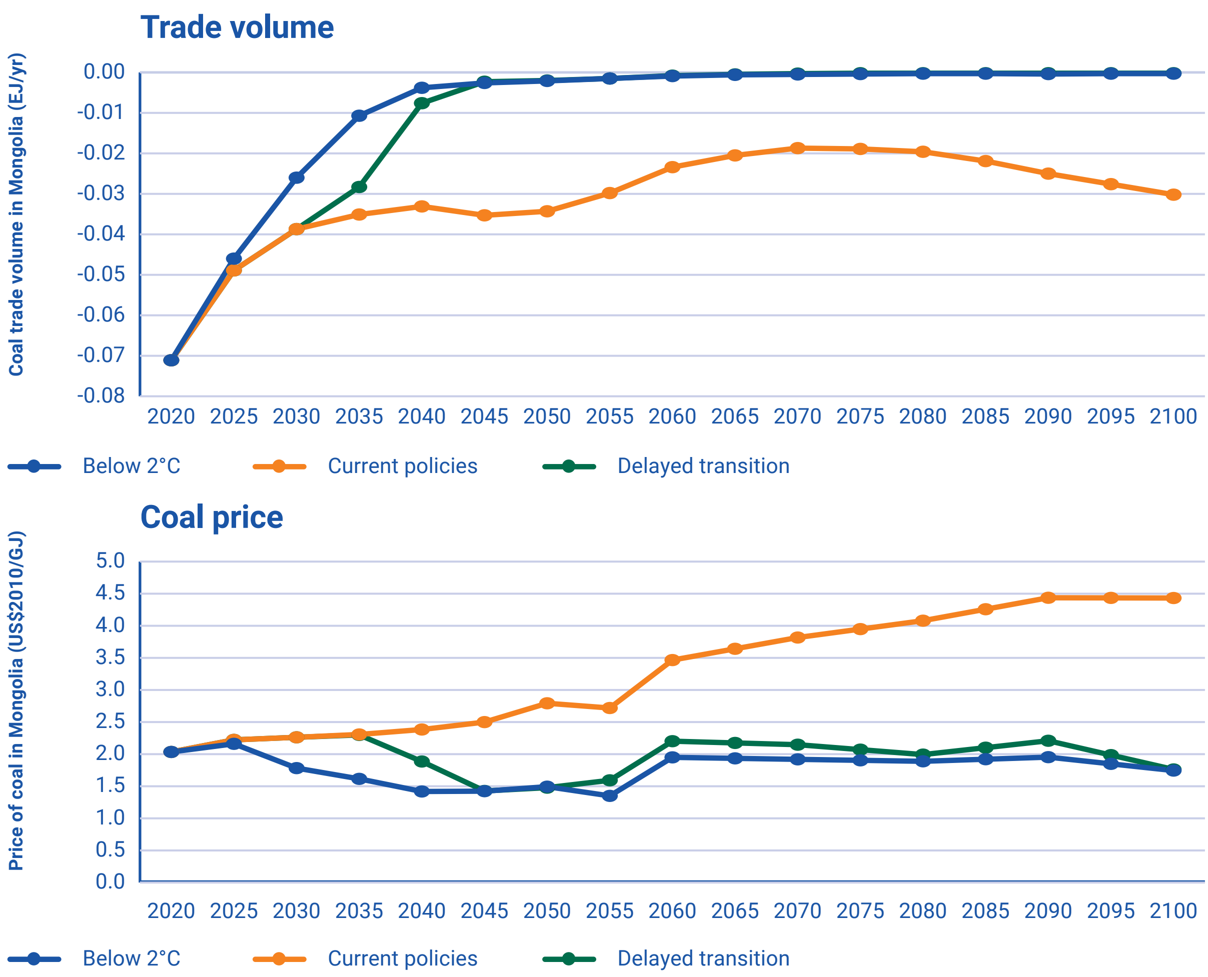
## Transition risks to the sector

The mining sector is particularly vulnerable to climate change.[109] It faces both direct (operational and performance-based) impacts and indirect ones (through supply chains and rising energy costs). External risks in the transition to a sustainable, low-carbon future will bring high risks of stranded assets, which can develop into write-offs, devaluations or conversion to liabilities.

## Lower demand for coal exports

High dependency on coal mining exports to China make Mongolia particularly vulnerable to external transition risks from China in the form of changes in policies, regulations and laws to facilitate a shift toward a greener, low-carbon economy.

***Figure 44*** Trade volume and primary energy price pathways under selected NGFS scenarios




*Source: ESCAP calculations based on data from NGFS.*

108 Mongolia, Cabinet Secretariat of Government of Mongolia, *Mongolia's five-year development guidelines for 2021-2025* (Ulaanbaatar, 2020).

109 Douglas J. Arent and others, "Key economic sectors and services" in *Climate Change 2014 Impacts, Adaptation and Vulnerability: Part A: Global and Sectoral Aspects* (Cambridge, Cambridge University Press, 2015). Available at https://doi.org/10.1017/CBO9781107415379.015

Coal exports under all NGFS scenarios decrease until the end of the century (Figure 44). This is due to the decreasing demand for coal even under the Current Policies scenario. Under the Below 2°C scenario there is a significant drop in coal exports from Mongolia by 2030, and total trade in coal approaches negligible amounts by the end of the century. Under the Delayed Transition scenario, demand decreases gradually until 2030, but following rapid policy shifts in 2030, the trade of coal decreases steeply from 2035 onwards to meet climate goals.

Under both the Below 2°C and Delayed Transition scenarios, lower demand is reflected in lower coal prices. Under the former, prices drop immediately and decrease progressively to 2050, after which they stagnate to the end of the century. A similar trend is seen in the latter, with prices dropping after 2030-2035. Under the Current Policies scenario, prices increase and emissions reduction is not sufficient to meet climate goals.

### *China's transition towards a low carbon economy*

China's first nationally determined contribution (NDC) submission to UNFCCC has clear pathways to strictly control and limit coal-fired power generation and phase it down further during the 15th Five-Year Plan.[1] Coal-based energy consumption dropped from 63.8 per cent in 2015 to 56.8 per cent in 2020,[2] while renewable and clean energy increased to 24.3 per cent.[3]

China's national emissions trading scheme is the largest in terms of emissions covered (4.5 billion $tCO_2$ in 2019 and 2020).[4] In 2023, the carbon price in China was $8 per ton,[5] while the EU equivalent was trading at around $107 per ton.[6] Carbon reduction targets in terms of carbon emissions per unit of GDP are 65 per cent compared to 2005 levels.[7] In 2020, carbon intensity in China decreased by 48.4 per cent compared to 2005 levels.[8]

Given China's ambitious target of being carbon neutral by 2060, there is a strong shift towards renewable energy in China.[9] A combination of decreasing demand for coking coal from China, plus a potential price increase for coal-related emissions caused by the emissions trading system, could cause significant external transition risk for Mongolia.

1 The People's Republic of China, *China's Achievements, New Goals and New Measures for Nationally Determined Contributions* (Beijing, 2022). Available at https://unfccc.int/sites/default/files/NDC/2022-06/China%E2%80%99s%20Achievements%2C%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

2 National Bureau of Statistics China, "Total Energy Consumption". Available at https://data.stats.gov.cn/english/easyquery.htm?cn=C01 (accessed on 13 August 2025).

3 National Energy Administration, "More than 24%, clean energy "wind and solar power are good"", 13 August 2021. Available at https://www.nea.gov.cn/2021-08/13/c_1310125638.htm

4 Tan Luyue, "The first year of China's national carbon market, reviewed", Dialogue Earth, 17 February 2022. Available at https://dialogue.earth/en/business/the-first-year-of-chinas-national-carbon-market-reviewed/

5 Gibson Dunn, Carbon Markets Update - Q3 2023. Available at https://www.gibsondunn.com/wp-content/uploads/2023/10/carbon-markets-update-q3-2023.pdf

6 Frank Jordans, "EU carbon price passes symbolic 100 euros as reforms bite", AP News, 22 February 2023. Available at https://apnews.com/article/politics-european-union-europe-business-climate-and-environment-a0ada72d40ef5bef586d95b83213ef79

7 The People's Republic of China, *China's Achievements, New Goals and New Measures for Nationally Determined Contributions* (Beijing, 2022). Available at https://unfccc.int/sites/default/files/NDC/2022-06/China%E2%80%99s%20Achievements%2C%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

8 The State Council - The People's Republic of China, "China outperforms its carbon intensity reduction commitment", 2 January 2024. Available at https://english.www.gov.cn/news/202401/02/content_WS6593c9a0c6d0868f4e8e2b62.html

9 The People's Republic of China, *China's Achievements, New Goals and New Measures for Nationally Determined Contributions* (Beijing, 2022). Available at https://unfccc.int/sites/default/files/NDC/2022-06/China%E2%80%99s%20Achievements%2C%20New%20Goals%20and%20New%20Measures%20for%20Nationally%20Determined%20Contributions.pdf

## Risk of stranded assets

Mongolia has 34.6 billion tons of proven coal reserves remaining.[110] However, with the possibility that coal production will be curtailed in the future under several scenarios, there is a great risk of more companies being left with stranded assets. Similar examples include the French multinational energy and petroleum company Total Energies, which had to write off Can$9.3 billion in assets in tar sands/oil sands, including

110 Lorena Stancu and others, "Mongolia Mining 2024", Global Business Reports Series (Singapore, Global Business Reports, 2024). Available at https://www.gbreports.com/files/pdf/_2024/Mongolia_Mining-2024-GBR_Series-web-final.pdf

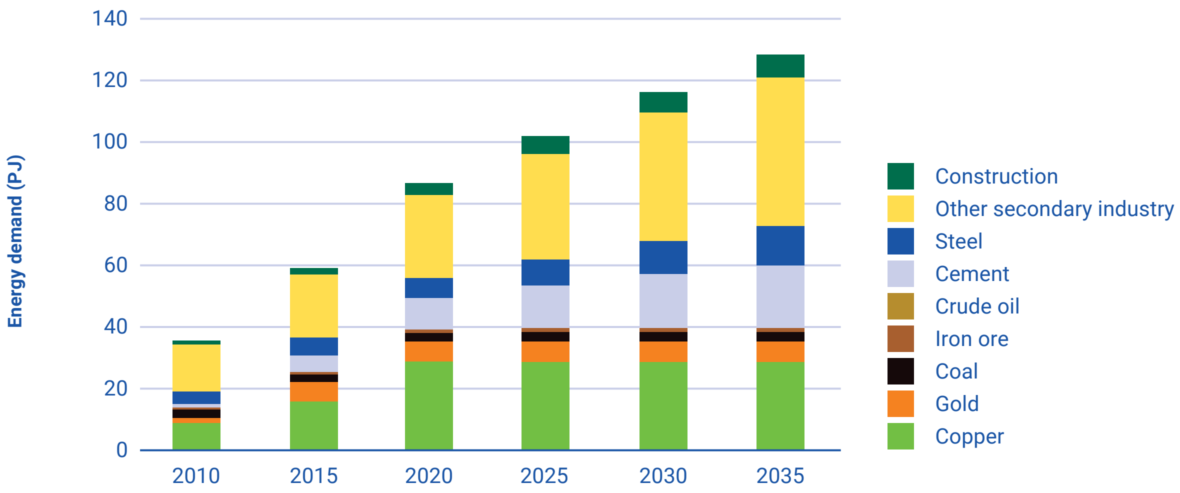
Can$7.3 billion in the Fort Hills mine in Canada, which closed just 2.5 years after it was inaugurated, and the nearby Surmont thermal oil sands project. The company defines stranded assets as meaning with reserves beyond 20 years and high production costs, with overall reserves that may therefore not be produced by 2050.[111]

## Direct and indirect impacts of carbon pricing

Total $CO_2$ emissions vary across the industry, largely depending on the type of resource being mined and the design and nature of the mining process. However, mining is an energy-intensive process and the cost of mining operations could be indirectly impacted by energy costs. It is widely recognized that available mining deposits are increasingly deep and of declining ore grade. This will lead to growing demands for water as well as greater mine waste, thereby raising energy consumption and increasing the industry's climate footprint.[112]

Diesel fuel accounts for nearly half of the energy consumed by the mining industry, as it is used in heavy mining equipment and the machinery used to extract minerals from the earth. The second greatest source of energy in the mining sector is electricity. For example, the Oyu Tolgoi copper and gold mine in the South Gobi region is a major electricity user.[113] Energy demands for the mining sector are projected to increase further (Figure 45). A higher carbon price will increase the costs of electricity and fuel, and thus increase the operational costs of mines. The profitability of the mines would then depend on the ability of businesses to pass this price on. However, this would largely depend on prices on the commodity markets.

***Figure 45*** Energy demand by subsector in the industrial sectors




*Source: Oyunchimeg et al. (2020).*[114]

## Environmental and social risks

Not only are climate-induced organizational and operational risks to mining activities significant in and of themselves, but the associated reputational risks to organizations, as well as to their social licence to operate, may be permanently fatal.[115] From an internal transition perspective, holders of mining exploration and exploitation licences must comply with environmental protection laws, minerals laws,

111 Total Energies, "Short term price revision and Climate Ambition: Total announces exceptional 8 B$ asset impairments including 7 B$ in Canadian oil sands", 29 July 2020. Available at https://totalenergies.com/media/news/short-term-price-revision-and-climate-ambition-total-announces-exceptional-8-b-asset

112 Climate Diplomacy, Climate change and mining: A foreign policy perspective. Available at https://climate-diplomacy.org/sites/default/files/2020-10/Report-Climate-Diplomacy-Climate-Change-and-Mining.pdf

113 Oyunchimeg Ch. and others, "Report of the Mongolia working group to the nautilus institute regional energy security (res) project", NAPSNet Special Reports (Berkeley, Nautilus Institute, 2020). Available at https://nautilus.org/wp-content/uploads/2020/09/Mongolia-Working-Group-Full-Report-SR-PDF-Sep8-2020.pdf

114 Oyunchimeg Ch. and others, "Report of the Mongolia working group to the nautilus institute regional energy security (res) project", NAPSNet Special Reports (Berkeley, Nautilus Institute, 2020). Available at https://nautilus.org/wp-content/uploads/2020/09/Mongolia-Working-Group-Full-Report-SR-PDF-Sep8-2020.pdf

115 International Council of Mining 7 Metals, Annual Review 2013 - Strengthening relationships with communities. Available at https://www.icmm.com/website/publications/pdfs/annual-review/2013_icmm_annual-review.pdf

laws prohibiting exploration and exploitation of minerals in water heads and protected zones of rivers and forested areas, environmental impact assessment laws, and other laws for environmental rehabilitation. These laws require exploration and mining licence holders to provide reporting on their environmental management plans. In addition, both exploration licence holders and mining licence holders must deposit an amount equivalent to 50 per cent of their annual environmental protection budget into a designated bank account established by the governor of the relevant *soum* or district, to ensure that they fulfil their obligations regarding environmental protection.[116]

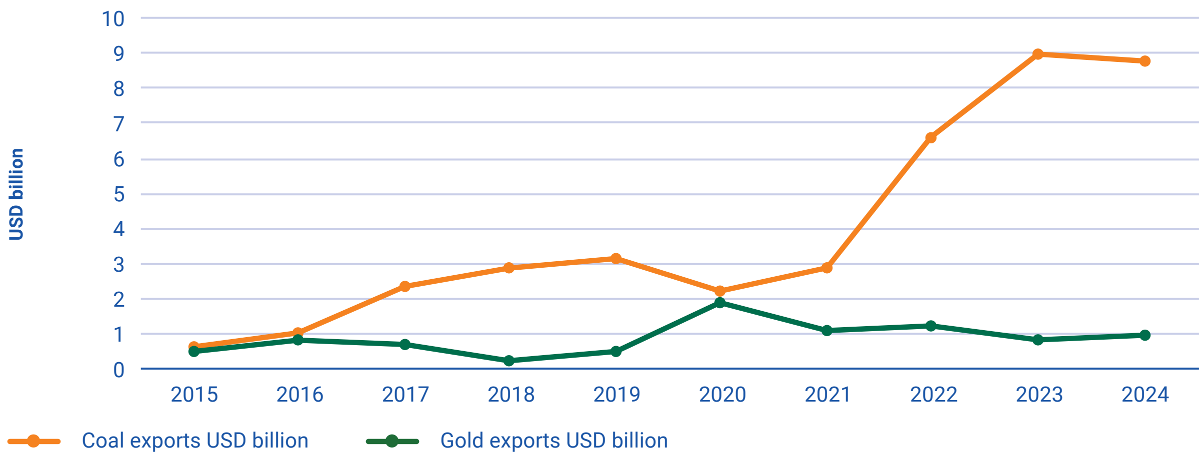
Under the Delayed Transition scenario, the assumption is that climate and environmental policies would only be introduced from 2030, with carbon and energy prices subsequently increasing faster than under a Below 2°C scenario. This would create higher transition risks, due to abrupt and less coordinated shifts in policies and regulations. The accelerated increase in carbon and energy prices, as well as stricter rules on environmental protection of water resources and biodiversity conservation, would lead to more expensive coal exploitation and exploration, and increased financial risks for the banking sector.

## Opportunities for mining under transition

Mongolia is rich in mineral resources, attracting growing international interest and presenting an opportunity for diversification in the mining sector. While coal exports to China fell in 2020, there was an increase in gold exports to Switzerland. The total value of Mongolia's gold exports increased to $1.79 billion, up from $0.42 billion in 2019, which more than compensated for the ~$1 billion fall in the value of coal exports (Figure 46).

Rare earth elements, vital for high-tech industries, are seen as a promising area for investment, offering new economic opportunities and necessitating the development of a national strategy for their exploitation. Additionally, Mongolia's vast mineral reserves, including copper, offer lucrative prospects for investors, further contributing to the country's high-potential economy and fast-growing mining sector.[117]

***Figure 46*** Mongolia's coal and gold exports ($ billion)




| | 2019 | 2020 | Drop/Increase |
|---|---|---|---|
| Gold | $0.42 billion | $1.79 billion | $1.37 billion |
| Coal | $3.08 billion | $2.13 billion | $0.95 billion |
| Sum export value | | | $0.42 billion |

*Source: ESCAP, based on data from National Statistics Office of Mongolia.*

116 Mongolia, Law on Environmental Impact Assessments, chap. 1. Available at https://admin.theiguides.org/Media/Documents/LawEnvironmentalImpactAssessments.pdf

117 Charles Krusekopf, "Mongolia's Development of Critical Minerals Opportunities and Challenges", The National Bureau of Asian Research, 16 August 2023. Available at https://www.nbr.org/publication/mongolias-development-of-critical-minerals-opportunities-and-challenges/

A transition to a low-carbon economy will have a significant impact on the mining industry both globally and in Mongolia. Coal mining operations particularly will face business risks arising from lower global demand, higher costs of operations, stringent environmental and social regulations and declining prices. Higher costs of fuels will further impact the operating costs of coal mining corporations.

This presents significant risks to the economy as well as to the financial system. While most coal-related financing is raised through state-owned enterprises, some banks have relatively high direct financial exposure to the coal industry (up to 10 per cent). In addition, there will be second-order effects on other sectors, given their dependency on coal products, coal transport and coal usage in energy and industry.

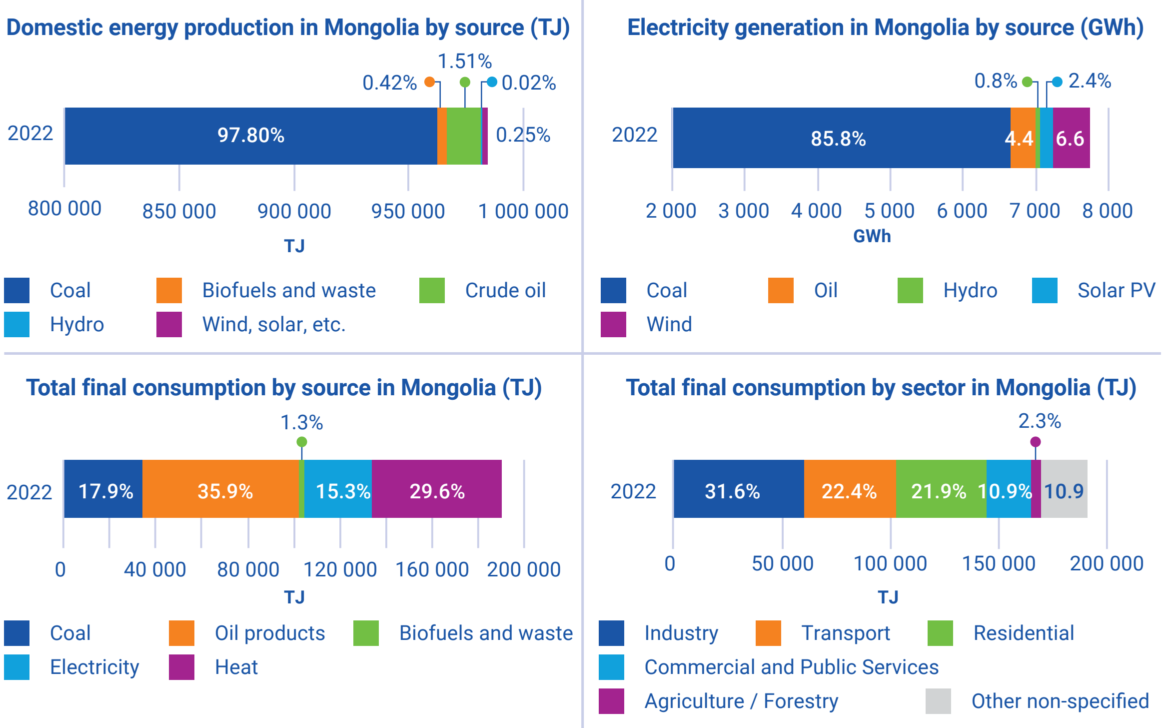
Furthermore, mining, quarrying, manufacturing, construction and transport, which are all considered high emitting and hard-to-abate, account for over 20 per cent of all loans from Mongolian banks. In addition, these sectors experienced a weighted average non-performing loan (NPL) rate of 18.1 per cent in 2023.[118] Despite the ceiling of 10 per cent exposure to mining, the compound effects of transition would be significant.

# ▶Power/energy

## Context

Ulaanbaatar is the coldest capital city in the world and home to half of Mongolia's population. It experiences extreme winters, which necessitates substantial heating, consuming 30 per cent of the country's final energy. Oil drives Mongolia's economy, accounting for 35 per cent of final energy consumption due to its use in transportation, mining and agriculture, followed by electricity (15 per cent) and coal (19 per cent) for the remaining energy needs, and to power homes and industries (Figure 47). In Ulaanbaatar, many residents, including nomads in *ger* districts, rely on traditional heating and cooking methods such as coal, with some using biofuels and waste (1 per cent). Mongolia's energy consumption is divided between key sectors: industry (32.5 per cent), transportation (20.6 per cent) and residential (22.6 per cent).

***Figure 47*** Domestic energy production and consumption overview




*Source: International Energy Agency data.*

118 CEIC, "Mongolia Non Performing Loans Ratio", CEIC data. Available at https://www.ceicdata.com/en/indicator/mongolia/non-performing-loans-ratio (accessed on 4 June 2024).

