

CRISIS RISK OVERVIEW

Because of its geographic location and climatic conditions, Madagascar frequently experiences natural hazards, such as droughts, tropical cyclones, and floods, and is among the most vulnerable country to the effects of climate change worldwide (UN News 20/01/2023; ND-GAIN accessed 08/12/2023). At 'high risk', this country ranks 27th out of 191 countries in the 2024 INFORM Risk Index, a global, open-source risk assessment tool built on a set of exposure, vulnerability, and coping capacity indicators (EC accessed 29/12/2023). High poverty rates, weak governance, and inadequate human and physical capital, combined with reliance on rain-fed agriculture and inadequate infrastructure, collectively undermine community resilience to natural hazards, triggering humanitarian needs and hampering long-term development efforts (IMF 16/11/2022; IOM Accessed 18/01/2024 accessed; WB accessed 29/12/2023).

The country is still recovering from the impact of Cyclone Freddy in February 2023 and its widespread damage to infrastructure and homes, affecting over 290,000 people as at 14 March 2023 (OCHA 14/03/2023; IFRC 13/03/2023). The cyclone also aggravated the impact of the drought the country had been experiencing since 2018. People affected in the Grand-Sud and the Grand Sud-Est struggled to recover after the loss of their livelihoods and the effects on their ready-to-harvest crops, such as rice and fruits (IPC 22/08/2023; FSIN 05/03/2023; IFRC 13/03/2023).

In a typical year, Madagascar's long rainy season runs from January–April, while the cyclone season runs from December–April. During this periods, the country experiences cyclones with strong winds, heavy rainfall, and storm surges causing flooding, landslides, displacements, and cropland and livestock destruction, leading to the loss of livelihoods (FEWS NET accessed 12/09/2023; FAO 17/03/2023; Duke Lemur Center accessed 17/09/2023).

Between 2000–2023, 47 tropical storms and cyclones hit Madagascar, severely damaging the country's infrastructure, economy, and food security and leaving more than 740,000 people homeless. During the same period, these cyclones affected more than six million people, with an average of 1.3 million people affected yearly (EM-DAT accessed 11/10/2023).

About this report

Aim of the report: in Madagascar, the cyclone season runs from December–April. This report provides an overview of the country's cyclone exposure based on historical data from 2000–2023, its cyclone vulnerabilities, and its response capacities, aiming to inform strategic planning and anticipatory action.

Methodology: this report is based on secondary sources with historical data covering previous cyclone incidents. Sources include humanitarian organisations, think tanks, academic research, government demographic data, disaster risk management plans, and local and international media.

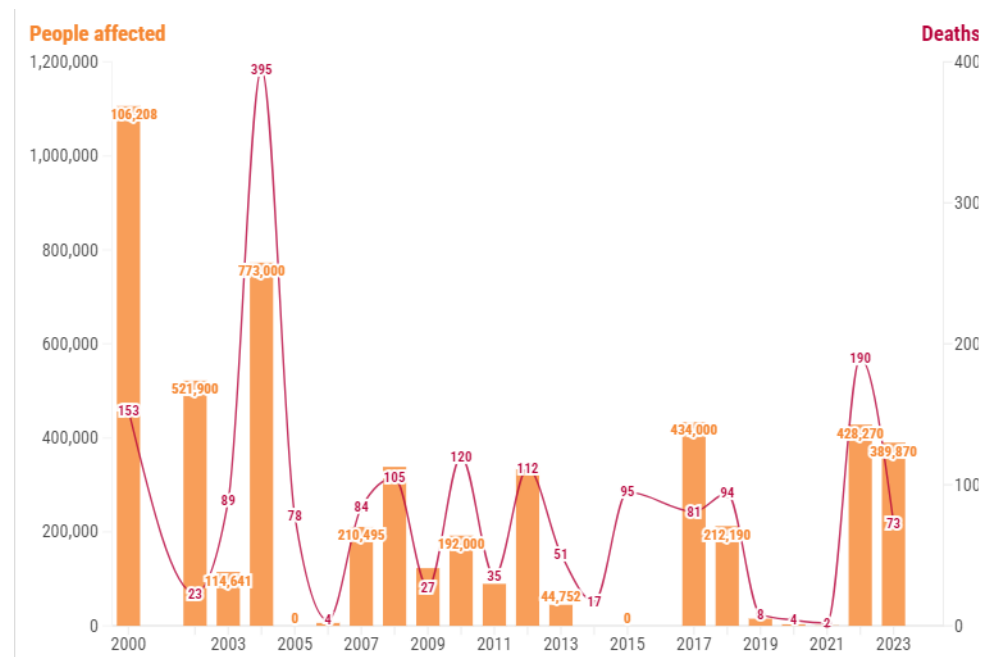
Scope: the geographic scope of this report is at the country level. The cyclone vulnerability analysis focuses on socioeconomic vulnerability factors, infrastructure, food security, national response capacities, and access to water, sanitation, and health services.

