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Food Insecurity and Climate Shocks in Madagascar

REPUBLIC OF MADAGASCAR

Dominique Fayad

SIP/2023/037

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on February 15, 2023. This paper is also published separately as IMF Country Report No 23/118.

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Food Insecurity and Climate Shocks in Madagascar
Prepared by Dominique Fayad

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ABSTRACT: Food insecurity dramatically increased in Madagascar over the last 10 years, hampering human development. Using most recent data and surveys conducted by UN Agencies and local authorities, this paper analyzes the root causes of food insecurity in Madagascar related to demographic vulnerabilities, multidimensional poverty, lack of education, as well as structural weaknesses in the food value chain and the lack of basic infrastructure, such as irrigation and transportation, that hamper agricultural activity development. Moreover, Madagascar is exposed to a large variety of climate shocks that climate change will likely exacerbate. This paper formulates country specific macroeconomic and operational policy recommendations in collaboration with the World Food Program to reduce food insecurity, which include i) measures to improve the emergency response and preparedness, ii) policies to address structural food insecurity, by improving the food chain and addressing challenges posed by climate shocks, and iii) measures to improve Green PFM and climate related public investment management to invest in long-term resilience and mobilize external financing.

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SELECTED ISSUES PAPERS

Food Insecurity and Climate Shocks in Madagascar

Republic of Madagascar

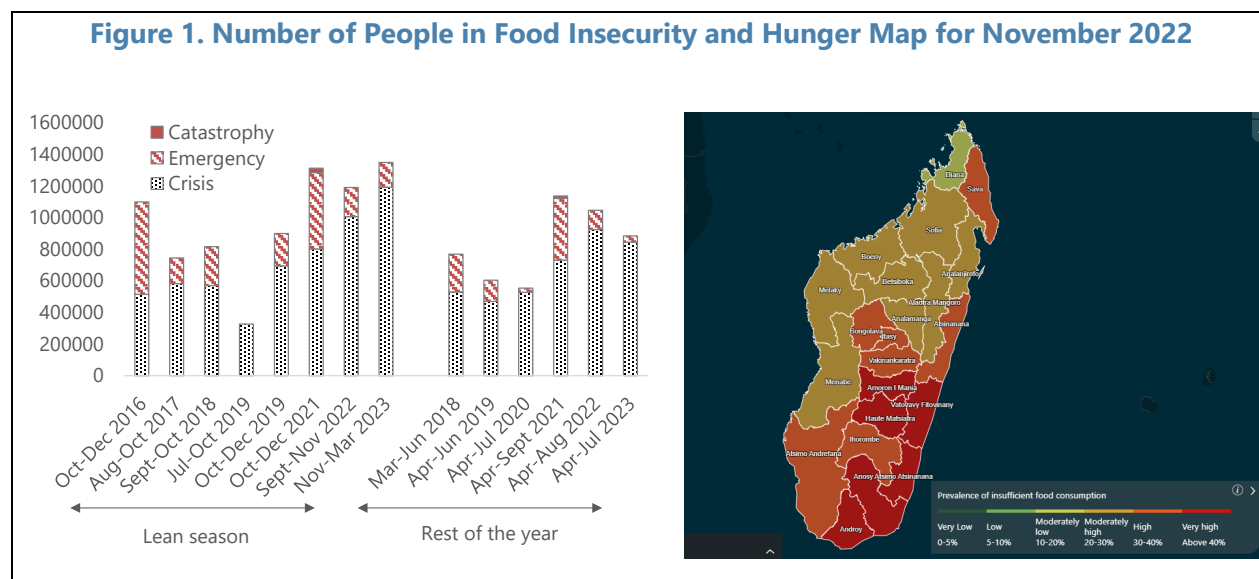
Prepared by Dominique Fayad¹

¹ The author would like to thank Aminata Doucoure, Herilalaina Rambalo, and Federico Ramonda (all from the World Food Program) for their close collaboration. The analysis benefitted from helpful comments from the European Union (EU) and The Food and Agriculture Organization (FAO).

FOOD INSECURITY AND CLIMATE SHOCKS IN MADAGASCAR

A. Food Insecurity in Madagascar: Recent Developments

1. Food insecurity dramatically increased in Madagascar over the last 10 years, hampering human development. As of September 2022, 8.8 million people across Madagascar (about 33 percent of the population) are food insecure¹, an increase of one million in three months. As of November 2022, 2.22 million people in the Great South and Great South-East are facing emergency levels of food insecurity (Figure 1). The number of people in food insecurity is particularly higher over the lean season, but the situation remains critical throughout the year. Five million people are affected by recurring natural disasters, such as cyclones, floods, and droughts². The prevalence of acute malnutrition³ stands at 8 percent, while the prevalence of chronic malnutrition⁴ stands at 40 percent, ranking Madagascar as the 10th most affected country by stunting.