## Policies supporting transition

Having submitted its first *Biennial Update Report* in 2017, Mongolia has since introduced and amended some of its policy documents and programmes. The following address the energy sector: *Vision 2050*,[119] *Mongolia's New Revival Policy 2021*,[120] *Mongolia's Nationally Determined Contribution (NDC) (2019-2030)*,[121] *Sustainable Development Vision 2030* (2016),[122] *Action Programme of the Government of Mongolia (2016-2020, 2020-2024)*,[123] *National Action Programme on Climate Change (NAPCC) (2011- 2021)*,[124] *Green Development Policy (2014-2030)*,[125] *Mongolia's Five-Year Development Guidelines for 2021-2025*,[126] and *Mongolian National Programme for Reducing Air and Environment Pollution, 2017-2025*.[127]

Mongolia's energy policies focus on two key areas: increasing the use of renewable energy through grid integration and storage technologies, and improving energy efficiency. Efficiency measures target reducing heat and electricity loss in transmission systems, enhancing building performance, promoting cleaner transport fuels, and replacing raw coal with improved fuel in Ulaanbaatar.[128]

In 2020 the share of renewables in power generation was 10.1 per cent.[129] Investment in clean energy was around $3.6 million in 2022, a decrease of 52 per cent from 2020 ($7.5 million).[130] The level of subsidies and flat pricing at consumer level make investments in the renewable energy sector less attractive for the private sector, which explains the limited investments to date. Mongolia thus runs the risk of a delayed transition to renewable energy production if current policies are not executed as intended, and if subsidies are not reduced.

## Transition risks to the sector

The transition towards renewable energy could bring a major shift in primary energy away from carbon-intensive energy sources, which are currently highly dependent on coal (96 per cent of domestic energy production and 84 per cent of domestic electricity production). While dependence on domestically produced liquid fuels is low (3 per cent of energy production, 4.6 per cent of electricity), most crude oil is exported to China for refinement. Renewable energy production is growing but remains limited (10.1 per cent of the total). Currently, only 1GW of renewable energy is produced in Mongolia, via three wind farms and nine solar farms, despite Mongolia's estimated vast potential (3,300 GW).[131]

Under all three NGFS climate scenarios, final energy consumption is expected to shift from solids (mainly coal and coke) and liquids (mainly petroleum and gas), which represented more than 60 per cent of total final energy in 2024, towards heating and electricity (Figure 48). Heating represents more than 86 per cent of total final energy by 2100.

Electricity and heating are projected to be produced through renewable energy sources, making the transition to wind and solar energy inevitable. One possible option is to replace coal-fired power generation with renewable energy generation, as proposed by ESCAP in its 2024 report *SDG 7 Road Map for Mongolia*.[132] Shifting to renewable energy alternatives for cooking and heating in the *ger* districts, where coal-based devices currently account for 91 per cent of energy use, would significantly reduce emissions,

119 Vision 2050 Mongolia, "Vision 2050". Available at https://vision2050.gov.mn/eng/index.html
120 ODI Global, "Mongolia's New Recovery Policy – an ODI dialogue with Nomin Chinbat, Minister of Culture", 26 August 2022. Available at https://odi.org/en/press/mongolias-new-recovery-policy-an-odi-dialogue-with-nomin-chinbat-minister-of-culture/
121 Mongolia, *Mongolia's nationally determined contribution to the United Nations framework convention on climate change* (Ulaanbaatar, 2020). Available at: https://policy.asiapacificenergy.org/sites/default/files/First%20Submission%20of%20Mongolia%27s%20NDC.pdf
122 Mongolia, The Secretariat of the State Great Hural, *Mongolia Sustainable Development Vision* (Ulaanbaatar, 2016). Available at: https://policy.asiapacificenergy.org/sites/default/files/First%20Submission%20of%20Mongolia%27s%20NDC.pdf
123 Partnership for action on green economy, "Mongolia". Available at https://www.un-page.org/countries/mongolia/
124 Mongolia, Mongolian Parliament, *National Action Programme on Climate Change* (Ulaanbaatar, 2011). Available at https://policy.asiapacificenergy.org/node/2721
125 National Statistics Office of Mongolia, Green Development Policy. Available at http://sdg.1212.mn/en/Content/files/Green_development_decision.pdf
126 Mongolia, Cabinet Secretariat of Government of Mongolia, *Mongolia's five-year development guidelines for 2021-2025* (Ulaanbaatar, 2020).
127 Mongolia, Ministry of Environment and Tourism, *Mongolia's Second Biennial Update Report* (Ulaanbaatar, 2023). Available at https://unfccc.int/sites/default/files/resource/20231112_BUR_II_MGL_Final.pdf
128 Mongolia, Ministry of Environment and Tourism, *Fourth national communication of Mongolia* (Ulaanbaatar, 2024).
129 Ministry of Energy, "Energy sector production data for December 2020". Available at https://energy.gov.mn/c/1211
130 Climatescope, "Mongolia". Available at https://www.global-climatescope.org/markets/mongolia
131 Invest Mongolia, "Energy". Available at https://investmongolia.gov.mn/energy/
132 United Nations Economic and Social Commission for Asia and the Pacific, *Energy Transition Pathways for the 2030 Agenda SDG 7 Road Map for Mongolia* (United Nations publication, 2024).

and would improve public health in urban areas.[133] Also, electrifying the transportation sector alongside a boost in renewable energy capacity would accelerate Mongolia's transition to a greener economy. The maturing of renewable energy technologies over recent decades has made them a cost-competitive alternative to coal-fired power plants.[134]

***Figure 48*** Final energy production pathways under selected NGFS scenarios


*Source: ESCAP based on data from NGFS.*

Mongolia is currently a net importer of electricity and refined petroleum, while its consumption is based around fossil fuels. In 2022 Mongolia imported electricity at a cost of $178 million, mainly from China (71 per cent) and Russia (29 per cent). Sixty-four per cent of energy consumption is related to coal, for electricity and heating. Mongolian heating and electricity are mainly coal-fired.

133 Jeroen "July" Jagt, "Giving up fire for air - How social practices impact the transition from coal stoves to electric heaters in Ulaanbaatar, Mongolia", student paper, Wageningen University & Research, Amsterdam, The Netherlands, September 2023. Available at https://edepot.wur.nl/647313

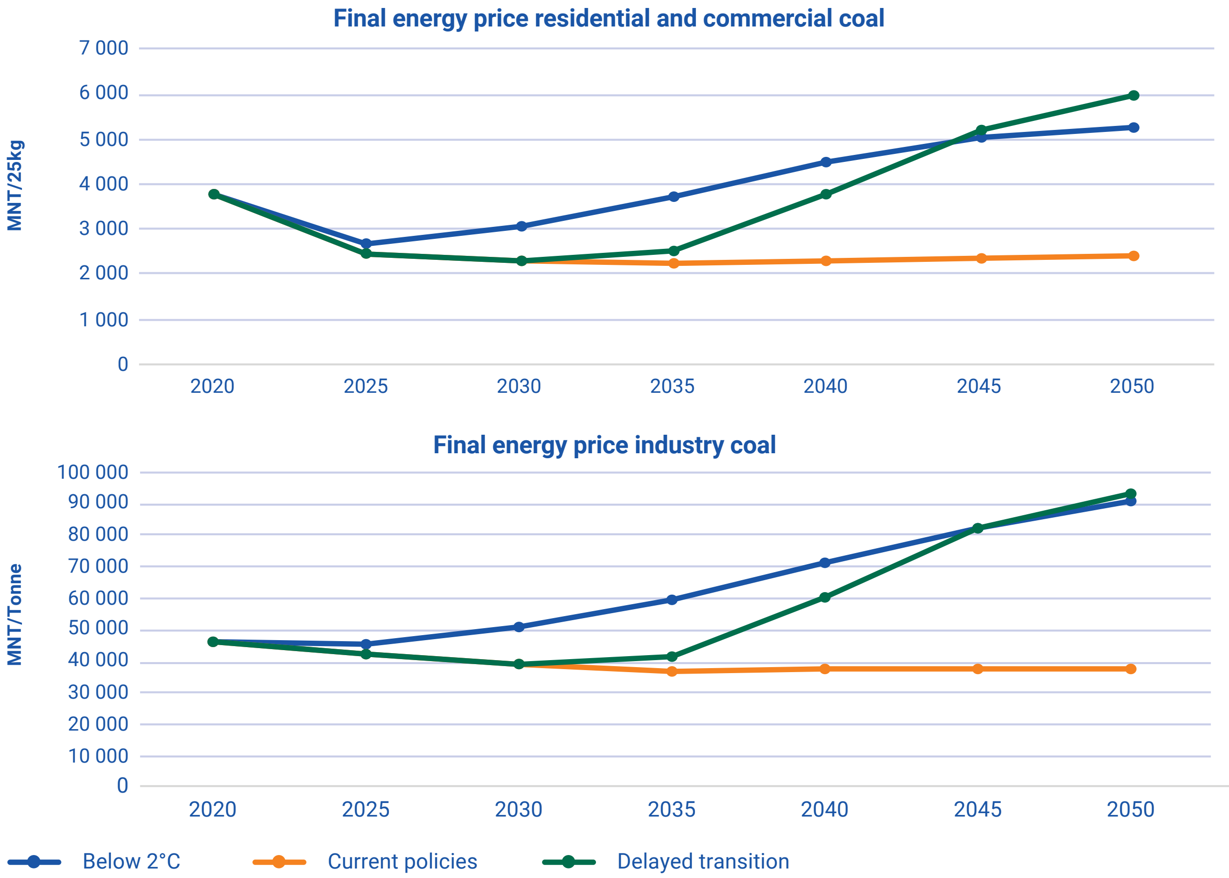
134 United Nations Economic and Social Commission for Asia and the Pacific, *Energy Transition Pathways for the 2030 Agenda SDG 7 Road Map for Mongolia* (United Nations publication, 2024).

Oil products account for another 35 per cent of Mongolia's final energy consumption, but the country lacks domestic refining capabilities. This necessitates imports of refined oil and gas products. Mongolia imports refined petroleum mainly from Russia, worth $1.43 billion in 2022. China is the second largest provider ($47.9 million in 2022).[135] This dependency on energy imports from both countries leads to external transition risks in the form of price dependency and fragile energy security. More than 50 per cent of energy demand is absorbed by industry and the transport sector, followed by residential consumption and commercial and public services at 34 per cent. The agriculture sector is responsible for just 2.3 per cent of total consumption.

## Direct and indirect impacts of carbon pricing

In 2022 the fuel and power sectors emitted 42 per cent of total greenhouse gas emissions in Mongolia, which makes the two sectors highly vulnerable to the effects of $CO_2$ pricing within or outside the country.[136] An increased carbon price in Mongolia will increase the cost of energy production across all industries, given the high dependency on fossil fuels (Figure 49). While the prices for solids, which include coke, wood chips, wood pallets and briquets, do not change much under a Current Policy scenario, they increase by a factor of 3.1x by 2100 under a Below 2°C scenario, and 4.6x under a Delayed Transition scenario. An increased energy price can have several effects in Mongolia. Increased energy costs will hit household budgets hard, especially for lower-income families in rural areas, as they depend heavily on coal-fired stoves for heating and cooking.[137]

***Figure 49*** Average final energy price of coal in Mongolia under NGFS scenarios




*Source: ESCAP and Bank of Mongolia calculations based on data from NGFS.*

135 OEC, "Refined Petroleum in Mongolia". Available at https://oec.world/en/profile/bilateral-product/refined-petroleum/reporter/mng

136 Task Force on National Greenhouse Gas Inventories (TFI), "Energy" in *2007 IPCC Guidelines for National Greenhouse Gas Inventories*, vol. 2, Simon Eggleston and others, eds. (Kanagawa, IPCC, 2006). Available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_0_Cover.pdf

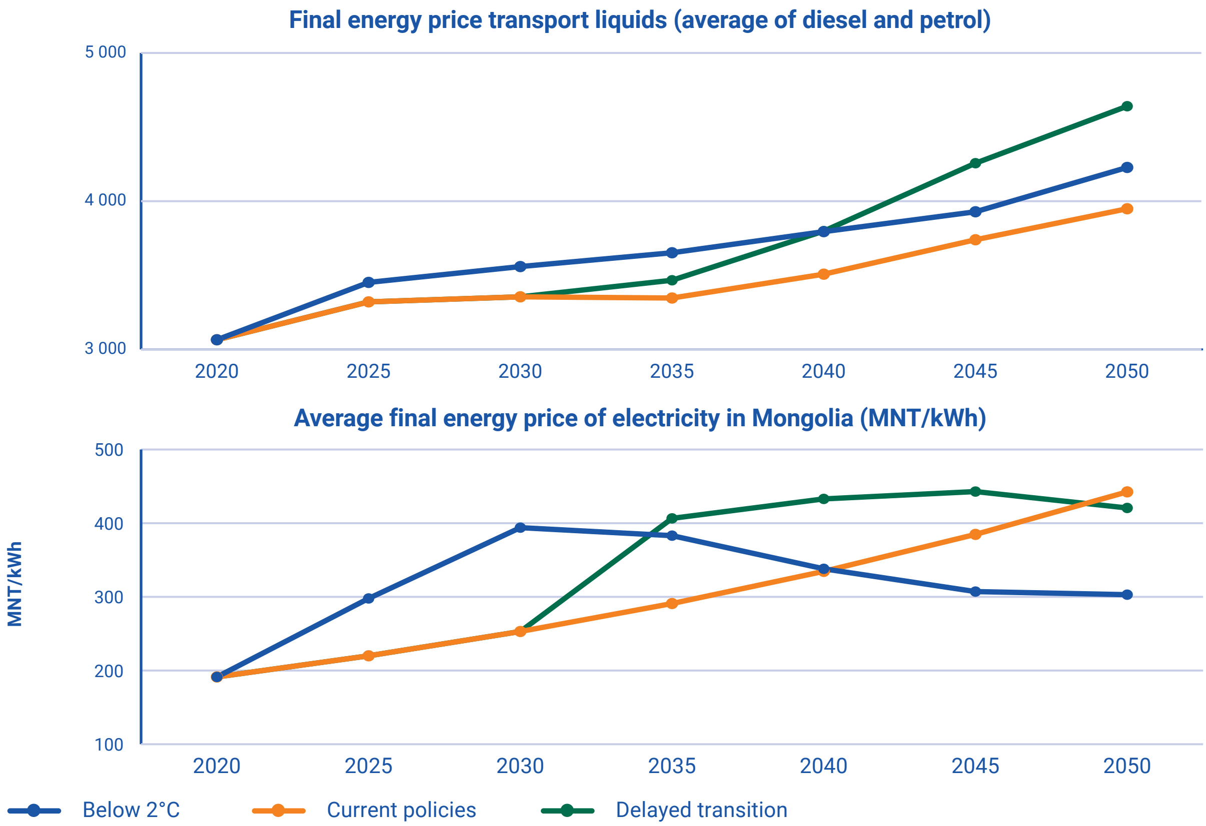
137 Oyunchimeg Ch, "Energy sector current status, recent developments and energy policies in Mongolia", Nautilus Institute, 16 May 2021. Available at https://nautilus.org/napsnet/napsnet-special-reports/energy-sector-current-status-recent-developments-and-energy-policies-in-mongolia-2/

The price of liquid and gas fuels is projected to rise in all scenarios. However, the increase is more sensitive to external factors such as carbon pricing in Russia (which is considering a scheme from 2028[138]) than Mongolia's own shadow carbon price. This means that even under current policies, rising fuel costs from Russia could create a significant burden.[139]

The phase-out of coal and other solids by the year 2040 is predicted in both Below 2°C and Delayed Transition scenarios. This increasing gap in energy demand is bridged by a higher consumption of liquids. Estimated lifecycle $CO_2$ emissions for coal are 363kg/MWh, compared to 260kg/MWh for oil and 202kg/MWh for natural gas, making coal the most polluting fossil fuel.[140] Therefore shifting from coal to liquid fuels can be seen as an initial step, due to their lower carbon footprints. However, the focus on electricity increases significantly between 2023 and 2050, before reaching a plateau. Notably, the Current Policy scenario doesn't entirely phase out solid fuels from Mongolia's energy mix.

Both the Delayed Transition and Below 2°C scenarios predict higher costs of power generation due to both internal operational factors and external market forces (Figure 50). This directly translates to increased operational costs for businesses, particularly those reliant on high energy usage such as in mining, manufacturing and transportation. These sectors are sensitive to fluctuations in energy prices, with higher costs leading to reduced operational efficiency and increased expenses and therefore decreased profitability.[141] Higher operational costs and squeezed profit margins could drive companies to face an increased risk of financial instability, which can lead to higher risks and potentially more defaults, especially in sectors with thin profit margins or significant debts.[142]

***Figure 50*** Energy price pathways under selected NGFS scenarios




*Source: ESCAP based on data from NGFS.*

138 Vicky Wang, "Russia mulling carbon pricing system from 2028", Yieh Corp, 01 February 2024. Available at https://www.yieh.com/en/News/russia-mulling-carbon-pricing-system-from-2028/146303

139 RBC, "В России предложили внедрить плату за выбросы парниковых газов Властям предстоит определить охват и форму «цены на углерод»" (26 January 2024). Available at https://www.rbc.ru/economics/26/01/2024/65b243229a79472c5cfc3592

140 Forest Research, "Carbon emissions of different fuels". Available at https://www.forestresearch.gov.uk/tools-and-resources/fthr/biomass-energy-resources/reference-biomass/facts-figures/carbon-emissions-of-different-fuels/

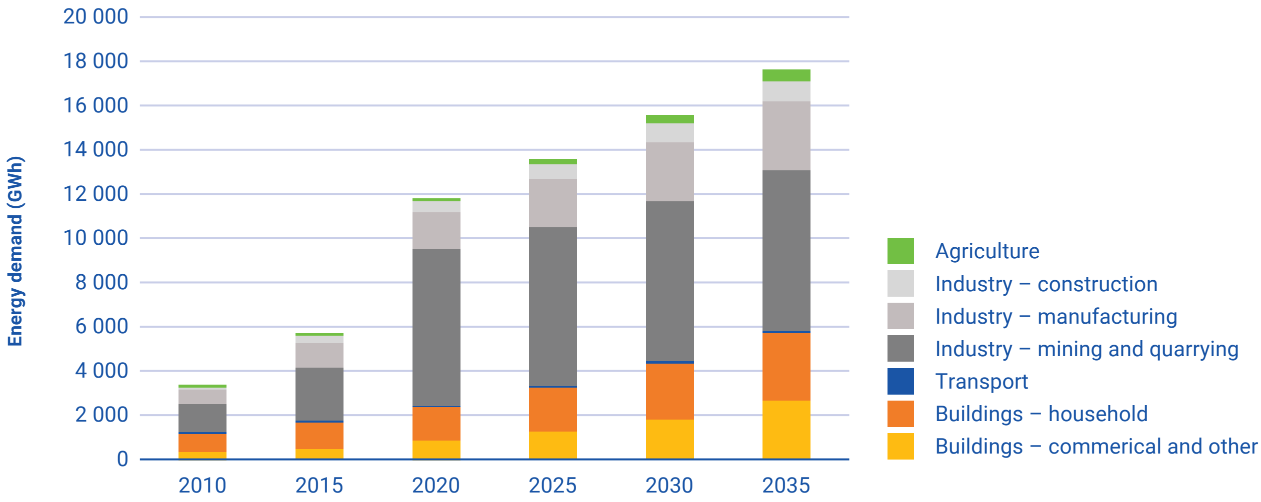
141 Thomas L. Keefe and others, "Decoding the cost dilemma: How can electric companies navigate a shifting landscape?", Deloitte, 01 June 2023. Available at https://www.deloitte.com/us/en/insights/industry/power-and-utilities/rising-electricity-costs.html

142 Grant Dougans and others, "Cost Reduction Strategies for Power Generation", Bain & Company, June 2018. Available at https://www.bain.com/insights/cost-reduction-strategies-for-power-generation/

## Sovereign debt risk

Energy consumption at household and commercial levels is expected to increase, according to a study by GGGI[143] (Figure 51). In addition, Mongolia's energy sector is grappling with several challenges due to its current pricing mechanisms and reliance on government subsidies. The country's flat energy pricing, under which all users pay the same rate regardless of consumption, simplifies billing and keeps electricity affordable, which was crucial during the COVID-19 pandemic. However, this approach does not encourage energy conservation or efficiency, since there is no financial incentive for consumers to reduce their usage.[144] The government has set ambitious targets to increase the share of renewable energy in its mix to 30 per cent by 2030. This shift involves building new power generation plants, including renewable sources such as solar, wind and hydro, and improving energy efficiency and conservation through regulatory mechanisms.[145]

***Figure 51*** Electricity demand by sector, reference scenario, GGGI Report




*Source: Oyunchimeg et al (2020)*

The actual costs of producing electricity in Mongolia are considerably higher than the price charged to consumers, thanks to significant government subsidies. For example, the production cost of electricity is 409 MNT/kWh, but commercial users are charged 90 MNT/kWh, and private households 50 MNT/kWh. The difference is covered by government subsidies, which are necessary due to the high operational costs, including those for diesel generators in remote areas.[146] This subsidy system, while providing immediate relief, poses long-term financial sustainability challenges for the energy sector. High subsidy levels increase government spending, which constrains the fiscal space. This is concerning given Mongolia's already critical debt situation, with net external debt-to-GDP at 150 per cent in 2023, and almost half of government revenues being spent on debt servicing[147] (Figure 52).