Limitations: the limitations of this analysis include the limited availability of hazard vulnerability information at the subnational level, demographic data sourced from the 2018 census, and a lack of updated assessment reports looking into current national response capacities.

TABLE OF CONTENTS

Crisis risk overview.....	1
Cyclone exposure.....	2
Cyclone vulnerabilities and coping capacities.....	3

Figure 1. Number of people affected by cyclones and deaths reported from 2000–2023

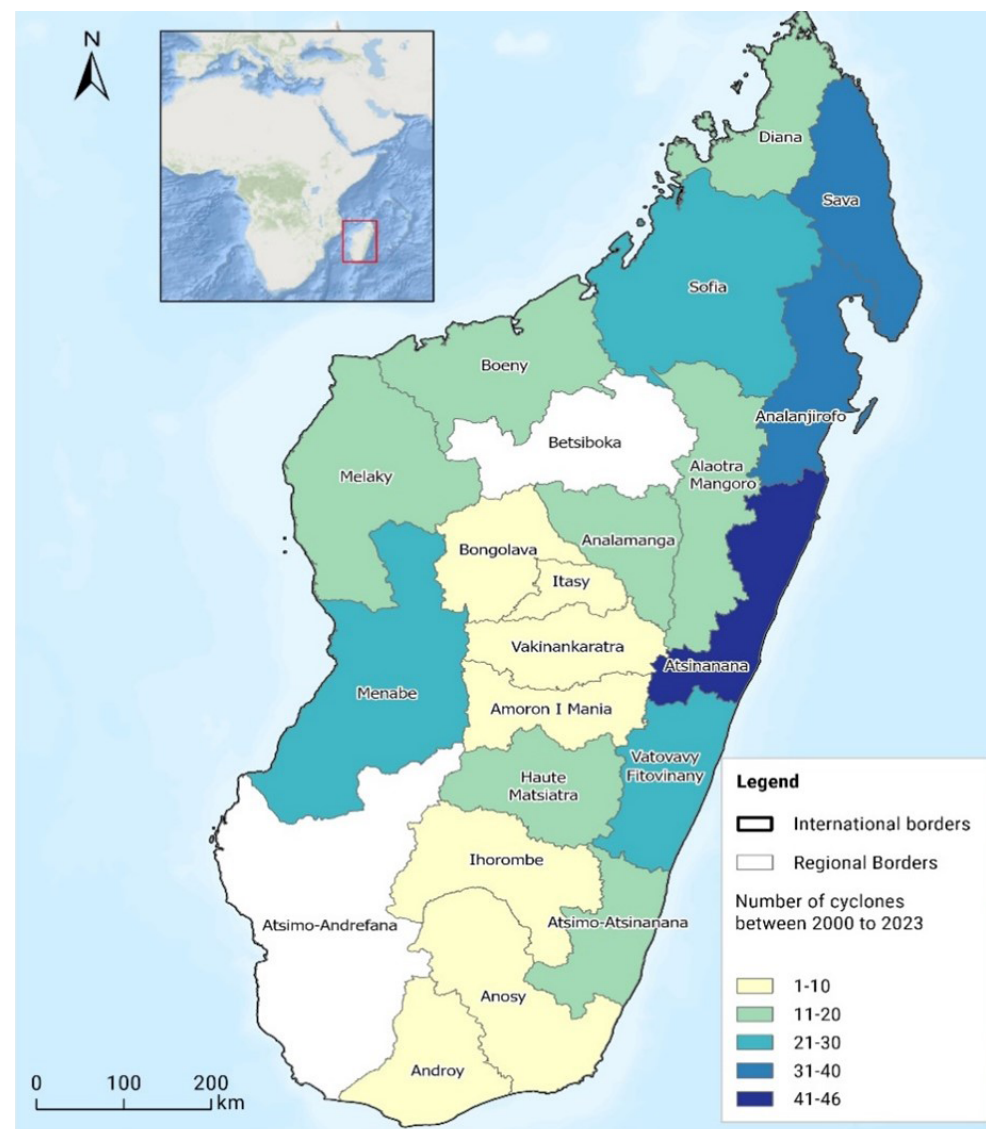


Source: ACAPS using data from EM-DAT (accessed 28/11/2023)

Because of climate change, eastern and southern Africa are likely to experience an increase in average tropical cyclone wind speeds and rainfall, as well as a higher proportion of Category 4 and 5 storms (IPCC accessed 05/12/2023; WWA 11/04/2022). The intensity of storms making landfall off Madagascar's coasts has already increased since the 1990s. Based on a report on the state of the environment in Madagascar, from 1980–1993, only one cyclone (Cyclone Kamisy in 1984) of the 20 that hit Madagascar brought winds exceeding 200km/h. Since 1994, stronger-intensity cyclones have become more frequent (Govt Madagascar 10/2014).

The influence of the positive Indian Ocean Dipole might cause the cyclone season in 2024 to be below average. Southern Madagascar expects to experience a below-average number of cyclones until April. Despite the diminished probability of a cyclone impact, the potential for catastrophic damage persists should an intense cyclone occur (FEWS NET 04/12/2023). On 1 January, the first tropical cyclone of the season named Alvaro made landfall over the southwestern-central coast of Madagascar. Alvaro crossed the southern-central parts of the country, affecting more than 26,000 people. The worst-hit regions were Atsimo-Andrefana, Ihorombe, Matsiatra, Menabe, and Vatovavy Fitovinany (ECHO 05/01/2024).

CYCLONE EXPOSURE



Source: ACAPS using data from EM-DAT (accessed 28/11/2023)

Madagascar frequently experiences natural hazards, such as cyclones, floods, and drought, given its position in the southwestern Indian Ocean Basin.