¹ According to World Food Summit in 1996, food security is defined when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

² According to UNDRR and UNDP.

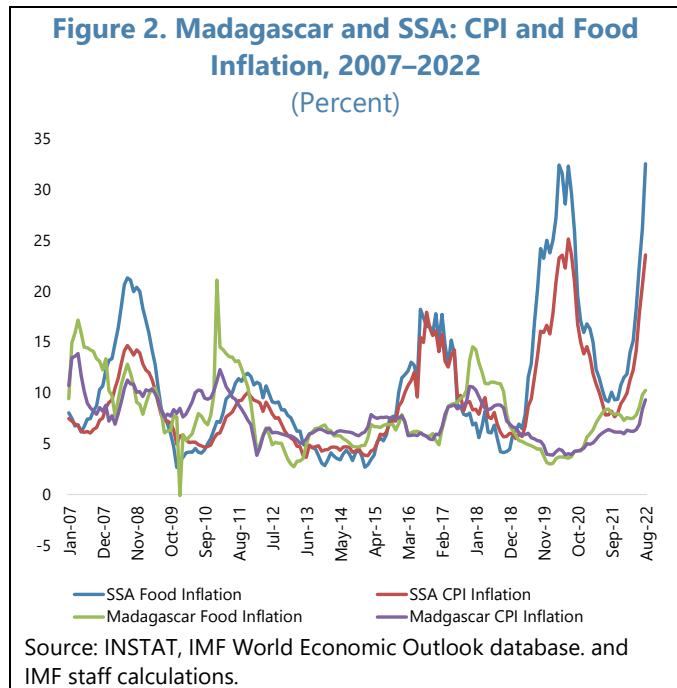
³ Also known as 'wasting', acute malnutrition is characterized by a rapid deterioration in nutritional status over a short period of time. In children, it can be measured using the weight-for-height nutritional index or mid-upper arm circumference.

⁴ Also known as 'stunting', chronic malnutrition is a form of growth failure which develops over a long period of time, as a result of inadequate nutrition over long periods of time (including poor maternal nutrition and poor infant and young child feeding practices) and/or repeated infections. It is defined as the percentage of children, aged 0 to 59 months, who have low height for age. Height for age < -2 standard deviations from the median height for age of reference population = stunting. Height for age < -3 standard deviations from the median height for age of reference population = severe stunting.

Source: Joint Malnutrition Estimates – WFP, UNICEF, WHO, World Bank
 Note: People with insufficient food consumption refers to those with poor or borderline food consumption, according to the Food Consumption Score (FCS). The FCS is a proxy indicator for food security that measures the diversity of household diets, and how frequently food is consumed. The FCS is calculated using the frequency of consumption of eight food groups by a household during the 7 days before the survey using standardized weights for each of the food groups reflecting its respective nutrient density, and then classifies households as having ‘poor’, ‘borderline’ or ‘acceptable’ food consumption.

2. Extreme weather events, the COVID-19 pandemic, and the fallout from the conflict in Ukraine have exacerbated food insecurity.

A prolonged period of exceptional droughts in the South since 2019 has reduced agriculture production, placing about 1 million people on average in food insecurity over the last 3 years, among which 250 000 in famine situation. Madagascar was hit by no less than 5 tropical weather events⁵ in 45 days during the 2021/2022 cyclonic season, which meteorologic centers assessed as “normal” intensity based on historic trends for the whole season, but exceptional in terms of frequency. Heavy rains, strong wind, floods, and landslides caused extensive damage to the road network, dams, houses, schools



and sanitary facilities, rice fields (many flooded twice) and orchards putting pressure on food prices and impacting subsequent harvest seasons. Despite the rainfall from Batsirai and Emnati cyclones in the Southeast, farmers' supply remains insufficient in areas that experienced protracted poor harvest seasons following droughts and pest damage to crops. The past cyclonic season also appears to have had a significant impact on cash crops production, such as cloves, coffee, and pepper, which are exported at 90 percent and constitute the most important source of revenue for the national economy. Up to November 2022, the cost of the food basket increased on average by 19 percent over the last three years, as a consequence to a decrease in farmer’s supply as a result from a poor harvest following three consecutive years of drought in the Great South as well as an increase in transportation costs as a result of a rise in international oil prices and administrated pump prices. Although, Madagascar’s food inflation remains much lower than SSA average (Figure 2), the cost of the average food basket on the markets of the Great South stands at MGA 2 013 (USD 0.45) per person per day, while about 85 percent of the population lives on less than USD 1.90 a day.