143 Global Green Growth Institute, *Strategies for development of green energy systems in Mongolia (2013-2035) Extended Executive Summary* (Seoul, 2015). Available at https://gggi.org/wp-content/uploads/2017/11/2015-02-Strategies-for-Development-of-Green-Energy-Systems-in-Mongolia-2013-2035.pdf

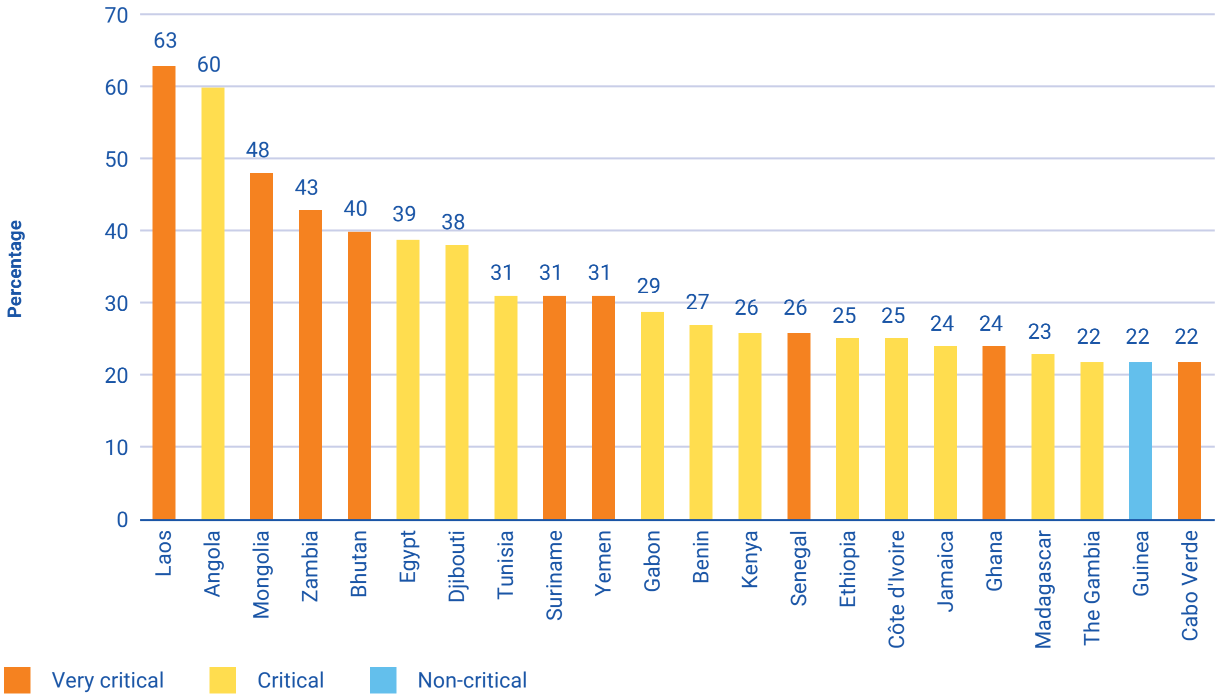
144 Asian Development Bank, "Mongolia" in *Asian Development Outlook (ADO) April 2023* (Metro Manila, Asian Development Bank, 2023). Available at https://dx.doi.org/10.22617/FLS230112-3

145 Oyunchimeg Ch, "Energy sector current status, recent developments and energy policies in Mongolia", Nautilus Institute, 16 May 2021. Available at https://nautilus.org/napsnet/napsnet-special-reports/energy-sector-current-status-recent-developments-and-energy-policies-in-mongolia-2/

146 Energypedia, "Mongolia Energy Situation". Available at https://energypedia.info/wiki/Mongolia_Energy_Situation

147 Entwicklung braucht Entschuldung and Misereor, 2024 Global sovereign debt monitor. Available at https://erlassjahr.de/wordpress/wp-content/uploads/2024/04/GSDM24-online.pdf

***Figure 52*** Public debt service payments to external creditors in 2024 as a percentage of government revenue: Mongolia vs. other countries




*Source: Global Sovereign Debt Monitor.*

Additionally, the expansion and modernization of Mongolia's energy infrastructure is ongoing. Efforts are focused on increasing capacity and reducing losses in transmission, diversifying energy sources, and enhancing connectivity between regions. This includes building new power plants and upgrading existing ones to support economic growth and regional development, which will further strain government budgets and spending.[148] Increased debt levels at the sovereign level may decrease credit ratings and lead to increased refinancing costs for the government of Mongolia.

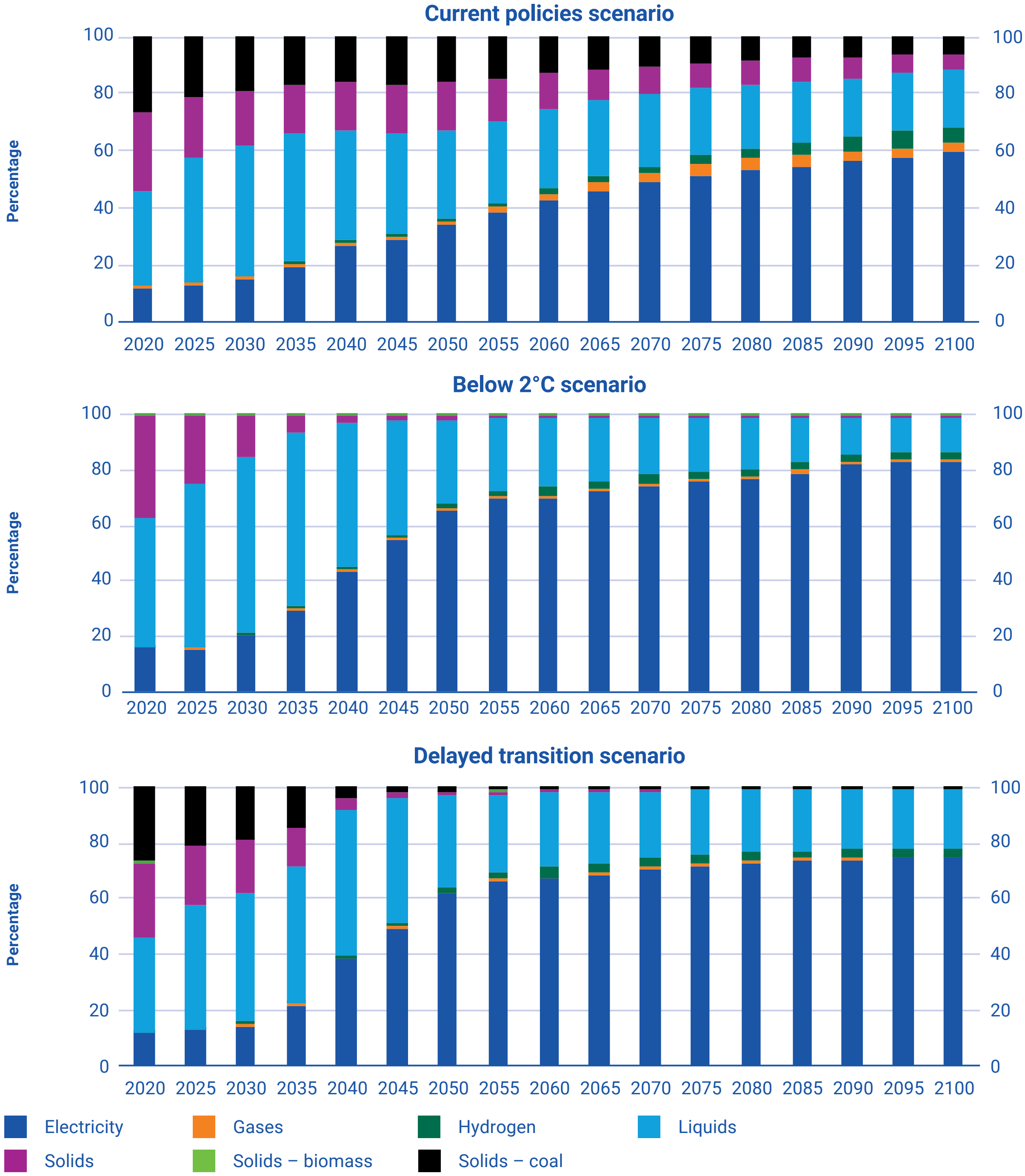
## Risk of stranded assets

Limited grid absorption capacity due to outdated systems and operating procedures remains a major constraint to scaling up renewable energy, as the intermittent variability of renewable energy needs to be balanced out.[149,150]

As the International Renewable Energy Agency (IRENA) notes, the risk of stranded assets increases if policy action towards a low-carbon economy is delayed. The coal-fired capacity would be significantly expanded and would need to be stranded after 2030 to meet decarbonization targets. On a global basis, stranded assets are expected to increase three-fold compared to the Current Policy scenario.[151] In China and India, power generation would have the largest share of total stranded assets, at between 25 and 45 per cent of total value. Given the dependency of Mongolia on exports to China, this presents further risks to the Mongolian economy from a transition risk perspective.

148 Oyunchimeg Ch, "Energy sector current status, recent developments and energy policies in Mongolia", Nautilus Institute, 16 May 2021. Available at https://nautilus.org/napsnet/napsnet-special-reports/energy-sector-current-status-recent-developments-and-energy-policies-in-mongolia-2/
149 Asian Development Bank, "Unlocking Mongolia's Rich Renewable Energy Potential", 02 June 2020. Available at https://www.adb.org/news/features/unlocking-mongolias-rich-renewable-energy-potential
150 Adam Barth and others, "How grid operators can integrate the coming wave of renewable energy", McKinsey & Company, 08 February 2024. Available at https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/how-grid-operators-can-integrate-the-coming-wave-of-renewable-energy
151 International Renewable Energy Agency, *Stranded Assets and Renewables* (Abu Dhabi, 2017). Available at https://www.irena.org/publications/2017/Jul/Stranded-Assets-and-Renewables

***Figure 53*** Secondary energy pathways by source under selected NGFS scenarios




*Source: ESCAP visualizations based on data from NGFS.*

All three scenarios involve a move away from solid fuels (mainly coal) towards electricity and liquids (Figure 53). While the Current Policies scenario implies a gradual decline in coal use, the more ambitious scenarios aim for complete phase-out by 2050. This shift towards cleaner energy sources, however, raises the risk of stranded assets due to Mongolia's current heavy reliance on coal extraction. As Mongolia transitions to renewable energy sources such as wind and solar, the infrastructure established for coal extraction and energy production from fossil fuels risks becoming obsolete or devalued, leading to economic losses for stakeholders invested in these assets. IRENA notes that those delays in policy implementation for energy transitions could lead to extensive financial implications for the power generation and upstream energy sectors due to stranded assets.[152]

152 International Renewable Energy Agency, *Stranded Assets and Renewables* (Abu Dhabi, 2017). Available at https://www.irena.org/publications/2017/Jul/Stranded-Assets-and-Renewables

### The super grid opportunity for Mongolia

Mongolia's geographic and strategic positioning makes it a pivotal player in a potential Asian Super Grid, a massive infrastructure project aimed at connecting energy grids across northeast Asia to enhance regional energy security and integrate renewable energy sources. This grid is expected to span multiple countries, including China, Russia, Republic of Korea and Japan, with Mongolia playing a central role due to its vast renewable energy potential, particularly in solar and wind energy, which are abundant in the Gobi Desert region. Mongolia has already begun tapping into this potential, with projects such as the Salkhit wind farm and plans for further projects, including a significant 8,000 MW wind power initiative intended for export.[153] The initiative aligns with global trends towards decarbonization and increased reliance on renewable energy, positioning Mongolia as a crucial energy hub in the region.[154]

## ▶Conclusion

Mongolia is exposed to a unique combination of climate-related hazards, the most critical of which are floods, droughts and *dzuds*. These events are increasing in frequency and severity, leading to recurrent losses of livestock, disruption of agricultural output, degradation of ecosystems and damage to infrastructure. Projections indicate further intensification, with drought frequency expected to rise by up to 20 per cent by mid-century and *dzuds* projected to occur with greater regularity and severity, contributing to large-scale livestock mortality and rural poverty. The cumulative impacts of these hazards will accelerate desertification, biodiversity loss and rural-urban migration, compounding long-term social and environmental vulnerabilities.

Equally, Mongolia's economic structure is subject to substantial exposure to transition risks. Coal accounts for almost half of national emissions and underpins energy production, while livestock represents more than half of emissions and is central to rural livelihoods. Both sectors are highly sensitive to global and domestic decarbonization efforts. Declining demand for coal exports, volatility in commodity prices, and the potential for stranded assets pose systemic risks, while shifts in agricultural policy or climate regulation could undermine the income of herder households. Analysis of carbon pricing pathways demonstrates that policy delays increase the probability of disorderly transitions, magnifying costs for key industries and export revenues.

Taken together, the evidence presented in Chapter 1 highlights the fact that Mongolia's climate risks are not only biophysical but also structural and systemic. The convergence of acute hazards and transition pressures places the economy at a critical point. Inaction would amplify economic fragility, while disorderly policy responses could destabilize livelihoods and threaten fiscal stability. The implications could extend beyond immediate losses, as these risks are transmitted through credit, market, operational and legal channels into the financial system. These findings provide the analytical foundation for Chapter 2, which explores how climate risks propagate through macroeconomic and microeconomic transmission channels, and assesses their potential to undermine Mongolia's financial stability over the coming decades.

153 David von Hippel, "What Could an "Asian Super-grid" Mean for Northeast Asia?", Nautilus Institute, 13 April 2015. Available at https://nautilus.org/napsnet/napsnet-policy-forum/what-could-an-asian-super-grid-mean-for-northeast-asia/

154 Bayar Bat-Erdene and others, "Development of Mongolia's Electric Power Industry and its Role in Shaping the Northeast Asian Super Grid", *Energy Systems Research*, vol. 1, No. 4 (February 2018). Available at https://dx.doi.org/10.25729/esr.2018.04.0002

*Chapter 2*

# Climate change-related risks to Mongolia's financial sector

Building on the potential impacts of climate change in Mongolia discussed in Chapter 1, this chapter examines how climate-related risks – both physical and transition risks – could propagate through Mongolia's financial system over the coming decades. As the financial sector plays a critical role in capital allocation, credit provision and economic intermediation, its vulnerability to climate shocks poses systemic risks to long-term growth and stability. Chapter 2 takes a structured, analytical approach to assess climate risks using the dual lenses of macroeconomic and microeconomic transmission channels.

At the macroeconomic level, climate change may affect GDP growth, inflation, employment and trade balances, thereby influencing monetary and fiscal dynamics. At the microeconomic level, risks can materialize through borrower defaults, collateral devaluation, insurance losses or increased operational costs.

The analysis then identifies how climate-related risks interact with traditional risk categories in the banking system such as credit, market, liquidity, operational and legal risks. These are examined in the light of emerging international practices and global case studies based on relevant climate scenario analysis (or climate stress test) exercises.

The aim of the analysis is to support national regulators, policymakers and financial institutions in understanding the pathways through which climate risks may undermine financial stability while also identifying opportunities for strategic mitigation and resilience-building.

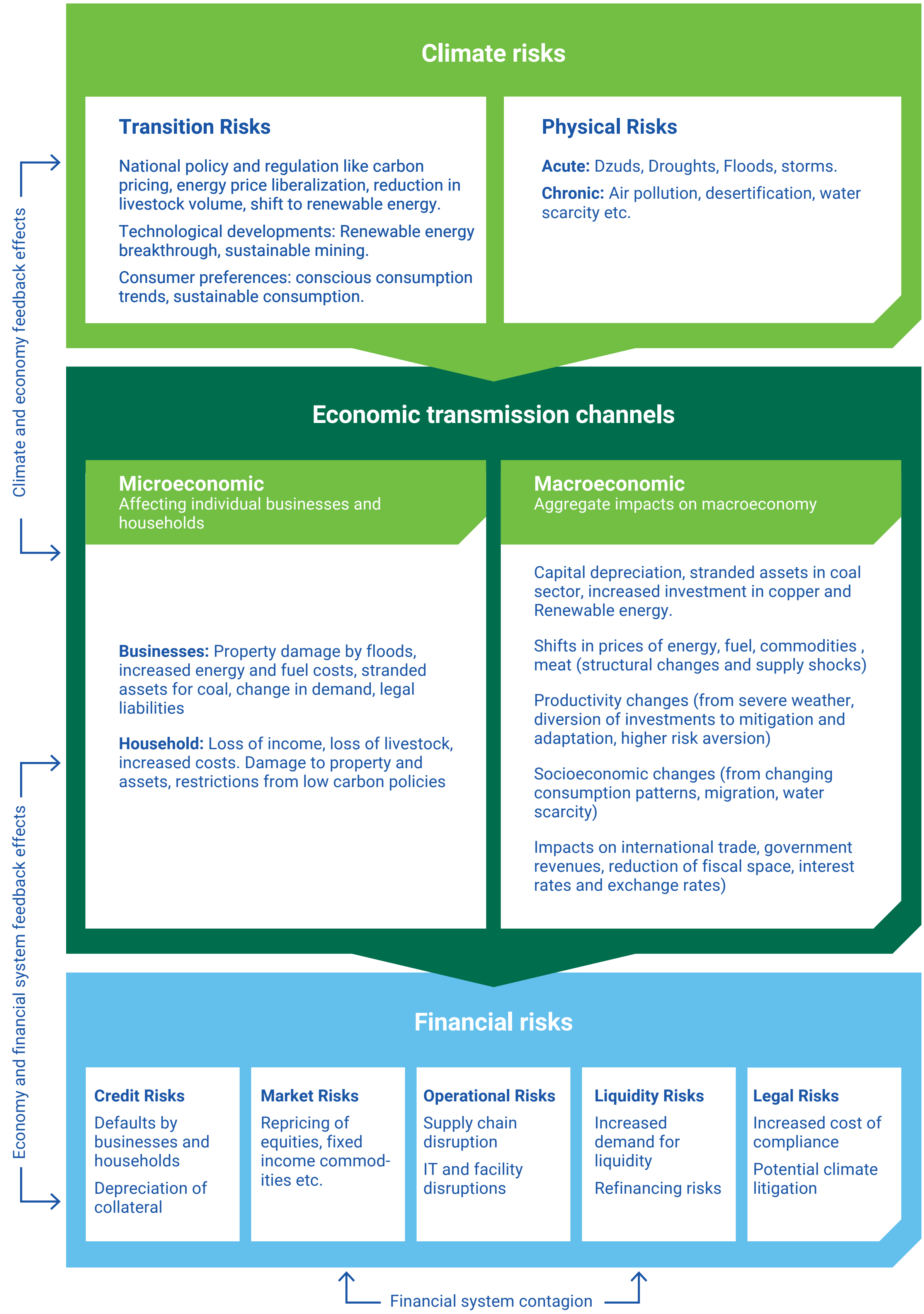
## ▶Transmissions channels

Climate risk drivers can lead to substantial financial implications when transmitted through causal pathways known as transmission channels. The transmission of climate risks has multifaceted implications for asset values, credit exposure and the broader economy, and presents significant challenges to financial stability. Transmission channels can be subdivided into microeconomic channels and macroeconomic channels (Figure 54).

**Microeconomic transmission channels:** These are the pathways by which climate risk affects the financial status of banks' counterparties (businesses and households), resulting in climate-related financial risks for banks. This could occur through loss of income, labour market frictions or property damage from severe weather events for households. Businesses could suffer due to changes in demand and consumer preferences, increased costs for inputs and compliance, stranded assets and new capital expenditure due to policy change or technology change, and litigation liabilities.

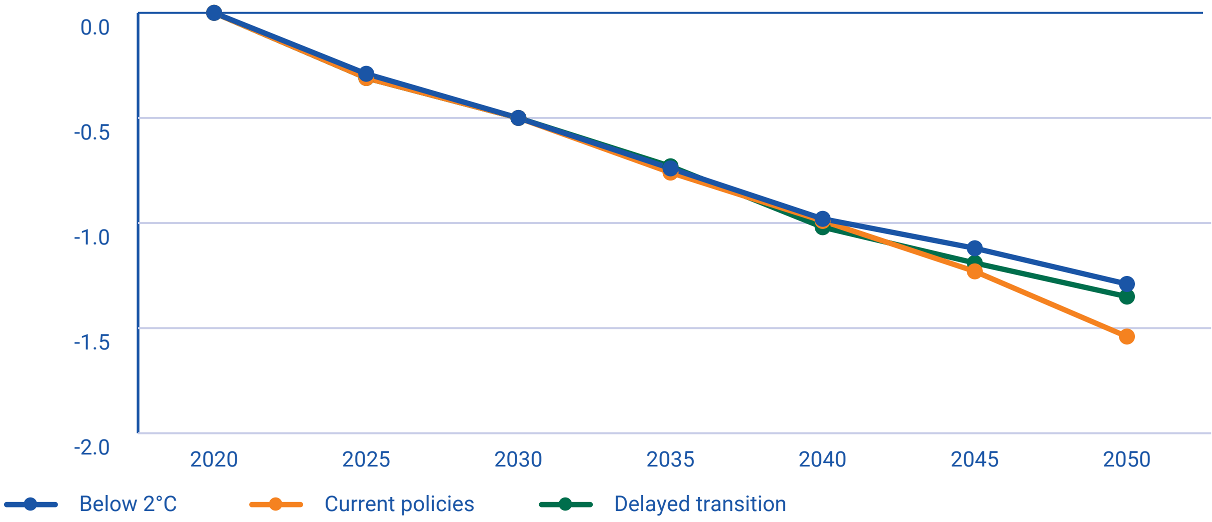
**Macroeconomic transmission channels:** These are the pathways by which climate risk can impact macroeconomic stability. Banks are impacted by macroeconomic transmission channels indirectly through the effects of climate change on the economy. These impacts could include impacts on growth (Figure 55), increased price volatility, changes in labour markets, productivity changes, changes to interest rates, the repricing of assets, sovereign debt distress effects, constrained government revenues, and socio-economic changes through consumption pattern shifts, migration and conflict.

***Figure 54*** Transmission channels in the Mongolian context




*Source: ESCAP adaptation from NGFS (2019).*

***Figure 55*** Expected GDP loss due to physical risks under selected NGFS scenarios




*Source: ESCAP based on NGFS data.*

Financial institutions, including banks and insurers, face increased default risks and losses as a result of their exposure to affected entities. However, the repercussions of physical risks extend beyond direct exposure, affecting the wider economy through disruptions in supply chains, reductions in asset values and overall economic instability. This, in turn, creates feedback loops within the financial system that exacerbate financial vulnerabilities.[155]

Transition risks, on the other hand, materialize from banks' (or their counterparties') exposure to assets that rapidly decline in value, such as investments in fossil fuel companies and carbon-intensive industries. The devaluation of these assets poses a threat to financial stability, particularly if asset price adjustments are abrupt and unexpected, triggering a re-evaluation of asset worth and creditworthiness.[156]

Furthermore, transition risks can lead to shifts in global commodity markets, affecting Mongolia's export revenues, particularly in the mining sector, which is a significant contributor to the country's exports. An increase in the shadow carbon price caused by a transition to a green and low-carbon economy would also lead to higher costs for high-emitting industries such as agriculture, energy and coal mining. A study by the European Central Bank (ECB) shows that an increase in carbon price by EUR 200/ton would lead to additional financial losses for the banking industry of up to 10 per cent.[157] This level of carbon pricing will be reached in Mongolia by 2060 in the Delayed Transition scenario, and by 2070 in the Below 2°C scenario.

The transmission channels also affect market variables such as risk-free interest rates, inflation rates, commodity prices and foreign exchange rates.[158] For example, significant damage to public infrastructure from flooding can lead to increased public spending on reconstruction efforts, thereby affecting economic stability and leading to higher taxes and lower government spending.

The impacts of physical risks and transition risks for traditional financial risk categories are transmitted to the financial sector through households, businesses, corporations and sovereigns. These impacts manifest themselves differently for different sectors, which are analysed for each traditional risk category below. Definitions and examples for each risk category can be found in Annex 1.