Eastern and northern coastal regions are the most exposed to cyclones. Between 2000–2023, the five most frequently hit regions were Analjirofo, Atsinanana, Menabe, Sava, Sofia, and Vatovavy Fitovinany (EM-DAT accessed 11/10/2023).

CYCLONE VULNERABILITIES AND COPING CAPACITIES

Madagascar scores very high in hazard vulnerability (5.7/10) and lack of coping capacity (7.1/10) in the INFORM Risk Index, mainly from limited institutional disaster risk reduction and response capacities, high socioeconomic vulnerability levels (including one of the highest multidimensional poverty rates), poor infrastructure, and limited healthcare access (EC accessed 04/01/2024).

Socioeconomic vulnerability

The combination of weak economic growth, rapid population expansion, and dependence on agriculture has resulted in Madagascar having one of the highest poverty rates globally, reaching 75% in 2022 (ILO accessed 15/01/2024; WB accessed 12/11/2023). Menabe and Vatovavy Fitovinany show the highest percentage of households living in extreme poverty among the regions most exposed to cyclones, with more than 64% and 72%, respectively (INSTAT 01/10/2021).

The country has a large rural population, with an estimated 60% of people living in rural areas in 2022 (WB accessed 08/11/2023). Agriculture is the main source of livelihood, generating 26% of the country's GDP in 2023 (FAO accessed 07/11/2023). Over 85% of the country's population depended on agriculture for their livelihood in 2023, and women were responsible for producing 80% of food crops (WB 28/11/2023). The agriculture sector, characterised mostly by subsistence and rain-fed farming, employs traditional crop management techniques. Poverty prevents farmers from investing in equipment and adopting more productive farming methods. Most farms are family-owned and small, often less than 25 acres, reducing farmers' capacity to absorb shocks (FAO accessed 07/11/2023). Their difficulties in securing their land property rights compound cyclone impacts. Because of the lack of clear ownership and tenure, farmers struggle to recover from losses incurred during extreme weather events, hindering their ability to rebuild (IMF 05/06/2023; WB 28/11/2023).