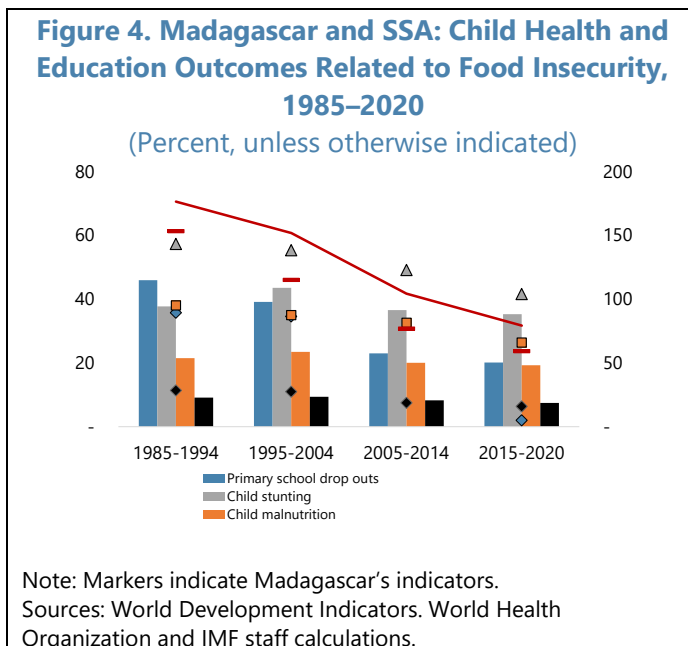
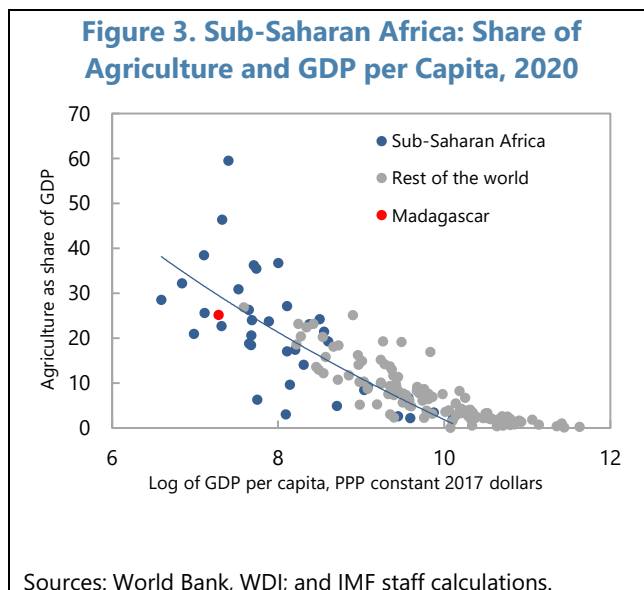
3. The 2022/2023 agricultural prospect is uncertain and food insecurity could further worsen. Despite the benefits of cyclone-induced precipitation in February 2022, the small size of the agricultural land in the Great South limits the amount of anticipated crops production. In addition, potential infestations, such as locust and armyworm may arise. The authorities have ignored calls by

⁵ Cyclones Batsirai and Emnati impacting the Est, and tropical storms Ana, Dumako, and Gombe.

the FAO and other agencies to conduct preventive treatments and pest damage has already been widely observed by communities mainly on maize, sweet potato and to a lesser extent rice and cassava. Agricultural destruction in other regions is also severely impacting the prospects for the next agricultural campaign. As a result, 1.5 million people are expected to experience emergency levels of food insecurity (IPC Phase 3) over April to July 2023.

4. Natural hazards, poor agricultural practices, the inadequacy of hydro-agricultural infrastructure and the lack of education, are identified as the root causes of malnutrition by the Malagasy authorities.