155 Pierpaolo Grippa and others, "Climate Change and Financial Risk", International Monetary Fund, December 2019. Available at https://www.imf.org/en/Publications/fandd/issues/2019/12/climate-change-central-banks-and-financial-risk-grippa

156 Pierpaolo Grippa and others, "Climate Change and Financial Risk", International Monetary Fund, December 2019. Available at https://www.imf.org/en/Publications/fandd/issues/2019/12/climate-change-central-banks-and-financial-risk-grippa

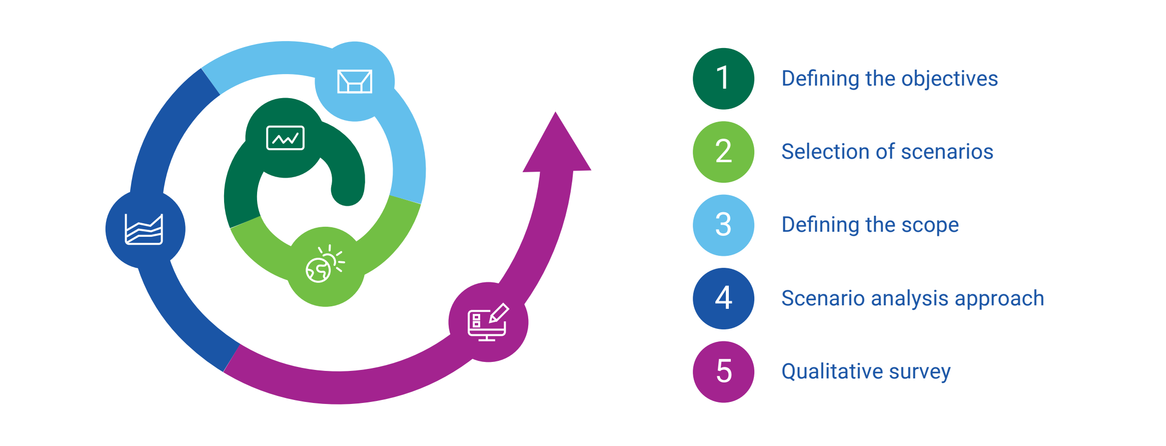
157 Marco Belloni and others, "Euro Area banks' sensitivity to changes in carbon price", ECB Working Paper, No. 2654 (Frankfurt, European Central Bank, 2022). Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2654~9a537f810a.en.pdf

158 Basel Committee on Banking Supervision, *Climate-related risk drivers and their transmission channels* (Basel, Bank for International Settlements, 2021). Available at https://www.bis.org/bcbs/publ/d517.pdf

### *Climate scenario analysis*

Scenario analysis is a key tool to assess financial risks arising from climate change, as standard risk modelling cannot adequately capture the unprecedented nature of climate risks and the inherent uncertainty of future climate-related events.[1] Scenario analysis offers a flexible 'what-if' methodological framework that is better suited to exploring the risks that could crystallize in different possible futures. One specific purpose of scenario analysis is climate stress testing, which examines the resilience of an organization or system under different extreme but plausible stress conditions. Scenarios chosen for stress tests need to include such system- or organization-specific stress situations, as appropriate.[2]

**Figure 56** Steps to design a climate scenario analysis




Across jurisdictions, pilot climate scenario analyses are deployed for similar objectives: to raise awareness of climate-related financial risks, build capacity among regulators and financial institutions, and identify gaps in data and methodologies. Importantly, none of the exercises to date have been used to set capital requirements.

Most pilots draw on NGFS Phase 4 scenarios, often adapting them to national contexts. For instance, France calibrated scenarios directly from NGFS pathways, while New Zealand adjusted the "Too Little, Too Late" scenario to compound risks. Countries typically narrow the focus to key hazards, such as floods and cyclones in India, typhoons in Japan, or drought and fire weather in Australia.

The scope of participation varies. Some regulators, like the ECB, involved over 100 banks, while others limited exercises to a handful of representative institutions. Sectoral coverage ranges from just three sectors in India and Japan to more than 20 in France and the ECB, with agriculture given special emphasis in Australia.

While all pilots estimate credit risk, some extend analysis to market, operational and even litigation risks. Different methodological choices also shape outcomes. Some authorities apply a top-down approach (e.g., ECB, Republic of Korea, Indonesia), while others use bottom-up exercises (e.g., UK, USA, Singapore), or hybrids (e.g., China, Malaysia). Most rely on static balance sheets to gauge current exposures, although a few, such as the ECB and France, incorporate dynamic assumptions for long-term realism. Several pilots also integrate qualitative surveys to capture institutions' governance, strategy, disclosure practices and preparedness for climate risk management. A comparative analysis of selected climate scenario analysis exercises can be found in Annex 2.

1 Climate risks: scenario analysis – Executive Summary Climate risks: scenario analysis – Executive Summary (bis.org)
2 Purposeful scenario analysis: A framework to guide central banks and financial supervisors in the selection and design of climate scenarios Matthias Täger and Simon Dikau Policy insight May 2023.

## ▶Credit risk

***Figure 57*** Credit risk and associated transmission channel matrix

| | Physical risk drivers: Floods, droughts, dzuds and chronic effects | Transition risk drivers: Policy change, technological change and behavior change |
|---|---|---|
| Microeconomic transmission channels | **Households, corporates, and sovereigns:** Wealth and incomes are impacted by physical impacts, the ability to repay and or profitability/-sales is reduced, contingent liabilities, cost of borrowing increases, and devaluation of collateral. (Income and wealth effect) leading to NPLs, NPA, and lower equity ratios for banks. | **Households, corporates, and sovereigns:** Higher taxes on emissions like carbon tax can lead to stranded assets for businesses which can reduce creditworthiness, increase the cost of capital, reduce investments, and increase litigation costs for corporates and governments. Higher taxes on households constrain budgets. |
| Macroeconomic transmission channels | **Gov Debt, GDP, Labor changes, socio-economic changes:** Impact on mortality, labor supply, and productivity, morbidity can impact output. Exposure raises the cost of borrowing, and climate contingent liabilities can increase debt. Increased debt can hamper growth, increase taxes, reduce economic activity, and indirectly impact banks' credit risks. | **Gov Debt, GDP, Labor changes, socio-economic changes:** Stranded assets for developing countries will impact govt revenue, social spending, debt service, the value of bonds, and credit ratings, which could increase the credit risk. Income effects from carbon taxes, increased prices & costs, lower consumption, and lower GDP, could decrease the ability of borrowers to repay. |

Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. The aim of credit risk management is to maximize a bank's risk-adjusted rate of return by keeping credit risk exposure within acceptable parameters.[159] Some of the parameters that reflect credit risks for banks include the Probability of Default (PD), Loss Given Default (LGD), Cure Rate,[160] Non-Performing Loans (NPL) Percentage, and Loan-to-Value (LTV) of collaterals.

Credit exposure for banks could rise as borrowers in vulnerable sectors or regions become increasingly unable to meet their financial obligations due to the impacts of climate change or the transition to a low-carbon economy. This could lead to higher levels of loan defaults and credit losses for financial institutions, undermining their stability and resilience.

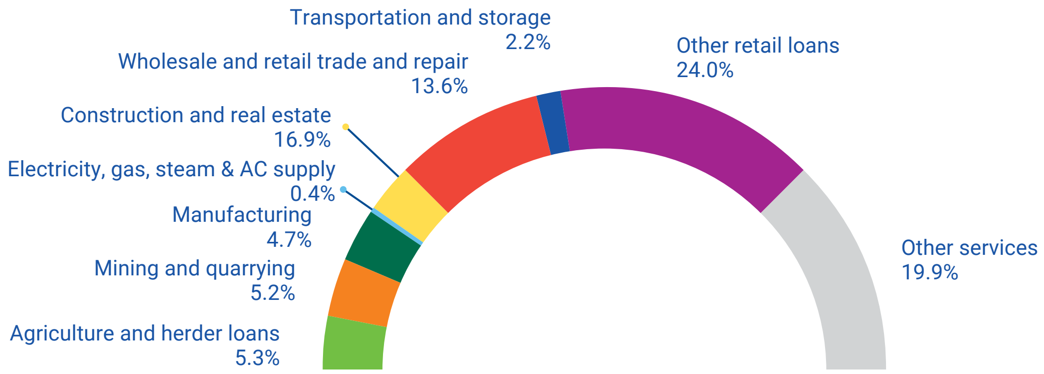
Analysis of the distribution of outstanding loans across sectors in the Mongolian banking system (Figure 58) shows that:

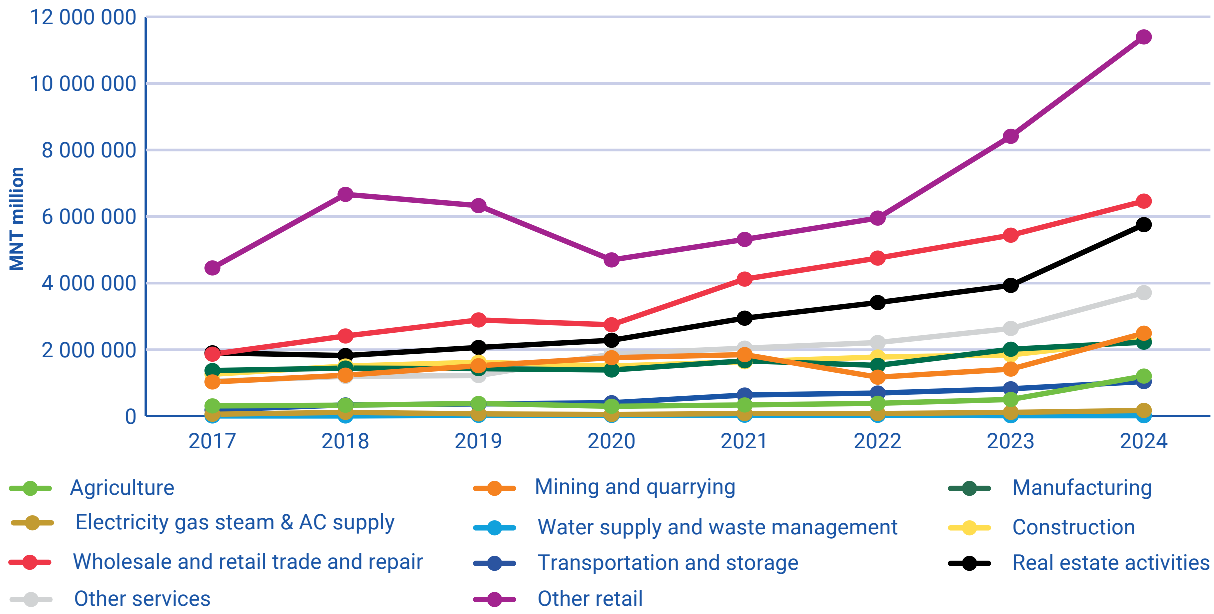
- The highest share of total outstanding loans (17 per cent) is in the real estate and construction sectors (combined), signifying high exposure to the risks from collateralized infrastructure and real estate.
- The next highest share of loans is in the wholesale, trade and service sector (13.6 per cent). This includes sales and repair of motor vehicles as well as the retail and wholesale trade.
- The share of these two sectors has increased in the past six years.
- Agriculture sector and herder loans together represent 5.3 per cent. This still amounts to a significant exposure of 2.5 trillion MNT or $0.7 billion.
- The share of loans to the mining sector is 5.2 per cent, half the 2020 figure. This is attributed to the fact that regulations do not allow individual banks to have more than 10 per cent exposure to this sector.

The percentage of non-performing loans (NPLs) in the Mongolian Banking System (Figure 59) is 7.5 per cent.

159 Basel Committee on Banking Supervision, Principles for the Management of Credit Risk. Available at https://www.bis.org/publ/bcbs75.pdf
160 Cure Rate is a metric used in the context of Non-Performing Loan management and Loss Given Default risk assessment. It denotes the percentage of loans that previously presented arrears (where in delinquency) and, post-restructuring, present no arrears. (ECB Guidance to banks on non-performing loans, March 2017).

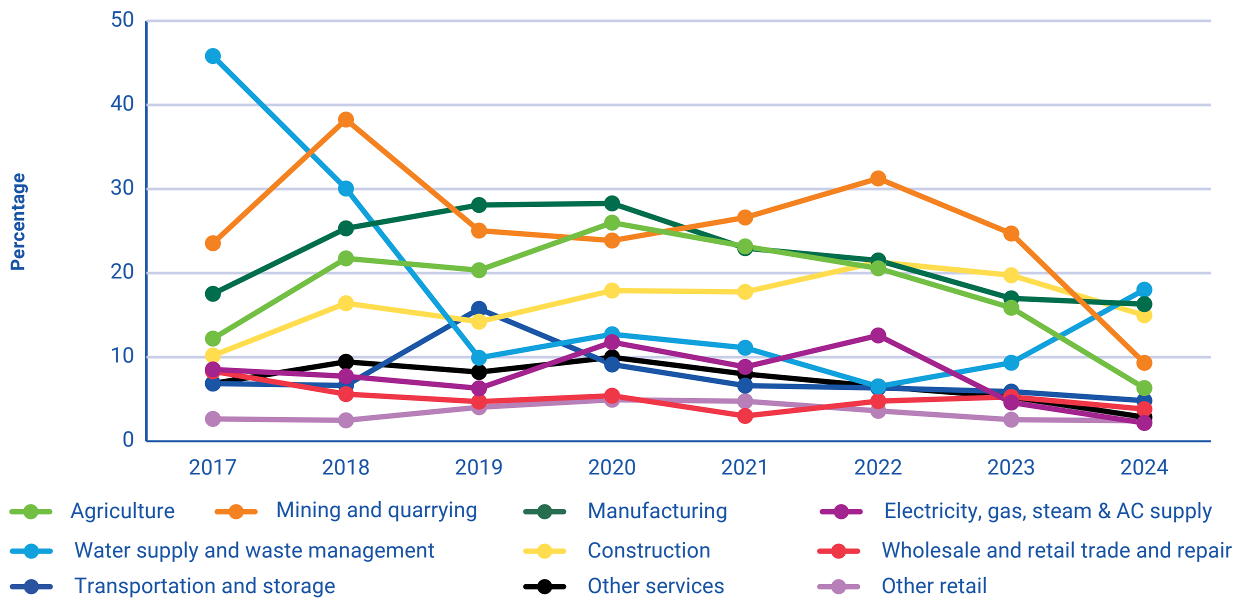
### *Figure 58* Overview of outstanding loans across different sectors in Mongolia




*Source: ESCAP based on data from Bank of Mongolia.*

### *Figure 59* Historical overview of non-performing loans in Mongolia (in million MNT)




*Source: ESCAP based on data from Bank of Mongolia.*

- The highest volume of NPLs is in the construction and manufacturing sectors. The mining sector had the highest NPL percentage in 2023, at 24.7 per cent.
- The volume of NPLs in the wholesale and retail trade (including repair of motor vehicles and motorcycles) has increased since the COVID-19 pandemic.
- The NPL volume in the construction sector has been on a steady rise.
- Agriculture sector loans have lower NPL volumes than other sectors, although the percentage of NPLs remained high at 15 per cent in 2023, coming down to 9.3% in 2024.

Given the exposure of bank credit to high-emitting sectors,[161] climate change impacts can lead to credit risks for banks in several ways. Despite the mining and agriculture sectors being only a small proportion of the overall loan portfolio, bank credit to these sectors plays an important role in sustaining their operations and ensuring their continued contribution to the economy. However, it must also be noted that the disaggregated data by sector only goes back to 2017. Between 2017 and 2023, the volume of NPLs increased but their share of total loans decreased. Analysis by sector for longer time horizons, for both volume and share of NPLs, would give a better understanding of vulnerabilities.

## Agriculture

The effects of climate change could lead to losses in income and potentially to increases in loan defaults among those who rely on livestock production for their livelihood, especially in regions where herding is the primary driver of the economy.

- Floods and *dzuds* lead to livestock mortality, reducing herders' income streams, affecting livelihoods and reducing their ability to repay loans.
- Droughts and extreme dry summers impact herding cycles, which also leads to a decline in herders' incomes. A drought preceding a *dzud* can significantly increase the severity of losses during the *dzud*.

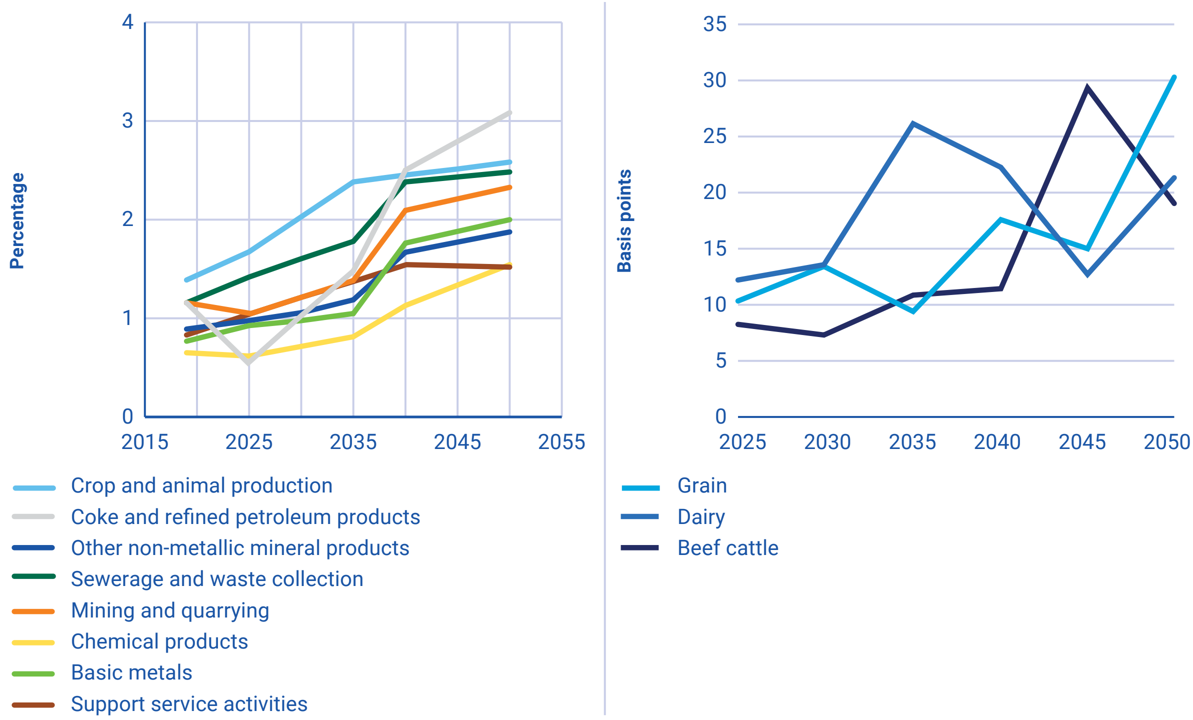
For example: The recent *dzud* in 2023/24 resulted in the loss of more than 6.8 million head of livestock across the country.[162] Assuming an average price of MNT 1.45 million[163] (~$426) for one fully grown head of livestock, this represents an economic loss of ~$2.9 billion. The Bank of Mongolia allowed herders to postpone loan repayments until June 2024 on account of the *dzud*. The bank's database includes more than 140,000 herder loans, with a value of MNT 1.2 trillion. Of these, 51.2 per cent (MNT 618 billion ($182 million)) are from the State Bank and 48.5 per cent (MNT585 billion ($172 million)) from the Khan Bank. These loans would directly become $S_2$ (Special Mention) loans, increasing the value at risk.

Analysis of the potential impacts of climate change on the agriculture sector in other jurisdictions include the following:

- In a climate vulnerability analysis by the Australian Prudential Regulation Authority, aggregate annualized loss rates in the beef cattle cluster increase from around 8 basis points in 2025 to 12 basis points by 2035 and to 30 basis points by 2045; the dairy cluster aggregate annualized loss rates increase from 12 basis point in 2025 to 30 basis points in 2050.[164]
- In a climate pilot exercise by ACPR France, the point-in-time probability of default for the crop and animal production sector increases from 1.5 per cent in 2020 to 2.5 per cent in 2050.[165]

161 Agriculture and mining, despite contributing 12% to total loans, represent a value of ~$0.7 billion.
162 National Emergency Management Agency, "The task of destroying animal carcasses has been ordered to be completed by May 1st", 18 April 2024. Available at https://nema.gov.mn/post/154950
163 National Statistics Office, "Average market price of Agricultural product, in November of 2023". Available at https://1212.mn/en/dissemination/62038235 (Accessed on July 2024).
164 Australia, Australian prudential regulation authority, *Climate vulnerability assessment results* (Sydney, 2022). Available at https://www.apra.gov.au/sites/default/files/2022-11/Information%20Paper%20-%20Climate%20Vulnerability%20Assessment%20Results.pdf
165 ACPR, "A first assessment of financial risks stemming from climate change: The main results of the 2020 climate pilot exercise", Analyses et syntheses, No. 122-2021 (Paris,2021). Available at: https://acpr.banque-france.fr/system/files/2025-02/20210602_as_exercice_pilote_english.pdf

***Figure 60*** Loss rates in different sectors as an effect of natural disasters




*Source: ACPR France and Australian Prudential Regulation Authority.*

## Mining

Mongolia's coal mining sector is particularly vulnerable to the transition effects of climate change and to policy shifts towards decarbonization both within the country and from trading and export partners. This could affect profitability of businesses with mining operations as well as those in supporting sectors. Mongolia's heavy reliance on coal exports to China leaves its mining sector vulnerable to China's green transition and rising carbon prices. This increases the likelihood of stranded assets, reducing the profitability and repayment capacity of mining firms.

› With the mining sector holding the highest share of non-performing loans (NPLs), banks face significant credit risk. In 2023, outstanding loans to the sector totalled MNT 1.4 trillion ($0.4 billion), underscoring the risk posed by a declining coal market.

› The broader Mongolian economy would face significant headwinds. Internal transition risks would lead to reduced investment in carbon-intensive sectors, coupled with the need for substantial capital to finance the transition to sustainable practices, which could strain economic resources.

› Transition to a low carbon economy will also impact credit ratings of fossil fuel-intensive companies. The three major rating agencies (Moody's, S&P and Fitch) incorporate transition-related risks into their credit rating assessments. Moody's moved its position from credit positive to credit negative in 2023, reflecting the increased transition risks of the sector.[166] Decreased creditworthiness will in turn increase the cost of capital for mining operations companies and will reduce investments from risk-averse investors.