Rapid population growth is intensifying the demand for land and natural resources in Madagascar (LandLinks accessed 15/01/2024). Madagascar's population estimates increased from 16.2 million in 2000 to 29.6 million in 2022 (WB accessed 01/12/2023). Practices such

as slash-and-burn agriculture, fuelwood collection, and unsustainable wildlife harvesting degrade the environment and destroy biodiversity resources (WildMadagascar accessed 10/01/2024; Africa Renewal 16/11/2022). This degradation compromises the delicate balance of ecosystems, diminishes productivity, and reduces the ecosystem's capacity to absorb shocks from natural hazards (Ralimanana et al. 02/12/2022; PBS accessed 10/01/2024).

Table 1. Demographic data of the six regions most exposed to tropical cyclones in Madagascar

REGION	POPULATION (2018)	RURAL POPULATION	% OF HOUSEHOLDS LIVING IN EXTREME POVERTY (2018)
Analanjirofo	1,150,089	968,106 (84.3%)	37.4%
Atsinanana	1,478,472	1,071,114 (72.4%)	51.5%
Menabe	692,463	580,245 (83.8%)	64.5%
Sava	1,123,772	915,182 (81.4%)	37.0%
Sofia	1,507,591	1,325,550 (80.7%)	50.9%
Vatovavy Fitovinany	1,440,657	1,304,082 (90.5%)	72.5%

Sources: City Population (accessed 11/11/2023); INSTAT (01/10/2021)

Basic infrastructure

Road network

The road network in Madagascar is one of the least developed in the world, and 17 million of Madagascar's rural population live more than 2km from an all-season road. Most national and local roads are earth roads in poor condition (WB 10/02/2023). An estimated 10% of the primary roads in the country are paved, and half of these lack maintenance, while the majority of secondary roads are unpredictable or difficult to use during the rainy season from December–June (Logistics Cluster accessed 10/10/2023). Over the last two decades, cyclones have affected infrastructure by damaging roads and destroying bridges (EM-DAT accessed 11/10/2023; Africanews 25/01/2023). A new highway connecting the capital with Toamasina, the country's main port city, is currently under construction (L'Express de Madagascar 05/12/2022).

Airports

Of Madagascar's 126 airports, only 29 have paved airstrips, while the others are made of clay and can become difficult to pass during the rainy season (Logistics Cluster accessed 02/01/2024). Six airports provide international flights: Antananarivo, Antsiranana, Mahajanga, Nosy Be,

Sainte Marie, and Toamasina. Because vast areas are cut off and inaccessible by road after cyclones and flooding, entry for assessment missions and response operations requires planes and helicopters. Ivato International Airport in Antananarivo is the main airport that receives international goods following a cyclone (Logistics Cluster accessed 03/01/2024).

Ports

Madagascar's port network comprises 17 ports, including Antalaha, Antsohihy, Antsiranana, Iharana, Mahajanga, Maintirano, Manakara, Maroantsetra, Morombe, Morondava, Nosy Be, Port Saint-Louis, Sainte Marie, Toamasina, Tolagnaro, Toliara, and Vohémar. Of these, only five (Antsiranana, Toamasina, Tolagnaro, Toliara, and Vohémar) have adequate port facilities for the commercial loading and unloading of goods at the dock. All five ports have customs offices and permit goods importation, but the Toamasina port handles a significant portion (75%) of the freight traffic in Madagascar. The remaining 12 ports limit access to small traditional vessels providing regional services or vessels requiring only a modest draft and limited facilities (Logistics Cluster accessed 02/01/2024; EIB 11/04/2023).

Madagascar lacks a comprehensive inland waterway system for large-scale inland water transport. Traditional canoeing and craft units, such as the kanota and laka, provide river navigation, facilitating the movement of local products and the transportation of the local population and tourists along the rivers of the west coast, including Betsiboka in Marovoay, Sofia in Port Bergé, and Tsiribihina in Miandrivazo (Logistics Cluster accessed 03/01/2024).