› A study by the Oxford Sustainable Finance Group showed that over the last decade the cost of capital for coal mining has increased, for the renewable energy sector it has decreased, and for the oil and gas industry it has remained stable. Comparing the loan spread average for the different industries in 2000-2010 and 2011-2020, the spread for coal increased by 65 per cent, for oil and gas it increased by 7 per cent, but for biofuels it decreased by 43 per cent.[167]

166 Fitch Ratings, Climate Vulnerability in Corporate Ratings - Discussion Paper. Available at https://www.fitchratings.com/research/corporate-finance/climate-vulnerability-in-corporate-ratings-discussion-paper-15-02-2023

167 University of Oxford, The energy transition and changing financing costs. Available at https://www.smithschool.ox.ac.uk/sites/default/files/2022-02/The-energy-transition-and-changing-financing-costs.pdf

***Figure 61*** Climate-vulnerable sectors account for a large proportion of total losses on bank lending

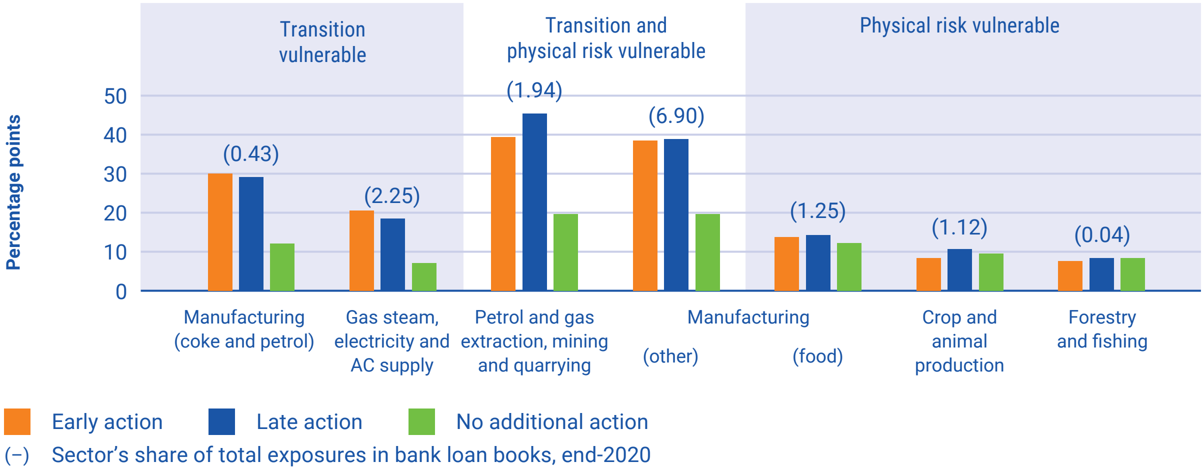
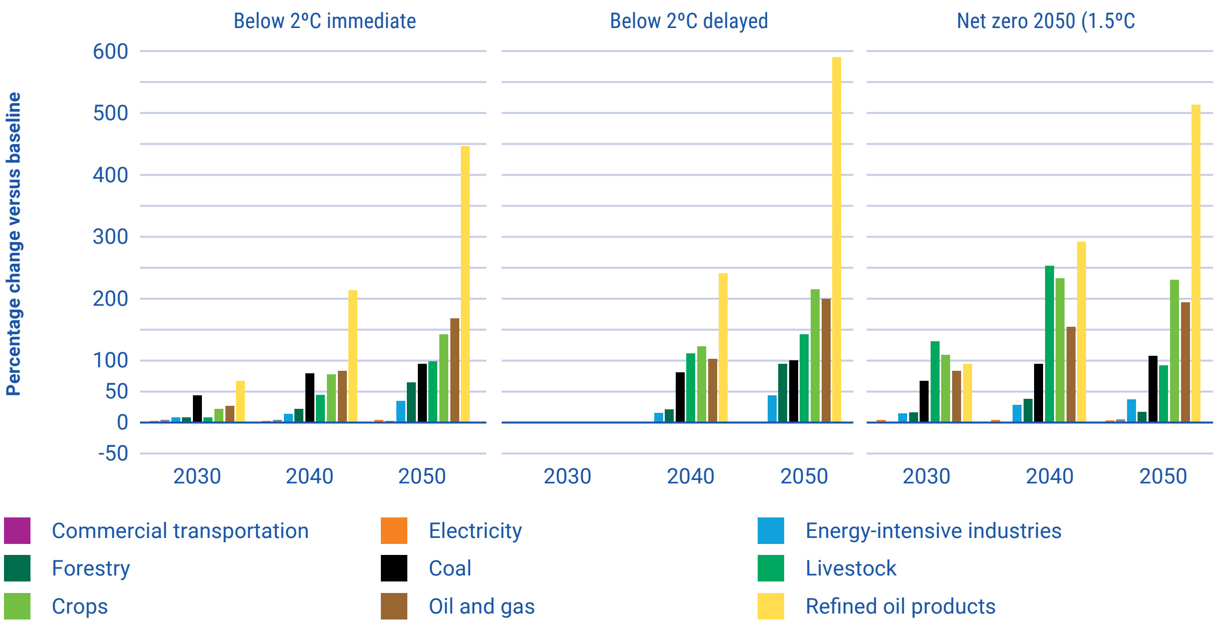



***Figure 62*** Change in probability of default in Canada across the transition scenarios




*Source: Bank of England and Bank of Canada.*

Several studies have estimated the credit risk impacts for the mining sector:

- The Climate Biennial Exploratory Scenario conducted by the Bank of England shows the highest impairment rates for banks for the oil, gas and mining sectors, with a 20 percentage point increase under the Current Policy-equivalent scenario and a 45 percentage point increase in the Delayed Transition-equivalent scenario. The sectors most affected by transition risks (Figure 61) accounted for around a third of banks' total provisions in the transition scenarios, despite these sectors only accounting for around 14 per cent of banks' total corporate exposure.[168]
- In a pilot climate scenario analysis by the Bank of Canada, under the Below 2°C scenario the probability of default increases by ~50 per cent in 2030, ~75 per cent in 2040 and ~100 per cent in 2050 (Figure 62). These increases in probability of default are much larger under more stringent transition scenarios such as Delayed Transition and Net Zero 2050.[169]

168 Bank of England, "Results of the 2021 Climate Biennial Exploratory Scenario (CBES)", 24 May 2022. Available at https://www.bankofengland.co.uk/stress-testing/2022/results-of-the-2021-climate-biennial-exploratory-scenario

169 Bank of Canada, Using scenario analysis to assess climate transition risk: Final report of the BoC-OSFI Climate Scenario Analysis Pilot. Available at https://publications.gc.ca/collections/collection_2022/banque-bank-canada/FB4-29-2022-eng.pdf

## Credit risk from collateral

Credit risk can arise from depreciation in the value of collateral used to secure loans due to the impact of acute physical hazards or of transition risks.

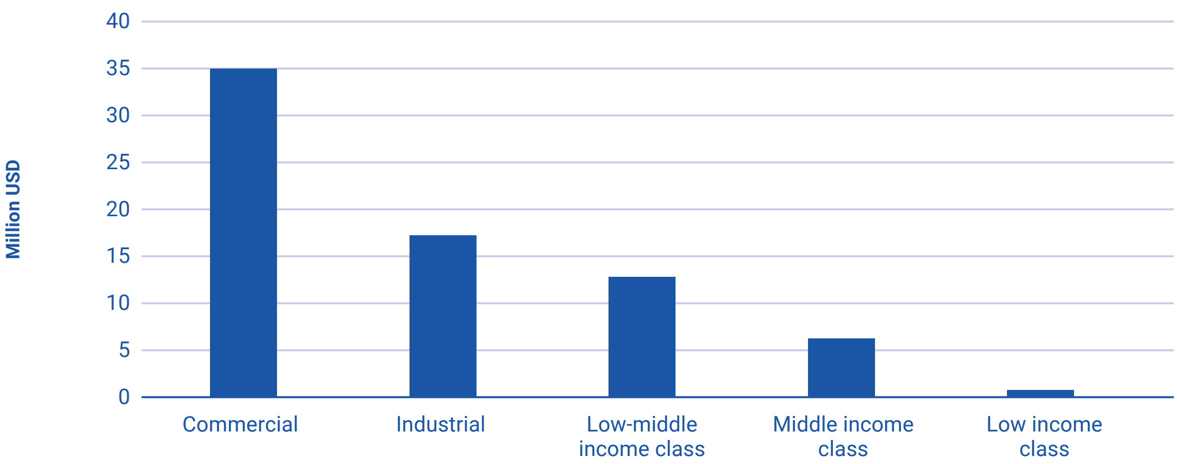
The impact of transition risks on the mining sector and the increased risks and cost of capital could force banks to impose higher collateral requirements for loans to the coal, agriculture and livestock sectors. Eligibility criteria, size and liquidity of collateral are bank-specific and may differ across different banks. However, accepting collateral in the coal mining and livestock sectors has the potential to heighten risks for the banking sector. When equipment and mining-related assets or livestock are used as collateral, it may amplify the negative impact of stranded assets. In the case of livestock, this could result in a stock of dead animals due to events such as a *dzud* or other extreme weather conditions.

As noted above, the frequency of disasters has been steadily increasing in recent decades. This also leads to increases in insurance costs for real estate, infrastructure and capital assets. Increasing claims burdens over time could lead to additional pressure on premiums and may cause shock-induced price rises.[170]

Although most insurance policies have provisions for short-term premium adjustment, the higher frequency and intensity of physical risk hazards could make some regions uninsurable. For example, the USA's largest property insurer, State Farm Insurance, announced in June 2023 that it will stop issuing new policies in California, the country's largest property insurance market, almost entirely, citing economic and climate exposure reasons.[171] The potential widening of protection gaps in the insurance sector due to rising costs, and the increasing prevalence of uninsurable risks, may exacerbate economic vulnerabilities, leaving individuals and businesses exposed to the full impact of climate-related events without adequate financial protection.[172]

In Mongolia, floods cause severe damage to property and infrastructure. Data from the Coalition for Disaster Resilient Infrastructure (CDRI) show that under the Current Policies climate scenario, average annual losses (AAL)[173] due to flooding affecting buildings in Mongolia are estimated to be $71.6 million (Figure 63). Of the 807,476 houses in Mongolia, 641,286 have been identified as highly exposed (at major susceptibility/intensity levels) to floods, including 150,033 at a high susceptibility/intensity level, and 491,253 at a moderate susceptibility/ intensity level.[174]

***Figure 63*** Average annual losses due to floods by subsector ($ million)




170 DeNederlandscheBank, Waterproof? An exploration of climte-related risks for the Dutch financial sector. Available at https://www.dnb.nl/media/r40dgfap/waterproof-an-exploration-of-climate-related-risks-for-the-dutch-financial-sector.pdf

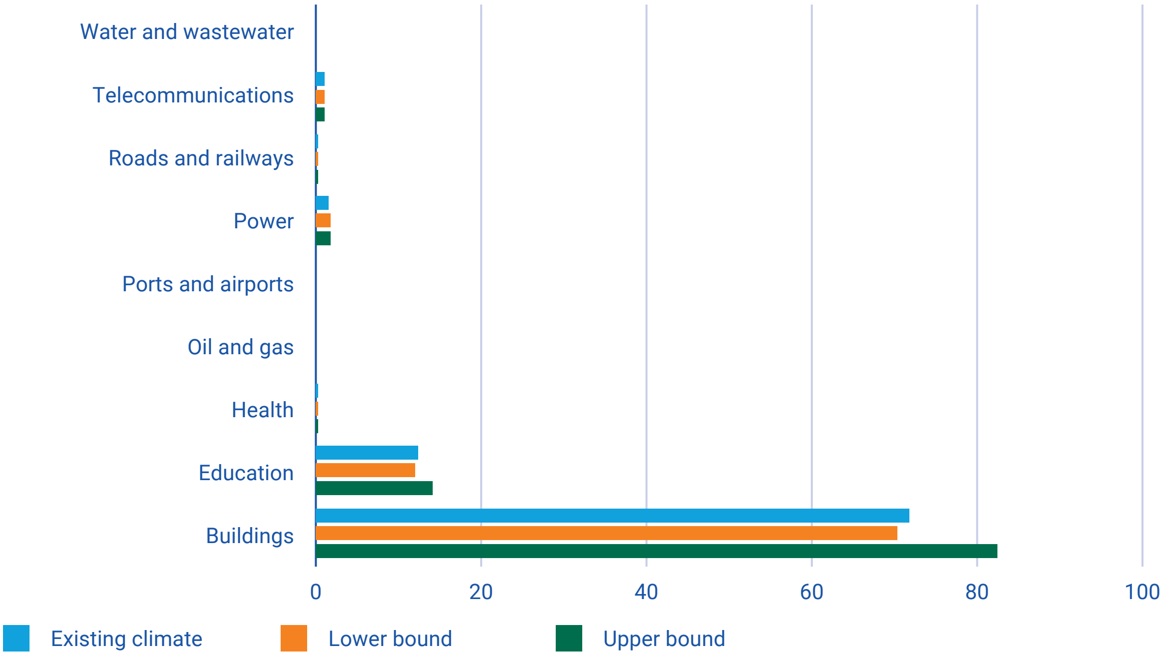
171 Kate Aronoff, "Climate risks have made California uninsurable. When will we wake up?", 06 June 2023. Available at https://www.theguardian.com/commentisfree/2023/jun/06/climate-risks-are-making-california-uninsurable-when-will-we-wake-up

172 Tobias Adrian, "Climate Risks and Financial Stability: What Can Central Banks and Financial Sector Supervisors Do?", 12 December 2023. Available at https://www.imf.org/en/News/Articles/2023/12/12/sp-climate-risks-financial-stability-what-can-central-banks-and-financial-sector-supervisors-do

173 Average annual losses (AAL) is a measure of annualized future losses over the long term, derived from probabilistic risk models. The AAL provides an estimator of losses that are likely to occur every year due to a specific hazard.

174 Asian Development Bank and The National Emergency Management Agency, Strengthening Capacity on Disaster Risk Assessment, Reduction, and Transfer Instruments in Mongolia, TA-9880 MON.

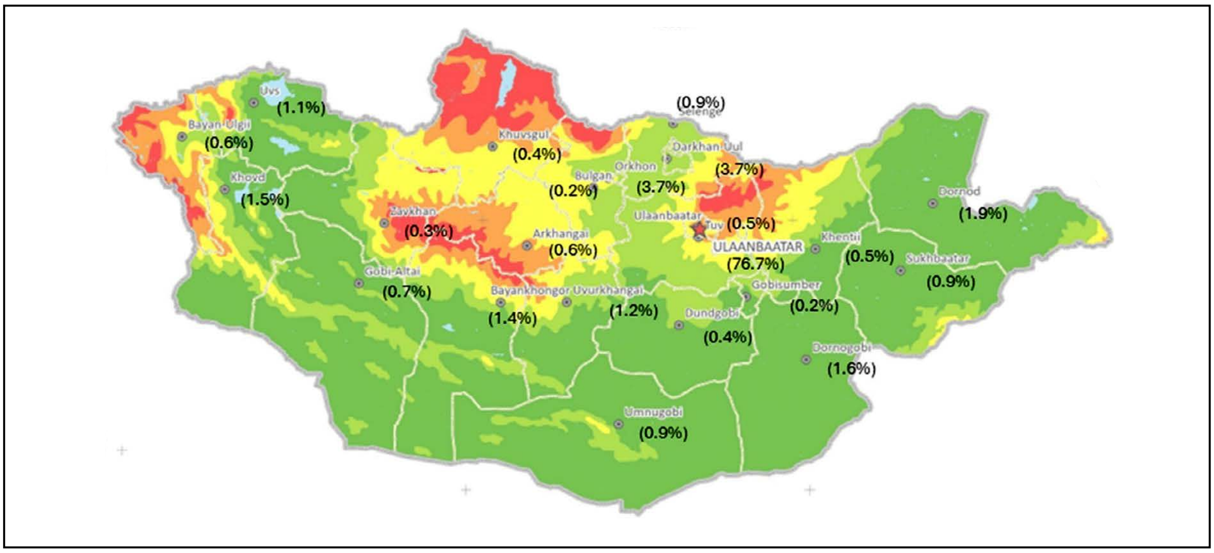
***Figure 64*** Average annual losses by sector and climate as a result of floods ($ million)




*Source: UNEP Giri database.*

Exposure of property to floods, especially commercial and industrial buildings, is significantly high, at $35 million and $17 million respectively (Figure 63). Damage to these buildings could lead to a significant repricing of their value, or in the worst cases to a loss of value, increasing the loss provisions for banks while decreasing the loan to value and consequently increasing credit risks. Even at the individual consumer level, the total value exposed to floods is estimated to be almost $20 million annually, significantly raising credit risks for mortgages.

***Figure 65*** Percentage of collateralized mortgage loans by province and current flood susceptibility




**Hazard susceptibility level**

Very high | High | Moderate | Low | Very low

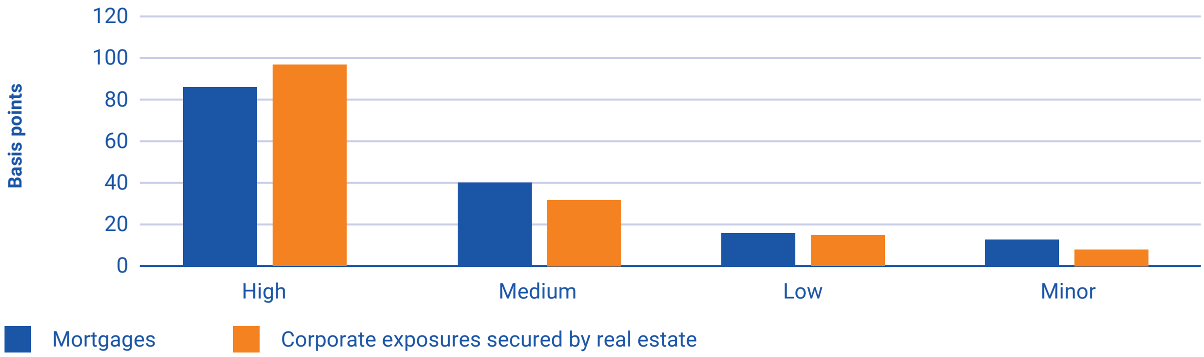
**Percentage of total collateralized mortgage loans**

**(%)**

*Source: ESCAP using data from Bank of Mongolia and NEMA.*

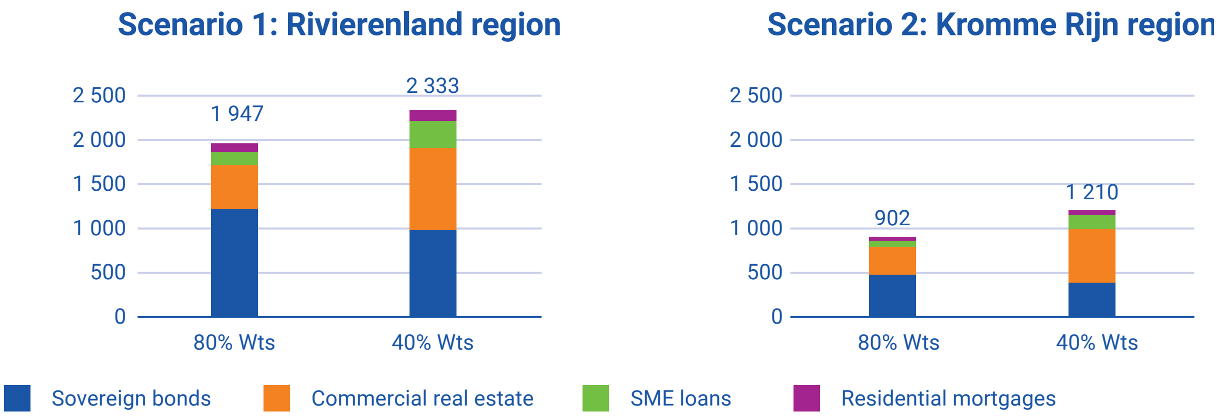
A high proportion of loans in the provinces of Ulaanbaatar, Tuv, Arkhangai, Zavkhan, Khuvsgul and Bayan-Ulgii are already at a high risk of flooding,[175] with the majority concentrated in Ulaanbaatar, as the flood risk susceptibility map shows (Figure 65).[176] Moreover, 79 per cent of all collateralized mortgage loans are in moderate to very high-risk provinces, representing a total outstanding value of MNT 3.4 trillion. High-resolution data for the location of these collaterals can help define risk to collateral with more precision, as the risk of flooding can vary across province areas.

***Figure 66*** Cumulative loan losses across the EU under the flood scenario




*Source: ECB 2022 Climate Risk Stress Test.*

***Figure 67*** Estimated impact of flooding on credit losses on Dutch debt instruments




*Source: DeNederlandscheBank, Waterproof? An exploration of climate-related risks for the Dutch Financial Sector (2017).*

*Note: "% Wts" refers to the percentage of damage compensated by the government in accordance with the Calamities Compensation Act [Wet tegemoetkoming schade bij rampen] (Wts).*

Several regulators have estimated potential losses under flood scenarios:

› The ECB's climate stress test found that under the flood scenario, medium and high-exposure regions see an increase of ~7-9 basis points in their risk exposure amounts (REA). However, it concluded that banks' projections did not seem to differentiate clearly between the different flood risk areas when applying credit risk shocks.[177]

› An analysis by DeNederlandscheBank found that the estimated impacts of flooding on credit losses were approximately EUR 600 million under a scenario of 80 per cent of damage compensated by the government in accordance with the Calamities Compensation Act [*Wet tegemoetkoming schade bij rampen*] (Wts);[178] and approximately EUR 1 billion under a scenario of 40 per cent of damage compensated.[179]

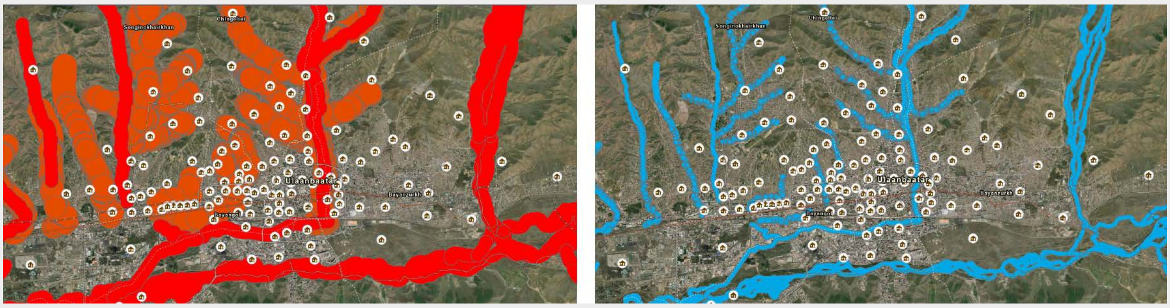
175 Based on data from the Mongolian Mortgage Corporation (MIK).
176 Asian Development Bank and The National Emergency Management Agency, Strengthening Capacity on Disaster Risk Assessment, Reduction, and Transfer Instruments in Mongolia, TA-9880 MON.
177 European Central Bank, 2022 climate risk stress test. Available at https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.climate_stress_test_report.20220708~2e3cc0999f.en.pdf
178 Wts percentage is the level of compensation by the government.
179 DeNederlandscheBank, Waterproof? An exploration of climte-related risks for the Dutch financial sector. Available at https://www.dnb.nl/media/r40dgfap/waterproof-an-exploration-of-climate-related-risks-for-the-dutch-financial-sector.pdf

***Ongoing work on flood risk assessment in Mongolia***

## 1. MIK: Estimation of flood risk impact on residential mortgage portfolios[1]

The Mongolian Mortgage Corporation has been leading work to assess natural disaster risk for banks' mortgage portfolios. Focusing on flooding in Ulaanbaatar, they use satellite data and 3D models to analyse terrain elevation, slope, river flow and direction to identify zones at high risk of flooding (Figure 60). Future projections of precipitation and simulations of future flood risk areas are identified geospatially under the SSP2-4.5 and SSP2-8.5 scenarios. For price shock, housing prices are analysed and an average price drop of 8.1 per cent is calculated, based on 1500 apartments in 12 flood-prone areas. The expected credit losses are calculated using this price shock, the probability of flooding under the scenarios, and collateral value.

***Figure 68*** Future flood risk mapping under SSP2-8.5 and SSP2-4.5 scenarios

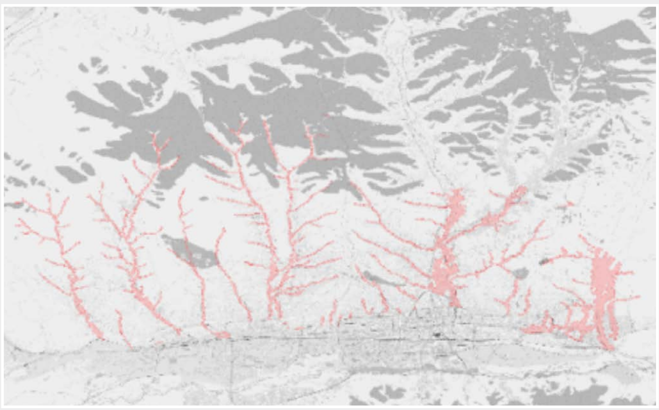


*Source: Mongolian Mortgage Corporation.*
*Note: The highlighted areas (red and blue) show modeled flooding risk under scenarios (SSP2-8.5 and SSP2-4.5 respectively).*

## 2. Mathematical modelling of climate change in Ulaanbaatar city and its effects on flood risk: NAMEM and UN-Habitat

The study modelled past floods, taking into account the interaction of the atmosphere-land-cover-hydrology system, and the flow of rivers and streams was calculated dynamically with high temporal and geographical accuracy. The maximum value change of Ulaanbaatar city rainfall days due to climate change was calculated for 2025-2080 by greenhouse gas scenario and regional model. Dynamic mathematical modelling was then used for a climate change impact assessment of floods in Ulaanbaatar. The study found that the area in Ulaanbaatar liable to flooding is expected to increase by 19.6 per cent by 2030-2080 (Figure 69).