Electricity

As at 2023, only 33.7% of the population had access to electricity, a low figure when compared to the 2020 average of 48.4% in Sub-Saharan Africa. The low electricity access compromises the resilience of critical infrastructure, such as hospitals, communication networks, and emergency response systems. During cyclones, electricity availability is crucial for powering essential services, such as hospitals, and facilitating timely disaster response and recovery efforts (WB 07/04/2023).

Housing

In rural areas, people build their houses with materials such as mud, wattle, woven matting, split bamboo, and wooden planks. This construction method implies susceptibility to damage and destruction from cyclones and other natural hazards but also enables quick reconstruction given the low cost and availability of materials (Britannica accessed 04/01/2024; The Conversation 08/04/2018). In Analanjirofo, Atsinanana, Menabe, Sava, and Vatovavy Fitovinany, more than 90% of households live in houses made of rudimentary materials (INSTAT 01/10/2021).

Food insecurity

The southern regions of Madagascar continue to grapple with food insecurity, primarily because of the adverse impacts of prolonged drought in the Grand Sud and consecutive tropical cyclones in the Grand Sud-Est (namely Batsirai and Emnati in 2022 and Freddy in 2023), which caused severe damage to the agriculture, livestock, and fisheries sectors (FAO 07/11/2023). More than one million people were estimated to be experiencing acute food insecurity – i.e. Crisis (IPC Phase 3) or worse – between June–September 2023. This figure is expected to rise to 1.72 million from January–April 2024, mostly because of the impact of El Niño, which is expected to cause below-average agricultural production in southern Madagascar during the 2023–2024 harvest season (IPC 22/08/2023; FEWS NET 04/12/2023).

With an agriculture sector characterised by small-scale, subsistence, and rain-fed farming, Madagascar heavily depends on food imports since it cannot produce sufficient supplies domestically. The country remains vulnerable to food insecurity and price fluctuations because of global factors and uncertain agricultural prospects (Global Voices 02/05/2023; La Vérité 13/08/2021). The combination of weak economic growth and high poverty rates has worsened the situation, with people's weak purchasing power making them vulnerable to food insecurity (WB accessed 04/01/2024; WB accessed 12/11/2023; FAO accessed 07/11/2023). In 2021, food imports accounted for 21.51% of Madagascar's total imports, with rice and palm oil being two of the three main imports valued at USD 235 million and USD 154 million, respectively (TE accessed 11/12/2023; OEC accessed 11/12/2023).

Access to water and sanitation

Limited access to safe water and sanitation in Madagascar increases the population's vulnerability to the impacts of cyclones, amplifying the risks of waterborne diseases. The country ranks third-lowest globally in the use of improved water sources and basic sanitation. Around 57% of the population depends on surface water or non-improved water points for their supply. In rural areas, only 36% of the population has access to improved water sources (UNICEF accessed 04/01/2024; MCD 19/04/2022; UNDESA accessed 07/11/2023). Sava and Vatovavy Fitovinany are some of the regions facing the most significant safe water access challenges, with more than 85% of households lacking access to potable water as at 2021 (INSTAT 01/10/2021). The common use of open wells as main water sources is among the main causes of waterborne diseases after cyclones as they are easily contaminated (The Conversation 08/04/2018).

In 2017, an estimated 45% of the population practised open defecation (more than ten million people, including nine million in rural areas), higher than the Africa Human Capital Target for 2023 (15%). This indicates that access to safe sanitation is a significant challenge in

the country, particularly in rural areas (WB 10/2020; UNDESA accessed 07/11/2023). Menabe and Vatovavy Fitovinany are the cyclone-exposed regions with the lowest access to sanitation, with more than 85% of households without access to adequate sanitation facilities (INSTAT 01/10/2021).