***Figure 69*** Flood risk map RCP-8.5 scenario for Ulaanbaatar



*Source: Author's visualization using data from NAMEM.*
*Note: The highlighted area in red shows modeled flooding risk under RCP-8.5 scenario.*

1 Mongolian Mortgage Corporation, Estimation of flood risk impact on residential mortgage portfolio.

## ▶Market risk

***Figure 70*** Market risk and associated transmission channel matrix

| | Physical risk drivers | Transition risk drivers |
|---|---|---|
| Microeconomic transmission channels | **Stock, currencies and asset prices:** Uncertainty about severe weather events can cause volatility in financial markets. | **Uncertainty about corporate exposure to transition risk:** Mispricing, risk of abrupt repricing events (e.g., stranded assets), increased volatility. |
| Macroeconomic transmission channels | **Stock, currencies, commodity and asset prices:** Sector policies, regulation, technological advances and investor sentiment, leading to repricing of assets, costs of hedgin and insurance increases for carbon-intensive assets. | The spread of microeconomic market risk channels through value chains and macroeconomic variables. |

Market risk is defined as the risk of losses arising from movements in market prices. The risks subject to market risk capital requirements include but are not limited to:

1. Default risk, interest rate risk, credit spread risk, equity risk, foreign exchange risk and commodities risk for trading book instruments; and
2. Foreign exchange risk and commodities risk for banking book instruments.[180]

Uncertainty about the timing, intensity and location of future severe weather events and other natural disasters may lead to higher volatility in financial markets. Analysis of the impact of physical risks on financial markets is limited. Few central banks have studied or quantified market risks in their pilot exercises, while most have restricted their pilot exercises to the quantification of credit risks.

Market risk can be quantified through various methodologies, some of which are described in the European Central Bank's climate stress test, in which market risk exposures used to calculate revaluations are all corporate bonds and stocks in the trading book (Fair Value through Profit and Loss). Banks are asked to calculate how the fair value of market risk exposures as used in the stress test is affected by the carbon price shock. This change in fair value needs to be broken down by risk driver (equity, credit spread, interest rates, commodities, foreign exchange movements and others).[181]

The Bank of Canada estimated the impacts of the climate transition on equity valuations for each sector-geography pairing, using a discounted dividend model.[182] Sectoral dividends under each climate transition scenario were calculated from projected sectoral value-added along the transition pathway, using assumptions on the capital share of value-added and the dividend distribution rate. The streams of dividends were then discounted using Morgan Stanley Capital International's average historical returns.[183]

ACPR France divided market risks into two sub-categories: the fair value revaluation of the trading book following an instantaneous market shock induced by the valuation of assets under adverse transition scenarios; and the impact of market shocks on the counterparty risk in the most sensitive sectors.

180 Basel Committee on Banking Supervision, Calculation of RWA for market risk - Definitions and application of market risk. Available at https://www.bis.org/basel_framework/chapter/MAR/11.htm?inforce=20230101&published=20200327

181 European Central Bank, 2022 climate risk stress test. Available at https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.climate_stress_test_report.20220708~2e3cc0999f.en.pdf

182 The Bank of Canada estimated geography-sector equity index values by discounting computed annual dividend flows within a 50-year, forward-looking window for each of the three climate transition scenarios from 2020 to 2100.

183 Bank of Canada, Using scenario analysis to assess climate transition risk : final report of the BoC-OSFI Climate Scenario Analysis Pilot. Available at https://publications.gc.ca/collections/collection_2022/banque-bank-canada/FB4-29-2022-eng.pdf

For the first component of market risk, the following exposures were studied: equity, corporate credit spreads (mainly related to bonds), sovereign credit spreads, and commodities (only oil-related positions). Variations in the valuation of interest rate portfolios were excluded from the results, as were the magnitude of the impacts (linked to massive interest rate variations in the scenarios).[184]

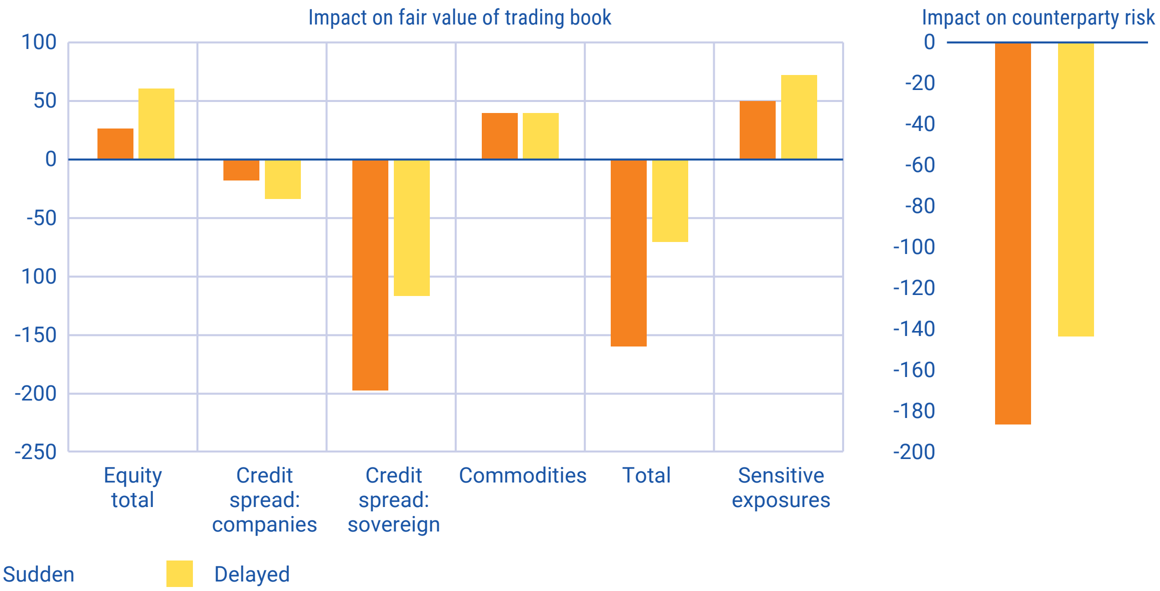
Banks may experience deterioration in asset values particularly if they have significant exposure to sectors or regions that are highly vulnerable to climate change impacts. As noted above, the Mongolian economy depends significantly on world commodity prices, and mining comprises a major share of exports. Volatility in prices of commodities and assets triggered by climate change impacts could increase market risks to the Mongolian Financial Sector.

- Risks arising from China's shift towards decarbonization and the resulting change in asset values may leave investments in coal and coal mines economically unviable.
- Asset values, particularly in the real estate and natural resource sectors, may decline as a result of the increased frequency and severity of climate-related disasters; policy-driven shifts away from fossil fuels by Mongolia and/or China; or an increase in carbon prices.
- Higher government costs to manage climate risk exposure (which are considered to be 1.17 per cent higher in developing countries) along with higher debt servicing costs could lead to higher taxes or lower government spending, which may indirectly impact banks.
- The effect on debt servicing could have further repercussions on the country's traded sovereign debt, leading to a lower market-to-market value of the bonds held by local banks[185] or a reduction in the value of sovereign debt collateral, resulting in the need to increase the collateral posted.

While limited, some exercises of stress testing include estimations of market risks:

- According to the ACPR analysis, the instantaneous impact of the transition scenarios is estimated to be €160 million in the case of a sudden transition, and €69.6 million in the case of a delayed transition (Figure 71). However, it must be noted that the recorded losses here are relatively modest compared with standard stress tests such as those usually carried out by the EBA.

**Figure 71** Impact of financial shocks on market risk (€ million)




*Source: ACPR.*

184 ACPR, "A first assessment of financial risks stemming from climate change: The main results of the 2020 climate pilot exercise", Analyses et syntheses, No. 122-2021 (Paris,2021). Available at: https://acpr.banque-france.fr/system/files/2025-02/20210602_as_exercice_pilote_english.pdf

185 The percentage of Mongolian banks' assets in sovereign debt were 4.9% on 31 March 2024.

- Under the ECB Climate Stress Test 2022, banks reported a very small drop in the net fair value of their trading portfolios from a one-year materialization of an instantaneous transition risk shock. Banks' hedging strategies are seen to be compensating for the losses in equity positions, even leading to an increase in the net fair value of the trading portfolio. For corporate bonds, the overall change was negative, showing less effective hedging positions. However, even without considering the effect of hedges, the market risk impact reported by banks was fairly benign.

***Figure 72*** Sectoral change in fair value: Net corporate bond positions

*Note: Index: fair value of net positions in 2021=100.*

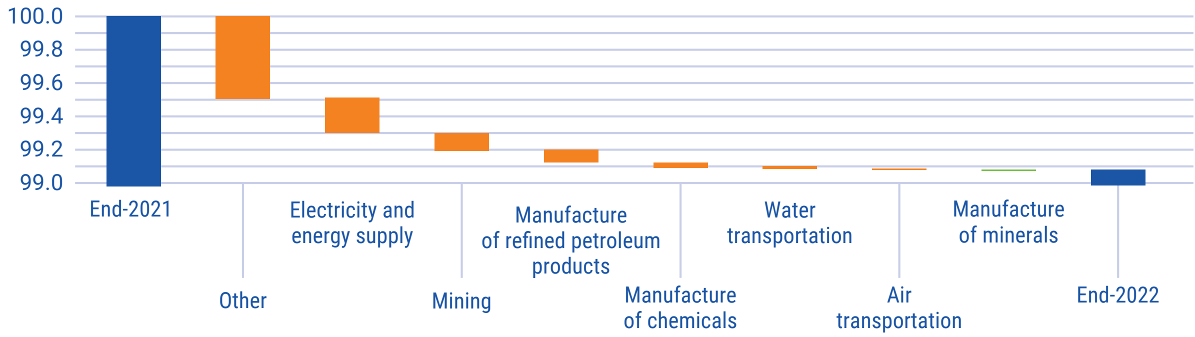
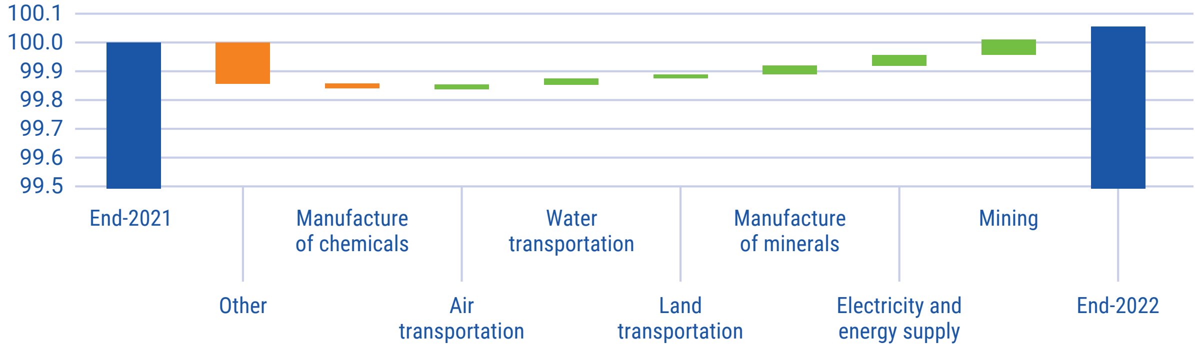



***Figure 73*** Sectoral change in fair value: Net equity positions

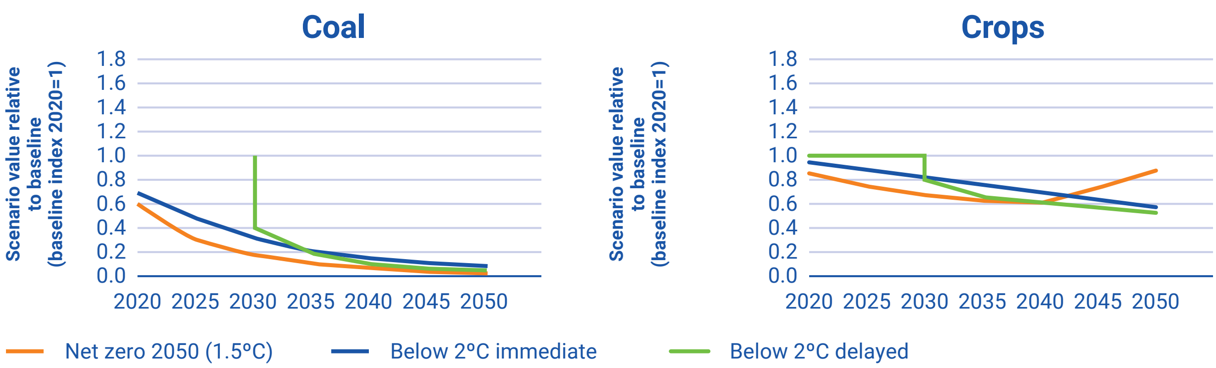
*Note: Index: fair value of net positions in 2021=100.*




*Source: ECB Stress Test Results 2022.*

- The pilot study by the Bank of Canada estimated the market risks for various sectors following global climate policies. The biggest negative impacts are observed in fossil-fuel sectors such as coal, oil and gas, and refined oil. Abrupt changes in the valuation of assets, as seen in the Delayed Transition scenario, pose greater risks to the financial system and to financial stability (Figure 74).

***Figure 74*** Coal and crop price pathways in Canada under selected NGFS scenarios




*Source: Bank of Canada, Using Scenario Analysis to Assess Climate Transition Risk, 2022.*

## ▶Liquidity risks

Liquidity risk is defined as the risk that the financial institution will not be able to meet both expected and unexpected current and future cash flow and collateral needs efficiently without affecting either daily operations or the financial condition of the firm.[186] Climate change-induced liquidity risks in the financial sector arise as banks and financial institutions are affected by the impacts of physical and transition risks on their liquidity (Figure 75).

This risk can affect a bank's ability to raise cash or cash-equivalent assets and liquidate assets directly or through increased demand for liquidity after a disaster event indirectly.

***Figure 75*** Liquidity risk and associated transmission channel matrix

| | Physical risk drivers | Transition risk drivers |
|---|---|---|
| Microeconomic transmission channels | **Asset valuation, counterparty behavior, funding conditions:** natural disasters can cause corporates and households to draw on banks credit lines and increase withdrawals for recovery, liquidity buffers are important to absorb local shocks, can impact banks's ability to raise funds, liquidate assets to meet customer's liquidity demand, central banks might have to inject liquidity to ensure market stability (example Japan 2011). The impact of transition risks on liquidity is less studied. | |

Climate risk can affect the liquidity of banks through their loan portfolios. Banks that have allocated funds to sectors susceptible to the consequences of climate change may experience higher rates of loan defaults and financial losses as a result of climate-related incidents, as discussed above. The drop in assets can lead to a loss in the bank's liquidity, thus increasing the difficulty for the bank to fulfil its short-term obligations.[187]

In the case of physical risks, disaster events such as *dzuds*, floods or droughts can lead to larger than expected withdrawals, leading to increased demand for liquid assets in the form of cash. Moreover, people may require additional expenses for relief, reconstruction and repair from the damage caused by the disasters. This in turn can increase liquidity pressures on the banks, which could lead to the liquidation of assets on banks' balance sheets to meet the increased cash withdrawal.[188] Liquidity demand from herders could increase, for several reasons:

- Droughts and *dzuds* disrupt livestock growth and survival, with small and mid-size herders most at risk of losing entire herds. Rebuilding becomes harder as disasters grow more frequent.
- Insurance and liquidity matter: index-based livestock insurance enables faster recovery, while rising fuel and hay costs erode herders' savings and increase liquidity needs.[189]

A case from Japan following the Great East Japan Earthquake in March 2011 illustrates the liquidity risks. The Bank of Japan (BoJ) had to provide daily liquidity of JPY 21.8 trillion (~$274 billion) to cover increased demand from households and businesses, channelled through banks. This was three times the liquidity that was offered by BoJ during the financial crisis in 2007/08. Without the extensive support of BoJ, the risk burden would have fallen on local banks.[190]

186 Basel Committee on Banking Supervision, Principles for Sound Liquidity Risk Management and Supervision. Available at https://www.bis.org/publ/bcbs144.pdf

187 Chien-Chiang Lee and others, "Climate risk and bank liquidity creation: International evidence", *International Review of Financial Analysis*, vol. 82 (July 2022). Available at https://doi.org/10.1016/j.irfa.2022.102198

188 Qiaoqi Lang and others, "The interaction of climate risk and bank liquidity: An emerging market perspective for transitions to low carbon energy", *Technological Forecasting and Social Change,* vol. 191 (June 2023). Available at https://doi.org/10.1016/j.techfore.2023.122480

189 Veronika Bertram-Huemmer and Kati Kraehnert, "Does Index Insurance Help Households Recover from Disaster? Evidence from IBLI Mongolia", *American Journal of Agricultura Economics*, vol. 100, Issue 1 (January 2018). Available at https://doi.org/10.1093/ajae/aax069

190 Basel Committee on Banking Supervision, Climate-related risk drivers and their transmission channels. Available at https://www.bis.org/bcbs/publ/d517.pdf

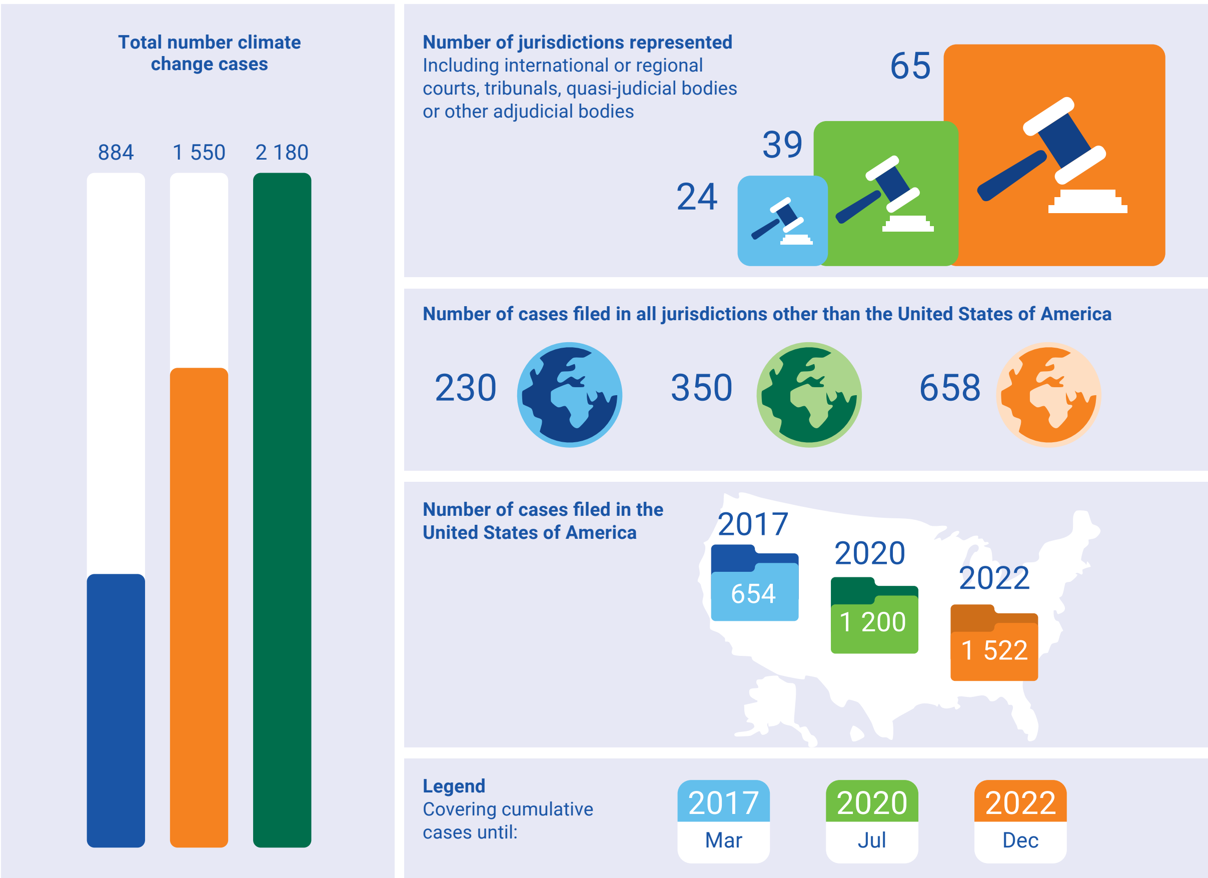
## ▶Legal and reputational risks

Legal risks resulting from climate change encompass various types of potential legal liabilities and challenges that financial institutions might face as a consequence of climate-related impacts and actions. Legal risks particularly include non-compliance with climate-related laws and regulations, and cases alleging misinformation or inadequate disclosure of climate-related risks by businesses.[191] While, reputational risk refers to the potential damage to a company's reputation that can occur due to actions, behaviours or events directly or indirectly associated with the company. Reputational damage can adversely affect a company's business outcomes, leading to loss of customer trust, decline in market value and other negative financial impacts.

Reputational risk is closely connected to legal and litigation risks that result from financing unethical businesses linked to climate change. Effective management of reputational risk involves practices such as maintaining good governance, transparency and ethical operations, and having contingency plans for crisis management.

Regulatory changes associated with transition, litigation for failing to meet GHG reduction targets and financial impacts from shifting investor and consumer preferences can lead to potential legal risks.[192] The number of climate-related litigations worldwide has increased significantly in recent years, with the total number of climate lawsuit cases, and the cumulative number of cases, currently 2.5 times higher than in 2017[193] (Figure 76).

***Figure 76*** Growth of climate litigation globally




*Source: UNEP (2023).*

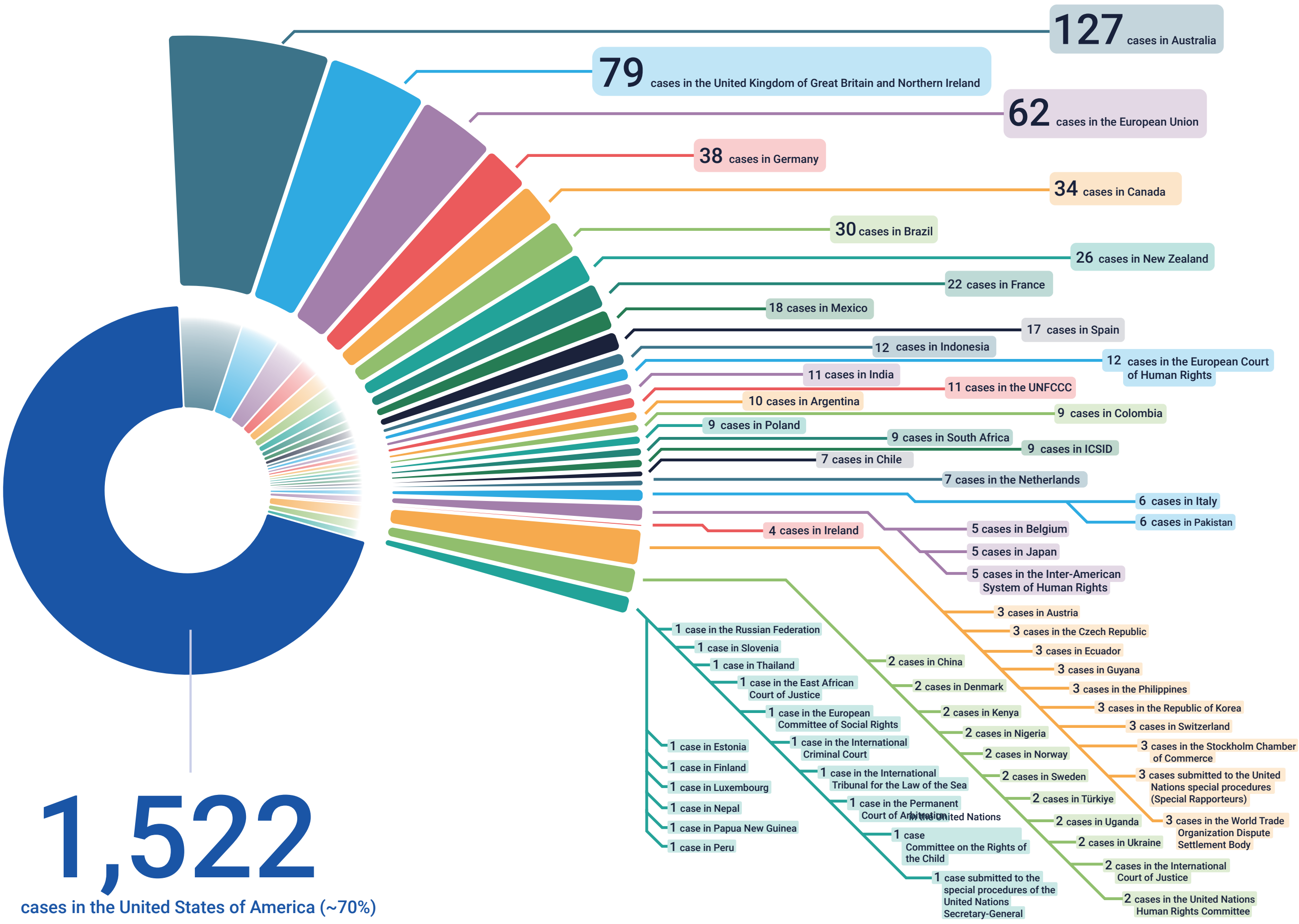
191 ClientEarth, "How can the law fight climate change?", 24 October 2023. Available at https://www.clientearth.org/latest/news/how-can-the-law-fight-climate-change/

192 Finma, "Climate risks and other nature risks". Available at https://www.finma.ch/en/documentation/dossier/dossier-sustainable-finance/klimarisiken-und-weitere-naturrisiken/

193 United Nations Environment Programme, *Global Climate Litigation Report: 2023 Status Review* (Nairobi, United Nations Environment Programme, 2023). Available at https://doi.org/10.59117/20.500.11822/43008

The legal risk is currently limited for Mongolia's banks and private sector institutions, because enforcement of environmental laws and environment-related provisions in sectoral legislation is considered challenging, as outlined in Mongolia's recent *Environmental Performance Review*.[194] Agreements aimed at safeguarding the environment, particularly agreements between mining corporations and municipal authorities, are not made available to the public.[195] However, international pressure is increasing for countries to abide by climate-related laws and to decrease financing for projects and interventions that can lead to climate-related disasters. The number of jurisdictions filing climate litigation has increased nearly three times since 2017 and continues to increase[196] (Figure 77).

***Figure 77*** Cumulative number of cases per jurisdiction[197]




*Source: UNEP (2023).*

Several examples of climate-related litigation are documented:

- The environmental law charity ClientEarth reports that it won two legal cases against the energy companies Enea and Energa, over a planned new coal plant and its effects on climate change in Ostreleka, Poland. As a consequence, the planned coal plant was suspended, and funding was cancelled for reasons of legal risk and reputational damage.[198]

194 *Environmental Performance Reviews Mongolia*, No. 49, Environmental Performance Reviews Series (United Nations Publication, 2018).
195 ClientEarth, "The end of Poland's last new coal plant?". Available at https://www.clientearth.org/latest/news/the-end-of-poland-s-last-new-coal-plant/
196 United Nations Environment Programme, *Global Climate Litigation Report: 2023 Status Review* (Nairobi, United Nations Environment Programme, 2023). Available at https://doi.org/10.59117/20.500.11822/43008
197 United Nations Environment Programme, *Global Climate Litigation Report: 2023 Status Review* (Nairobi, United Nations Environment Programme, 2023). Available at https://doi.org/10.59117/20.500.11822/43008
198 ClientEarth, "The end of Poland's last new coal plant?". Available at https://www.clientearth.org/latest/news/the-end-of-poland-s-last-new-coal-plant/

- Milieudefensie, the Dutch arm of Friends of the Earth, has actively pursued legal challenges against major corporations to enforce climate action. After its landmark victory against Shell, Milieudefensie turned its focus towards the financial sector, specifically targeting banks such as ING and BNP Paribas. These lawsuits argue that the banks' financing of fossil fuel projects contributes to climate change, thereby violating environmental and human rights norms.[199, 200] These legal actions are part of a broader trend of using courts to hold financial institutions accountable for their environmental impact, reflecting a growing recognition of the crucial role banks play in funding carbon-intensive industries.[201]

## ▶Operational risk

Operational risk is defined in the Basel Framework as the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events.[202] Operational risk can be subdivided into various sub-risk categories: conduct, cyber, disruption, error, fraud and legal risk (Table 4).

For example, a bank's operations may be disrupted due to physical damage to its property, branches and data centres as a result of extreme weather events.[203] Or second-order impacts may arise from increased conflict leading to external and internal frauds.[204]

***Table 4*** Operational risk categories and respective description

| Operational risk category | Description of possible transmission channels |
|---|---|
| **Conduct** | Stricter climate regulations will require banks to comply with new standards, increasing the risk of non-compliance and regulatory breaches, leading to reputational and legal issues. |
| **Cyber** | Increased geopolitical tensions due to climate impacts could raise the frequency and sophistication of cyber-attacks, particularly by state actors targeting financial institutions. |
| **Disruption** | Natural disasters such as floods, hurricanes and extreme weather events linked to climate change can cause operational shutdowns, affecting both banks and their supply chains. |
| **Error** | Heatwaves and extreme weather conditions may reduce staff efficiency and cause technology malfunctions, leading to higher operational errors and failures. |
| **Fraud** | Climate-related transitions and operational adjustments could expose new vulnerabilities, increasing the risks of both internal and external fraud, such as exploitation of process changes or technological weaknesses. |
| **Legal** | Banks may face legal exposure as partner companies are sued over environmental impacts, or for failing to adhere to new climate-related financial regulations. |

Current research indicates that the likelihood of banks experiencing significant financial losses due to climate-related operational issues is low, although this is based on analysis of unique occurrences and a restricted amount of publicly available data.[205] In Mongolia, floods can lead to significant damage to bank infrastructure, while *dzuds* and heavy snowfall can interrupt transportation and banking services for non-urban areas.

A case of disaster-related operational risk for banks emerged during the Typhoon Mangkhut in Hong Kong, China (September 2018). Often referred to as the world's most expensive tropical cyclone for that year, Mangkhut caused significant damage to buildings and infrastructure, and the suspension of business operations, with physical damage to bank branches and ATMs leading to temporary closures and disruptions in customer services. Such events underscore the need for enhanced risk management and investment in resilient infrastructure to withstand the impacts of climate change induced disasters.[206]

199 Milieu Defensie, "Out Climate Case Against ING". Available at https://en.milieudefensie.nl/climate-case-ing
200 Attracta Mooney, "ING faces threat of legal action from climate group behind Shell case", Financial Times, 19 January 2024. Available at https://www.ft.com/content/669b3d0a-11fd-41e3-b813-fb6cf4425089
201 Benjamin Bibas, "Banks, the new target of climate action", Justice Info, 12 December 2023. Available at https://www.justiceinfo.net/en/125924-banks-new-targets-climate-action.html
202 Basel Committee on Banking Supervision, OPE Calculation of RWA for operational risk. Available at https://www.bis.org/basel_framework/chapter/OPE/10.htm?inforce=20230101&published=20240705
203 European Central Bank, Guide on climate-related and environmental risks. Available at https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf
204 Elseware, "Climate Stress on Operational Risk". Available at https://www.elseware.fr/insights/climate-stress-on-operational-risk
205 Basel Committee on Banking Supervision, Climate-related risk drivers and their transmission channels (Basel, Bank for International Settlements, 2021). Available at https://www.bis.org/bcbs/publ/d517.pdf
206 Chun-wing Choy and others, "Assessment of the damages and direct economic loss in Hong Kong, China due to Super Typhoon Mangkhut in 2018", *Tropical Cyclone Research and Review*, vol. 9, Issue 4 (December 2020). Available at https://doi.org/10.1016/j.tcrr.2020.11.001

*Chapter 3*

# Mongolia Financial Sector Readiness and Opportunities

The magnitude of financial risks due to climate-related factors will depend on actions taken in the present. Thus banks need to address the issue of climate-related risk at a strategic level (i.e., board level), while also establishing frameworks for assessing and managing climate-related risk at all levels of their organizations. This chapter examines the current level of readiness of banks in the Mongolian financial sector in assessing and managing climate-related financial risks, discusses opportunities that banks can leverage and provides recommendations for the bank of Mongolia.

## Readiness of the Mongolian banking sector

An initial survey was conducted through the Mongolian Sustainable Finance Association (MSFA) in November 2023, with ten out of twelve banks responding to questions about their current climate risk management practices. The results provide a baseline for climate risk management practices in the Mongolian financial system under the following categories:

- Climate Risk Governance
- Climate Risk Management Policy
- Climate Risk Assessment
- Monitoring, Reporting and Benchmarking
- Role of the banking industry and banking regulations in supporting an orderly, market transition to a lower carbon economy.

The respondents together represent approximately 90 per cent of the total assets and a 94 per cent share of the financial sector in Mongolia. The following review analyses the responses from the banks and examines insights from key informant interviews conducted with the banks in the first quarter of 2024.

**Governance:** Most banks have some form of capacity-building in place for operational-level personnel, and participate in professional training to incorporate climate risk, such as the training organized by MSFA. The participation of personnel is highest among executive management and operational-level personnel, but less so at board level. Most banks currently incorporate climate risk discourse within the broader topic of sustainability.

**Climate risk management policy:** While most banks refer to an international standard, the majority do not have a climate risk management policy or a system to measure greenhouse gas emissions. Some banks are piloting the estimation of Scope 3 emissions and have a transition or financial plan in place. Some reported that climate risks are either a part of their overall risk management, broader sustainability policy or analysis on a case-and-need basis. Fossil fuel financing continues at most banks, with the exception of one bank that reported not financing fossil fuel-related businesses. The use of carbon offsets remains limited.

**Climate risk assessment:** Climate risk assessment is limited among banks. Some banks have performed sustainability and economic, social and governance (ESG) risk assessments, but few have identified physical and transition risks or conducted greenhouse gas emission calculations. Climate risk coverage in overall risk management is low. Only a few banks have analysed the effects of past disasters or assessed collateral based on geographical risks.

**Monitoring, reporting and benchmarking:** Climate reporting remains limited or is a subset of ESG and sustainability reporting. The breadth of indicator coverage is limited and only performed by a small number of banks. Monitoring systems remain non-existent in most banks, while a few banks implement them at the functional level, but monitoring at the board level remains low.

The role of the banking industry and banking regulations in supporting an orderly market transition to a lower carbon economy: All banks believe that the banking regulators have an essential role to play in supporting an orderly market transition to a lower carbon economy. Their recommendations included:

- Capital adequacy ratios to reduce risks of green operations, and risk-weighted ratios.
- Subsidies, a reduction in the cost of swaps to loans for green operations, and development of green technological operations.
- Guidance on data collection and scenario analysis to manage climate risks.
- Policies to support the transition (products, subsidies and capacity-building).
- Training and capacity-building initiatives from regulators.

## ▶Climate opportunities

For banks, integrating climate considerations into their risk management frameworks is essential. This involves not just identifying and mitigating risks, but also actively pursuing opportunities that arise from the global shift towards sustainability. By doing so, banks can not only safeguard their portfolios from potential climate-related losses but also position themselves as leaders in the growing field of green finance, thus securing competitive advantage and future profitability.[207]

Mongolian banks have begun to integrate environmental considerations into their business strategies. The private sector has a key role in mobilization of domestic resources for climate action and a transition to a low-carbon economy. This would mean investments for building resilience, powering new businesses and enabling counterparties to fulfil their net zero targets. These changes present several opportunities for banks in the areas of:

- Transition Finance
- Green product development

### Transition finance

The banking sector has a wide range of possibilities to effectively turn climate change risks into climate change opportunities through transition finance. This will require a combination of reducing financed emissions and financing emission-reduction projects and technologies. Transition finance can be used as either use-of-proceeds or for financing general corporate purposes. It can cover debt instruments such as bonds or insurance of equity, depending on the definition and taxonomy. Since transition finance is directed at corporates that are systemically transforming their business models and operations towards low-emission pathways, providers of transition finance should be in a position to assess the economic and environmental integrity of a corporate's entire business strategy in trying to raise finance for this purpose.

While several definitions of transition finance exist (see box below) the International Platform on Sustainable Finance's (IPSF) Transition Finance Working Group and the G20 Sustainable Finance Working Group's Framework for Transition Finance (developed for the Indonesian G20 Presidency in 2022) are examples of initiatives seeking to develop a common approach across jurisdictions.[208]

207 BNP Paribas, "Bank 2030: How can banks accelerate financing of a low-carbon economy?", 25 March 2020. Available at https://cib.bnpparibas/bank-2030-how-can-banks-accelerate-financing-of-a-low-carbon-economy/

208 OECD (2022), *OECD Guidance on Transition Finance: Ensuring Credibility of Corporate Climate Transition Plans*, Green Finance and Investment, OECD Publishing, Paris, https://doi.org/10.1787/7c68a1ee-en.

### *Definitions of transition finance*

**OECD:** Finance raised or deployed by corporates to implement their net-zero transition, in line with the temperature goal of the Paris Agreement and based on a credible corporate climate transition plan. It is currently extended mainly through fixed-income instruments and, notably, sustainability-linked bonds and loans.

**CBI:** Transition finance is any form of financial support to high-carbon companies intended to finance the implementation of their short-, medium- and long-term plans to achieve net zero.

**GFANZ:** Transition finance is defined as investment, financing, insurance and related products and services that are necessary to support an orderly real-economy transition to net zero as described by the four key financing strategies that finance or enable (1) entities and activities that develop and scale climate solutions; (2) entities that are already aligned to a 1.5°C pathway; (3) entities committed to transitioning in line with 1.5°C-aligned pathways; or (4) the accelerated managed phaseout of high-emitting physical assets.

**Japan's Ministry of Economy, Trade and Industry:** Financing that promotes long-term, strategic GHG emissions reduction initiatives taken by a company towards tackling climate change challenges for the achievement of a decarbonized society. Japan defines transition finance as finance supporting fundraisers that have set their targets consistent with the Paris Agreement and that satisfy the elements set out in their guidelines. Transition finance is determined not only by the use of proceeds of the funds raised, but also by the credibility of the strategies and practices of the fundraiser.

Mongolian banks can deploy dedicated climate transition finance to support companies that have laid out a clear path towards alignment with the Paris Agreement. For example, the energy mix of the country is highly dependent on coal and oil, which accounted for 97.3 per cent of the overall energy mix in 2021.[209] Supporting companies that plan to change the energy mix towards renewable energy production could be financed within this segment.

## Green product development

Green financial products can offer financial benefits to the borrower in the form of the so-called *greenium* (or green premium) or incentives such as reduction in debt servicing payments if certain climate risk-related KPIs are met.[210] Mongolian banks under the sustainable finance road map have a target of 10 per cent green loans in their portfolio by 2030. Many banks have scaled up green lending particularly in the energy efficiency sector. However, several challenges persist:

- Although recent green loan NPL data indicate solid performance, the rapid growth of green lending and limited long-term data make it premature to assess the risk profile of green loans in Mongolia. International evidence, such as a decade-long study from Romania, points to lower risks over time, but comparable data are not yet available domestically.
- Eligibility criteria for green loans may overlap with financially vulnerable groups. An MSFA survey found only 4.4 per cent of households qualified for energy-efficiency loans, raising concerns over borrower profiles, credit quality and household debt.
- Mongolia's banking sector is still developing measurement, reporting and verification (MRV) systems for green finance. Weak data, limited expertise, and the absence of clear definitions create inconsistencies and risks of greenwashing, hindering transparency, credibility and the ability to attract international investment.

209 International Energy Agency, "Mongolia". Available at https://www.iea.org/countries/mongolia/emissions
210 IHS Markit, Searching for 'Greenium': Evidence of a green pricing premium in the secondary Euro-denominated investment grade corporate bond market. Available at https://www.icmagroup.org/assets/documents/Sustainable-finance/Public-research/Greenium-whitepaper-110521.pdf

Beyond green loans, Mongolia's banking sector needs greater product innovation to fully leverage climate opportunities. Instruments such as green bonds (first three issuances between 2024-2025), sustainability-linked loans and risk-sharing facilities can diversify financing options, attract international capital and better support the transition to a low-carbon economy. A detailed list of potential green products can be found in Annex 3.

## ▶Recommendations for the Bank of Mongolia

Mitigating climate change-related impacts on the financial sector will require strong action from all parts of society, including the public and private sectors and the general public. Regulators and central banks can significantly accelerate this process by building capacity, highlighting the impacts of climate change and risk mitigation strategies, adopting global market standards, and enforcing stronger climate regulations.[211]

The BoM can play a significant role in promoting transparency and responsible financial practices in the context of climate change and the opportunities that may arise from essential action to limit its impacts. The NGFS highlights several key benefits of robust climate-related information disclosure by financial institutions:

- Improved capital market efficiency: Transparency in climate-related risks can improve pricing mechanisms in Mongolia's capital markets, allowing for a more efficient allocation of resources.
- Enhanced financial system oversight: Better disclosure can facilitate more effective surveillance of the financial system by the BoM, enabling it to identify and address potential risks.
- Stronger risk management: The process of public disclosure encourages financial institutions to develop robust data collection and risk management practices relating to climate change.
- Growth of green finance: Improved disclosure allows market participants and policymakers to identify and capitalize on sustainable investment opportunities, which will foster growth in Mongolia's green finance ecosystem.

This chapter makes recommendations for the Bank of Mongolia based on the analyses presented in this report for the Bank to effectively and proactively manage climate-related risks to the financial sector. The recommendations are grouped into three broad categories: supervisory strategy; peer learning and capacity-building; and frameworks for the development of green capital markets.

### Supervisory strategy

#### 1. Integrate climate-related risks into micro-supervision

Mongolia's banking system will play an important role in climate change risk mitigation and in steering the financial sector towards resilience and financial sustainability. The Bank of Mongolia is encouraged to integrate climate-related risks into its financial stability monitoring and supervision frameworks. This involves conducting climate-related risk analysis across the financial sector, enhancing the resilience of the financial sector to environmental shocks, and integrating climate-related risks into micro-prudential supervision by engaging with financial firms and setting supervisory expectations.

#### 2. Set supervisory expectations for the banks

The Bank of Mongolia should pro-actively communicate with the banking sector on the measures planned and how the regulator expects financial institutions to monitor and manage financial risks associated with their climate exposures, as well as the level of transparency required on climate-related issues.[212] This will help the banking sector prepare and build necessary capacities to meet regulatory and supervisory

211 Network for Greening the Financial System, Overview of Environmental Risk Analysis by Financial Institutions. Available at https://www.ngfs.net/system/files/import/ngfs/medias/documents/overview_of_environmental_risk_analysis_by_financial_institutions.pdf

212 Network for Greening the Financial System, A call for action Climate change as a source of financial risk. Available at https://www.ngfs.net/system/files/import/ngfs/medias/documents/synthese_ngfs-2019_-_17042019_0.pdf

requirements to enable a smoother transition. For example, in April 2019 the Bank of England issued a supervisory statement on enhancing banks and insurers' approaches to managing the financial risks due to climate change.

### 3. Improve data quality for analysis of climate-related risks

One of the major bottlenecks of climate-related analysis and forecasting is data availability. There is often a lack of clear, consistent, comparable, reliable and efficient data.[213] The Bank of Mongolia should increase collaboration between different specialized agencies and ministries such as the National Emergency Management Agency (NEMA), the National Agency for Meteorology and Environmental Monitoring (NAMEM), the Mongolian Mortgage Corporation (MIK) and the Ministry of Environment and Climate Change (MECC) to identify and aggregate climate-related data. Additionally, financial sector data currently lacks geographical granularity: greater geographical detail will be important to understand the concentration of risk. Coordinated efforts between these organizations can improve the collection and sharing of sectoral and regional data, enabling more precise and localized risk assessments.

Collaborative efforts will also support robust data for disaster risk management, adaptation investments, and management of climate-related risks in other sectors. While legal barriers and different mandates might appear as initial roadblocks, national level coordination mechanisms such as ministerial level working groups, climate-focused committees and stakeholder discussions under the national-level NDC planning process could offer opportunities.

### 4. Conduct climate risk assessments for the financial sector

The Bank of Mongolia should develop a pilot scenario analysis exercise for the banking sector, to build internal capacities within banks and the central bank, increase awareness and understanding of exposures to the financial sectors, and identify gaps in data and methodologies. More comprehensive scenario analysis exercises can be developed in the future, based on learnings from the pilot exercise. The Bank should also invest in building necessary capacities and frameworks for a top-down risk assessment, in order to compare results and understand which methodologies work best for the Mongolian banking sector. A detailed document, describing each element of the scenario analysis, along with specific recommendations, will be submitted to the Bank in addition to this report.

### 5. Improve transparency through climate- and nature-related disclosures

The first steps should be to introduce voluntary reporting standards for banks, in line with the ISSB's International Financial Reporting Standards (IFRS) $S_1$ and $S_2$. These requirements should be further expanded in line with NGFS recommendations. Banks should disclose the material climate risks they face, such as physical and transition risks, along with the strategies they have in place to mitigate these risks and create opportunities. The BoM is encouraged to require reporting on an institution's environmental impacts and their efforts to identify, prevent and minimize such impacts.[214]

To enhance climate-related disclosures, adopting a phased approach that starts with additional voluntary measures and progresses to mandatory reporting is recommended. Voluntary reporting allows banks to build capacity and integrate climate risk assessments into their operations gradually, providing a low-pressure environment for Mongolian banks to adapt to new requirements and refine their data collection processes.

213 United Nations Economic and Social Commission for Asia and the Pacific, *Sustainable Finance Bridging the gap in Asia and the Pacific*, ESCAP Financing for development series, No. 5 (United Nations publication, 2023).

214 Network for Greening the Financial System, A call for action Climate change as a source of financial risk. Available at https://www.ngfs.net/system/files/import/ngfs/medias/documents/synthese_ngfs-2019_-_17042019_0.pdf

## ▶Peer learning and capacity-building

Investment in the capacities of financial personnel to assess climate risks, innovate green financial instruments and supervise the transition path of the green economy[215] will be essential to effectively manage climate risks to the financial sector. The BoM can enable banks to transition to climate-resilient business models by building capacity and awareness for climate-related risks and opportunities. Building awareness and intellectual capacity within financial institutions and within the Bank of Mongolia is necessary for effective climate risk management. Such efforts ensure that stakeholders are well-informed and capable of addressing climate-related challenges proactively.