Access to health services

In Madagascar, the availability and accessibility of health services are critical factors that undermine the population's ability to cope with the impacts of cyclones. More than 60% of Madagascar's population live over 5km away from a health centre, often in remote areas that lack roads and communication infrastructure. The distribution of health personnel across the country is also uneven, and medical supplies and drugs are often out of stock in some areas (USAID accessed 12/12/2023; BP 01/07/2020). The geographic positioning of some areas worsens the situation. For example, in a rural municipality of Ambositra, people have to travel at least 2km to reach the nearest health centre, the distance significantly affecting children and mothers who need access to health services (UNICEF 09/02/2022).

As at 2019, the doctor-to-patient ratio in Madagascar was 1:7,000, falling short of the recommended minimum of at least 2.5 medical staff (physicians, nurses, and midwives) per 1,000 people to ensure sufficient primary healthcare coverage (WHO accessed 08/2023; WB accessed 28/12/2023). The limited human resources are unevenly distributed, affecting rural and urban areas. For example, a town in Antananarivo has 12 doctors, but in more remote areas, there is often only one healthcare professional (Barmania 22/08/2015).

In exposed regions, the impact of cyclone events frequently restricts access to health services. In 2022, Cyclone Batsirai destroyed a total of 93 health facilities, leaving more than 304,000 people in the whole country with no access to essential health services (WHO 09/03/2022).

Given the impact of climate change, cases of climate-sensitive diseases, such as acute respiratory infections, diarrhoea, malnutrition, and malaria are projected to increase, posing additional challenges to the health sector (Rakotoarison et al. 26/11/2018).

National response capacities

Since the adoption of the Sendai Framework for Disaster Risk Reduction 2015–2030, Madagascar has implemented numerous legislative, administrative, and programmatic measures to enhance its readiness to meet future hazards. The World Bank, the French Development Agency, the EU, the African Development Bank, the Japan International Cooperation Agency, the IMF, and UN agencies have pledged technical and financial support

(CADRI 10/02/2022). The initiatives that Madagascar has implemented include the introduction of new laws outlining the framework and duties of the National Office for Risk and Disaster Management (BNGRC) and the Emergency Prevention and Management Unit. The BNGRC is responsible for monitoring and managing risks and disasters in Madagascar, including tropical cyclones and floods. It coordinates all activities related to prevention, preparation, emergency response, early recovery, and reconstruction (UNDRR 22/12/2023; BNGRC accessed 18/10/2023).

A meteorological department issues weather forecasts and warnings for Madagascar and is responsible for monitoring tropical cyclones that affect the country. The department is part of the WMO and is listed on the Meteo France website as one of the national meteorological services in the southwest Indian Ocean (WMO accessed 18/01/2024; Meteo France accessed 19/10/2023).

Although efforts have been made and structures put in place to anticipate cyclones, authorities in Madagascar are often overwhelmed during disasters, encountering challenges in delivering a timely and effective response commensurate with the scale of needs (EC accessed 27/12/2023; British Red Cross 08/03/2023). More efforts in capacity building and more effective national preparedness and response strategies are needed for local authorities and stakeholders to take full ownership of preparedness and response operations before international organisations can come up with a phase-out strategy (WFP 04/12/2023; Logistics Cluster Accessed 18/01/2024). Some of the other priorities to enhance Madagascar's national preparedness and response capacities include decentralised access to funding, better-defined roles and responsibilities, strengthened coordination mechanisms as well as information management and sharing systems, and the establishment of decision-support tools at the local level for each type of hazard and not just for drought (CADRI 10/02/2022).

Madagascar has several early warning systems in place, each with partial coverage of the country. The BNGRC manages one for monitoring cyclones (BNGRC accessed 10/01/2024). The Emergency Prevention and Management Unit oversees another to detect tsunamis. The Authority for Flood Protection in the Antananarivo Plain and the WFP manage two others, with the latter running one in the southern part of the country, focusing on food insecurity and drought (CPGU accessed 10/01/2024; WB 14/03/2000; AH accessed 11/01/2024). These systems are fragmented, and there is a need to harmonise and consolidate them into a multi-risk early warning system at the national level (CADRI 10/02/2022). Another challenge lies in the need for a streamlined and flexible approach to minimise bureaucratic processes, swiftly convey early warnings, and facilitate prompt and effective disaster management actions (UNDP accessed 10/01/2024).