#### 6. Foster peer- to-peer learning with other central banks and across the banking sector

International groupings such as the Network for Central Banks and Supervisors for Greening the Financial System (NGFS) or the Sustainable Banking and Finance Network (SBFN) can be effective in promoting peer-learning among members. Numerous central banks have completed the pilot exercise of climate risk assessment in some form, and many are in the process of doing so. The Bank of Mongolia can benefit from their experiences, lessons learnt, challenges and solutions. Active engagement with other regulators will also ensure that regulations across jurisdictions are consistent and in line with international best practices.

The Bank of Mongolia should also enable peer-to-peer learning within the Mongolian banks by providing the right environment and offering the respective learning opportunities. Examples across the globe can serve as examples to develop the training programme, such as the Risk Management Association (RMA) Climate Risk Consortium, which helps banks develop comprehensive climate risk strategies by sharing knowledge on risk appetite, training and policy development. Most banks in the assessment have also expressed capacity-building as an expectation from the regulators. Since the level of expertise across banks remains heterogeneous, to bridge this knowledge gap, it is essential for the Bank of Mongolia to facilitate an environment that encourages peer-to-peer learning.

#### 7. Raise awareness and build capacity

Various stakeholders have emphasized the need to enhance capacity-building with the support of the MSFA and other stakeholders. The Bank of Mongolia can take a proactive role by organizing trainings on climate scenario analysis, in collaboration with development partners or international groups such as the NGFS. These sessions would equip banks with the necessary tools and knowledge to conduct similar analyses on their portfolios. Additionally, there must be a focus on disseminating these trainings and capacity-building initiatives to all departments within the central bank, as well as to the banks. The majority of trainings are provided to staff in the sustainability teams, but it is important for all members of other departments, such as the risk management, credit, communications, operations and legal departments, to be fully briefed on the impacts of climate change. The Bank of Mongolia can also leverage digital solutions such as E-learning courses tailored to the Mongolian context to increase the penetration of knowledge across functions and departments.

#### 8. Work with other regulators to manage climate-related risks

To effectively understand and address climate-related risks, greater coherence and coordination between regulators and policymakers will be essential.[216] The Bank of Mongolia can explore opportunities to collaborate with the Financial Regulatory Commission (FRC), which supervises non-banking financial institutions (NBFIs) and the insurance sector, as well as with the Ministry of Finance. Such collaboration could contribute to strengthening the overall resilience of the financial system and the real economy through homogeneous processes, broad data collection and enhanced transparency of climate related information.

215 United Nations Economic and Social Commission for Asia and the Pacific, *Sustainable Finance Bridging the gap in Asia and the Pacific*, ESCAP Financing for development series, No. 5 (United Nations publication, 2023).

216 United Nations Economic and Social Commission for Asia and the Pacific, *Sustainable Finance Bridging the gap in Asia and the Pacific*, ESCAP Financing for development series, No. 5 (United Nations publication, 2023).

Insurance is an important tool to hedge against the financial risks of climate change. Efforts to integrate climate risk considerations into insurance offerings should be carefully balanced to avoid unintended consequences, such as increased financial burdens on end-users. A coordinated approach between the BoM, the FRC and relevant government bodies could ensure that the development of climate-aligned financial products remains both effective and affordable, ultimately strengthening the resilience of Mongolia's financial system without impeding market development.

## ▶Frameworks and green market development

### 9. Develop the market for green products

Several options exist that could be considered to support the development of a deeper and more diverse green financial market in Mongolia. Expanding the range of green financial products may be facilitated through enhanced structuring capabilities within the financial sector. Central banks in other jurisdictions, such as the ECB, have adopted measures that could serve as useful examples. These include setting higher target allocations for green loans and applying more favourable haircuts for green collateral pledged to the central bank. Favourable treatment of green collateral can enhance the attractiveness and value of green financial products. Additionally, some central banks have introduced measures such as limiting the acceptance of assets with a high carbon footprint, which can further influence market behaviour. These approaches could be examined for their relevance and potential adaptation to the Mongolian context to support the growth of the green finance market.

### 10. Operationalize the Green and Sustainable Development Goal (SDG) finance taxonomy

A robustly implemented taxonomy of Mongolia's sustainable development goal, including a clear and effective system for measurement, reporting and verification (MRV), is essential, particularly as international stakeholders and the Bank of Mongolia are increasingly demanding that climate risk assessment is integrated into banking operations. Currently, the lack of standardized criteria for measurement and reporting systems presents a challenge. While banks, borrowers and third-party verifiers each have a critical role in implementing the taxonomy, it is ultimately the responsibility of the government and its relevant ministries to develop the necessary national frameworks for effective MRV. Their leadership is essential to set national standards, ensure consistency across sectors and maintain the integrity of reported data. The Bank of Mongolia is encouraged to work with relevant government ministries to support the development of MRV systems and the operationalization of taxonomies in the financial sector.

# ▶Annex 1: Summary of financial risks

| Risk Type | Definition | Mongolia Context and Transmission Channels | Example from around the world |
|---|---|---|---|
| Operational Risk (physical) | Manifests through damage to the bank's infrastructure (buildings, ICT, telecoms, transportation). | Given the unique environmental and climate-related context of Mongolia, with dry summers and cold and snowy winters, there is a high operational risk probability.<br>Floods particularly can lead to significant damage to bank infrastructure.<br>Dzuds and heavy snowfall can interrupt transportation and banking services for non-urban areas. | Typhoon Mangkhut in Hong Kong, China in September 2018 is often referred to as the world's most expensive tropical cyclone for that year. It caused widespread destruction across Hong Kong, China, including significant damage to buildings and infrastructure, the suspension of business operations, and physical damage to bank branches and ATMs, leading to temporary closures and disruptions in customer services. This event highlighted the operational risks banks face from extreme weather events, underscoring the need for enhanced risk management and investment in resilient infrastructure to withstand the impacts of climate change.[217] |
| Liquidity Risk (physical) | Manifested through increased demand for cash following a climate risk event. | Liquidity risk can result from more withdrawals of cash than anticipated to cover losses from disaster events. Dzuds, droughts and floods are the most pertinent climate-related hazards in the country.<br>The agriculture and livestock sectors are especially vulnerable to these disaster events. | Given limited experience of climate-related liquidity events, other examples are analysed to illustrate the effects of a liquidity crisis. These show significant negative effects of disasters on liquidity buffers. Bank of Japan (BoJ) had to provide daily liquidity of JPY 21.8 trillion (~$274 billion) to cover the increased demand from households and businesses channelled through banks. This was three times the liquidity offered by BoJ during the financial crisis in 2007/08. Without the extensive support of BoJ the risk would have been borne by the local banks.[218] |
| Legal Risk (physical) | Results from legal claims for contribution to climate change | Legal risk in the Mongolian context is relatively low because the level of enforceability and legal basis for legal cases is limited. There is no law or regulation in Mongolia which explicitly prohibits financing high-emitting industries. | One prominent example is the Dutch NGO Milieudefensie, which filed lawsuits against BNP Paribas and ING for contributing to climate change by financing carbon-intensive industries. Milieudefensie has already won a case against Shell which obliged Shell to reduce its emissions by 45 per cent by 2030 compared to a 2019 baseline.[219] |

217 Michael Grinter, "Super Typhoon Mangkhut responsible for economic loss of US$593m", The Hong Kong Maritime Hub, 8 January 2021. Available at https://www.hongkongmaritimehub.com/super-typhoon-mangkhut-responsible-for-economic-loss-of-us593m/

218 Basel Committee on Banking Supervision, *Climate-related risk drivers and their transmission channels* (Basel, Bank for International Settlements, 2021). Available at https://www.bis.org/bcbs/publ/d517.pdf

219 Attracta Mooney, "ING faces threat of legal action from climate group behind Shell case", Financial Times, 19 January 2024. Available at https://www.ft.com/content/669b3d0a-11fd-41e3-b813-fb6cf4425089

| Risk Type | Definition | Mongolia Context and Transmission Channels | Example from around the world |
|---|---|---|---|
| Market Risk (physical and transition) | Relates to the repricing of assets on a bank's balance sheet following a climate risk event | Mongolia faces significant market risk given its vulnerability to climate change, particularly in the agriculture and livestock sectors, which are central to its economy and way of life.<br>Droughts, a recurring natural hazard exacerbated by climate change, have severe negative consequences on Mongolia's economy, impacting agriculture and livestock, and thereby increasing market risks. These market risks manifest through repricing of assets, including sudden drops on equity and debt holdings of the banking sectors. One additional difficulty is that the correlation tends to converge to one in disaster cases. | From 15 June to October 2022, floods in Pakistan killed 1,739 people, and caused $40 billion of economic losses.[220] The 2031 government bonds dropped to 50.82 cents on the dollar.[221] Domestic debt of the government of Pakistan is on average twice the size of outstanding external debt,[222] causing significant market risk on the re-pricing of the debt securities. |
| Credit Risk (physical and transition) | Relates to defaults of counterparties and depreciation of collateral | In the Mongolian context, credit risk may arise as a result of a physical event, such as when herders default on their obligations due to the severe impacts on their livelihoods caused by a dzud event, combined with depreciation of livestock collateral due to the negative effects of dzuds on livestock survival rates. Transition policies may lead to business losses for counterparties in coal mining and dependent sectors such as coal transportation and export, impairing the ability of the companies to meet their loan obligations. | A recent report by Fitch estimates that 20 per cent of global corporations may face ratings downgrades by 2035 due to climate vulnerabilities.[223] In another study, S&P reported that 54-56 per cent of the metals and mining industry will face downgrade risk by 2050, increasing the cost of capital and the likelihood of stranded assets.[224] Moody's moved its evaluation of fossil fuel industries from "credit positive" to "credit negative", and issued clear and specific warnings about fossil fuel industry-related financial risks. |
| Model Risk (physical and transition) | Results from false assumptions in climate risk modelling | Model risk is permanent in the Mongolian context, given its dependency on external or internal transition risks resulting from Mongolia's pathways towards a green and low carbon economy. In addition, some physical risks, such as dzuds, are specific to Mongolia and difficult to model for future scenarios. Lack of reliable data is another element that increases model risk in the Mongolian context. | Projections of global warming have deviated quite significantly from reality, depending on the year of projections and the complexity of the model, as shown in the table below. Projections of disaster events and transition risks depend on imperfect simulations of temperature increase and precipitation change, which in turn could lead to false predictions of future events, and represent additional risks to the financial sector. |

220 Bloomberg, "Flood Losses Now Estimated at $40 Billion: Pakistan Officials Say", 19 October 2022. Available at https://www.bloomberg.com/news/articles/2022-10-19/flood-losses-now-estimated-at-40- billion-pakistan-officals-say

221 Bloomberg, "Pakistan Bonds Drop to Lowest in Month as Floods to Hurt Economy", 06 September 2022. Available at https://www.bloomberg.com/news/articles/2022-09-06/pakistan-bonds-drop-to-lowest-in-month-as-floods-to-hurt-economy

222 Pakistan, Ministry of Finance, *Pakistan Economic Survey 2021-22* (Islamabad, 2022). Available at https://www.finance.gov.pk/survey/chapter_22/PES09-PUBLIC.pdf

223 Fitch Ratings, "Climate Risk-Related Downgrade May Affect 20% of Global Corporates by 2035", 08 March 2023. Available at https://www.fitchratings.com/research/corporate-finance/climate-risk-related-downgrade-may-affect-20-of-global-corporates-by-2035-08-03-2023

224 Giorgio Baldassarri, "Using Scenarios to Evaluate the Medium to Long Term Impact of Transition and Physical Climate Risks on Credit Quality", S&P Global, 06 January 2023. Available at https://www.spglobal.com/market-intelligence/en/news-insights/research/using-scenarios-to-evaluate-the-medium-to-long-term-impact-of-transition-and-physical-climate-risks-on-credit-quality

| Risk Type | Definition | Mongolia Context and Transmission Channels | Example from around the world |
|---|---|---|---|
| Reputational Risk (physical and transition) | Results from financing unethical businesses relating to climate change. | Given Mongolia's vulnerability to climate-related events like droughts which negatively impact the economy, agriculture and livestock sectors, banks face the risk of reputational damage if they are perceived as not taking adequate measures to manage or mitigate climate risks. This includes the perception of not supporting sustainable practices or of failing to invest in climate resilience efforts in their financial activities. Additionally, growing awareness and regulatory expectations around climate risks mean that banks that fail to align their lending and investment practices with sustainability goals may face increased scrutiny from regulators, investors and the public, potentially leading to financial exclusion and increased cost of capital due to perceived higher risks. | An example of a company whose reputation was damaged due to financing fossil fuel investment is JP Morgan Chase. The bank has faced considerable criticism and negative impact on its reputation, particularly highlighted by climate protests and the focus from activist groups like Extinction Rebellion. During the COP26 climate summit, Extinction Rebellion specifically targeted JP Morgan for its investments in fossil fuel projects. These protests and the public outcry against the bank's financing practices have led to a notable decline in its reputation scores, as analysed by the stakeholder intelligence firm alva.[225] |
| Compliance and Conduct Risk (transition). | Results from failure to adhere to climate risk-related regulation; or manipulation of climate-related reporting and other misconduct | The introduction of the SDG taxonomy and voluntary ISSB's IFRS S1 and S2 means that the reporting burden for Mongolian banks is relatively high, which stakeholders have highlighted during consultations. Given the high reporting burden and the complexity of the reporting itself, there is medium probability of compliance and conduct risk across the banking sector. | Conduct risk arising from the manipulation of climate-related reporting and misconduct led to SEC's enforcement actions against DWS, a German Asset Manager, and Goldman Sachs Asset Management for misleading disclosures. In 2023, the SEC charged an investment management firm for making false statements and omissions about how it incorporated ESG factors into some of its mutual funds, holding the firm accountable for inaccurately describing its process.[226] |

225 Business Money, "Fossil fuel financing has strongest negative impact on US-UK investment banks", 16 March 2022. Available at https://www.business-money.com/announcements/fossil-fuel-financing-has-strongest-negative-impact-on-us-uk-investment-banks/

226 Patrick Temple-West and Madison Darbyshire, "SEC lawyers subpoena fund managers over ESG disclosures", Financial Times, 15 August 2023. Available at https://www.ft.com/content/518387b0-5c4c-4ff7-8221-27be0bb0b8ac

# Annex 2: Summary of climate scenario in selected jurisdictions

| Central Bank/ Regulator | Reserve Bank of India | Bank of Japan and Financial Services Agency of Japan | Bank Negara Malaysia | Hong Kong Monetary Authority (KHMA) | Australian Prudential Regulation Authority | Autorité de Contrôle Prudentiel et de Résolution France | Bank of Canada and Office of the Superintendent of Financial Institutions | OJK Indonesia | European Central Bank |
|---|---|---|---|---|---|---|---|---|---|
| Study Year | 2022 | 2021 | Proposed 2024 | Pilot 2021, second round 2023-2024 | 2021 | 2021 | 2020 | 2023 | 2021 |
| Coverage | 15 selected Banks | 3 banks 3 Non-Life Insurance | Industry Wide | participating AIs (number NA) | 5 largest banks | Banks and Insurance companies | 6 FIs: 2 Banks, 2 Life Insurers and 2 Property and Casualty Insurers | Commercial Banks | Commercial Banks |
| Survey | Yes | No | Yes | No | Yes | No | No | No | Yes |
| Sectors | 3 Sectors | 3 Key sectors | 13 sectors | All Sectors | Key Sectors and Sub sectors | 20 priority Sectors | 10 emission-intensive sectors | 5 key sectors | All sectors, with focus on top emitting factors |
| Approach | Hybrid | Bottom Up | Bottom Up | Bottom Up | Bottom Up | Bottom Up | Combined Top Down and Bottom Up | Bottom Up | Top Down |
| Physical Risks | Yes, 2 | Yes, 2 | Yes | Yes 2 | Yes | Yes, 3 | No | Yes, 3 | Yes, 2 |
| Transition Risks | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Credit Risk | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Market Risk | No | Limited | No | No (For banks) | No | Yes | Yes | Yes | Yes |
| Other Risks | NA | NA | Qualitative: liquidity and operational risks | Quantitative: Liquidity Qualitative: Risk drivers, assumptions and limitations | Business exposure transition risk for key sectors | NA | NA | Qualitative: Operational, conduct | Qualitative: All other risks |
| Balance Sheet | Static Balance Sheet | Static Balance Sheet | Static Balance Sheet | Static Balance Sheet | Static and proportional balance sheet | Constant (short-term) Dynamic (long-term) | Static Balance Sheet | Choice of Static and Dynamic | Static and Dynamic |
| Scenarios | NGFS: Below 2°C; Divergent Net Zero (Disorderly transition, NDCs (Hot house world) | Net Zero 2050, Delayed Transition, and Current Policies. | NGFS: Current Policy, NDCs, Delayed Transition | Short-term (23-27, compound), NGFS: Below 2°C, Delayed Transition, Current Policies | Delayed Transition, Current Policies | Three scenarios based on NGFS, Baseline, Delayed and Accelerated | NGFS: Below 2°C immediate, Below 2°C Delayed, Net Zero 2050, 2019 Baseline Current Policies | NGFS: Net Zero 2050, Delayed Transition, and Current Policies. | NGFS: Below 2°C, Current Policies, Delayed Transition |
| NGFS Data Availability | Strong | Strong | Weak | Strong (Same as Mainland China) | Strong | Moderate, EU level available at NGFS, rest modelled by France | Strong, Canada was modelled as a region | Strong: Country Model available | Strong: EU models available |

# ▶Annex 3: Overview of financial products

| Type of Instrument | Description | Climate Risk Addressed | Target Stakeholders /Investors | Scalability Potential |
|---|---|---|---|---|
| Green Bonds | Green bonds are financial instruments used to raise capital for projects that support climate change mitigation and adaptation, such as renewable energy developments and energy efficiency improvements. They offer a way for both public and private sectors to secure necessary funding for environmental benefits and to support Mongolia's goals for green transformation. | Chronic and Transition | Central Bank, financial institutions, investors, MDBs, institutional investors | High. Having a liquid green bond market in Mongolia would help to increase dedicated financing to climate risk adaptation and mitigation. Khan Bank was the first bank to issue a green bond, paving the way for other issuers.[227] |
| Green Loans | Green loans provide funding for environmentally sustainable projects, such as renewable energy production and energy efficiency enhancements. They incentivize businesses and individuals to adopt sustainable practices and contribute to reducing environmental footprints. | Chronic and Transition | Enterprises in climate-vulnerable sectors, non-banking financial institutions, MSMEs, retail customers | High. Based on stakeholder interviews, green loans are considered to be riskier than their non-green counterparts. With increased capacity-building and dedicated analysis this myth can be negated to enable green loans at scale. |
| Green Mortgages | Green mortgages offer favourable terms for financing the purchase or renovation of energy-efficient homes. They aim to promote sustainable real estate development by providing lower interest rates or increased loan amounts for properties that meet specific sustainability criteria. | Chronic and Transition | Homeowners and developers focused on sustainable and green housing projects | Medium to High. Green mortgages need to be supported by dedicated green and sustainable building standards aligned with international standards. Given the flat price model for energy, which is not linked to actual energy consumption, there is little incentive in the country to build green and sustainable. |
| Decarbonisation Loans[228] | These loans are aimed at financing the transition of businesses and industries towards low-carbon operations, including technology upgrades and process improvements for carbon footprint reduction. | Chronic and Transition | Businesses and industries seeking to reduce their carbon emissions, MSMEs | Low to Medium. Decarbonisation commitments are relatively low. Mongolia committed to 14 per cent GHG reduction by 2030 compared to business-as-usual. Most potential is in energy and energy efficiency sectors, as reported to UNFCCC.[229] There is a strong need to change the heating system in Mongolia from flat tariff to consumption-dependent tariffs. |

227 Reuters, "Mongolia's Khan Bank issues $60 mln green bond, country's first", 17 March 2023. Available at https://www.reuters.com/article/idUSL1N35P04B/

228 UNICEF, "UNICEF and partners launch new ger insulation and heating techniques in Ulaanbaatar", 27 October 2020. Available at https://www.unicef.org/mongolia/press-releases/unicef-and-partners-launch-new-ger-insulation-and-heating-techniques-ulaanbaatar

229 Mongolia, *Intended Nationally Determined Contribution (INDC) Submission by Mongolia to the Ad-Hoc Working Group on the Durban Platform for Enhanced Action (ADP)* (Ulaanbaatar, 2025). Available at https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Mongolia/1/150924_INDCs%20of%20Mongolia.pdf

| Type of Instrument | Description | Climate Risk Addressed | Target Stakeholders /Investors | Scalability Potential |
|---|---|---|---|---|
| Green Savings | These savings products are designed to allocate deposited funds towards financing green projects, allowing individuals to contribute to environmental sustainability. | Chronic and Transition | Individual savers | Low to Medium. The current focus of banks in the greening journey is on assets (loans, mortgages, liquid assets). Depending on the development of suitable green financial products by Mongolian banks and their appeal to the private sector, demand for green deposits and savings might be created. |
| Green Securitisation | Green securitisation involves the pooling of various types of green financial assets (e.g. green loans or mortgages) and selling them to investors as securities, increasing the funding available for green projects. | Chronic and Transition | Institutional investors | Medium. Given the urgent need to move to a more climate-resilient economy, the financial market might not be able to absorb the amount of green mortgages and loans to support the case for green asset-backed securities. |
| Green Project Finance | This involves financing for large-scale green projects where repayment is tied to the cash flows generated by the project itself, such as renewable energy facilities. | Acute, Chronic and Transition | Banks, MDBs, financial institutions, and investors | High. Current trend is to develop climate-resilient infrastructure, renewable energy and sustainable infrastructure to mitigate climate risks. |
| Sustainability Linked Loans | These incentivize borrowers to achieve predetermined sustainability performance targets or KPIs, such as reducing carbon emissions or improving energy efficiency. The achievement of KPIs has a positive monetary effect on debt repayment. | Chronic and Transition | Companies committed to improving their ESG performance | High. Given the outcome payment feature of these instruments, it will be beneficial for use with the SME sector to achieve a more climate-resilient economy. |
| Insurance-linked Loans | These are secured by insurance policies that cover specific climate-related risks. | Acute | SMEs, retail clients seeking to hedge against climate-related financial risks | Potential scalability depends on the development and availability of climate risk insurance products and the ability for the re-insurance sector to absorb the risk at scale and a reasonable price. |
| EV Insurance[230] | EV insurance covers electric vehicles, potentially encouraging the adoption of EVs by offering reduced cost insurance products. | Chronic and Transition | Owners of electric vehicles | Medium to High. EV insurance products are already offered by Tenger Insurance. Growth will depend on the growth of the EV market and supportive regulatory policies. Coal accounted for 70.8 per cent of the energy mix in 2021, which does not make electric vehicles a cleaner option than fossil-fuelled cars. |
| Disaster Risk Insurance[231] | Insurance products designed to cover losses from natural disasters, helping to mitigate the financial impact on individuals, livestock, buildings and businesses. | Acute | Homeowners, businesses, and the agricultural sector | High, especially as extreme weather events like dzuds, droughts and floods can have significant economic impacts on citizens and businesses. |

230 Tenger Insurance JSC, Electric Vehicle Insurance, Available at Машины даатгал, [Date accessed on February 10, 2024].
231 Climate and Development Knowledge Network, Index-based livestock insurance: the case of Mongolia. Available at https://cdkn.org/sites/default/files/files/Mongolia_InsideStory_Pr4Final_WEB.pdf