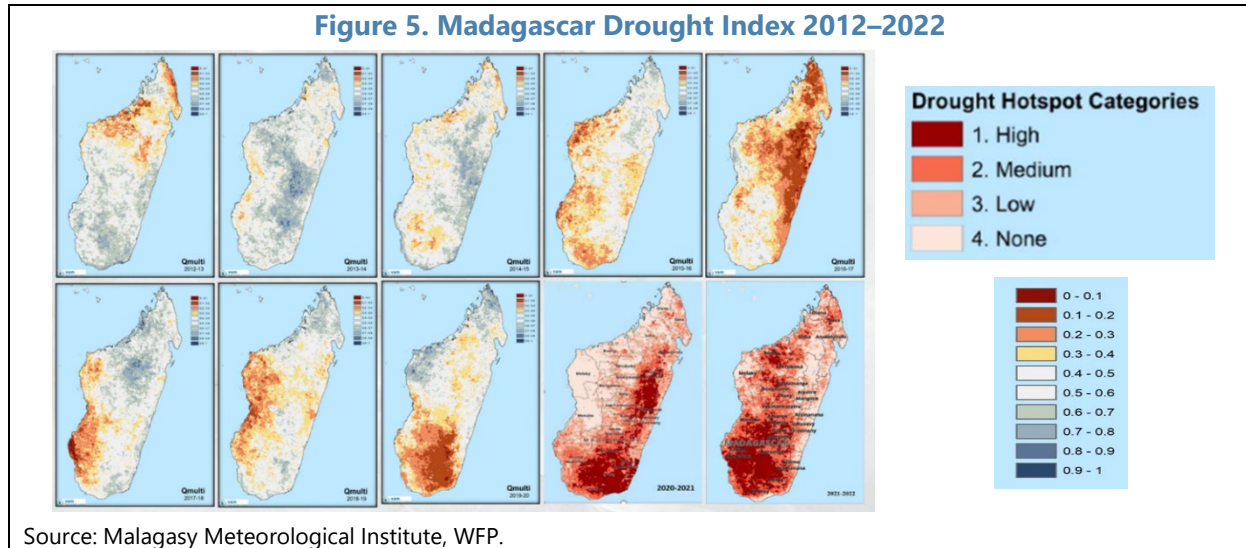
Chronic extreme weather events, along with severe multidimensional poverty and structural agriculture vulnerabilities, make Madagascar’s food supply chain dysfunctional. Since 2019, periods of drought are increasingly frequent (Figure 5) and 2.8 million people was exposed to drought⁶ in 2021. With agriculture employing 83 percent of the population (Figure 3)⁷, climate change is set to exacerbate food insecurity and potentially imperil hard-earned development gains. Drought occurs often in the Great South, with an interval of around two years, while precipitations have been declining in the previous twenty years, as it has in practically every other region of Madagascar. Before the impact of the El Niño weather phenomenon in 2016, the last drought with high intensity and impact dates to 2009–2011, and affected 720,000 people. The progression of the condition in this region is consistent with Burke et al. (year) prediction that meteorological drought caused by inadequate rainfall will rise in duration, frequency, and intensity. In the Great South of Madagascar, the degree of exposure to drought risk is very high and the impact of this deficit on



⁶ Regional South African Vulnerability Analysis (rSAVA).

⁷ According to the last Census in 2018, 83,2 percent of Malagasy households practice agriculture, 11.7 percent of which live in urban areas compared to 88.3 percent in rural areas.

agriculture is palpable. With a poor and predominantly rural population, the livelihood of the population depends on the agricultural sector and the resilience of households is diminished by the recurrent droughts. Increased food insecurity could affect child nutrition and educational attainment, worsening health and education outcomes, already much worse than SSA average (Figure 4). The 2030 UN Sustainable Development Goal 2 (SDG2) that aims to end hunger will be difficult to reach amid the “new normal” of frequent and recurring droughts, floods, cyclones, and rising temperatures.

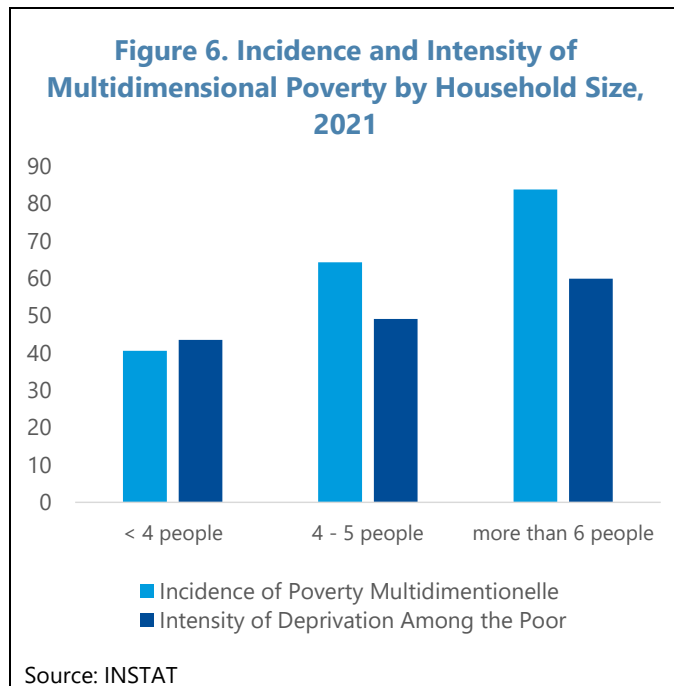


B. Demographic and Food Value Chain Vulnerabilities

The root causes of food insecurity in Madagascar are related to demographic vulnerabilities, and structural weaknesses in the food value chain, that hamper agricultural activity development.

Socio-Economic Vulnerabilities of the Food Insecure Population in Madagascar⁸

5. Household’s structure, low education level, and poor living conditions in the Great South constitute challenges for subsistence. In the Great South, more than one-third of households have 4 to 5 members and about one-fourth have more than 7 members, in comparison

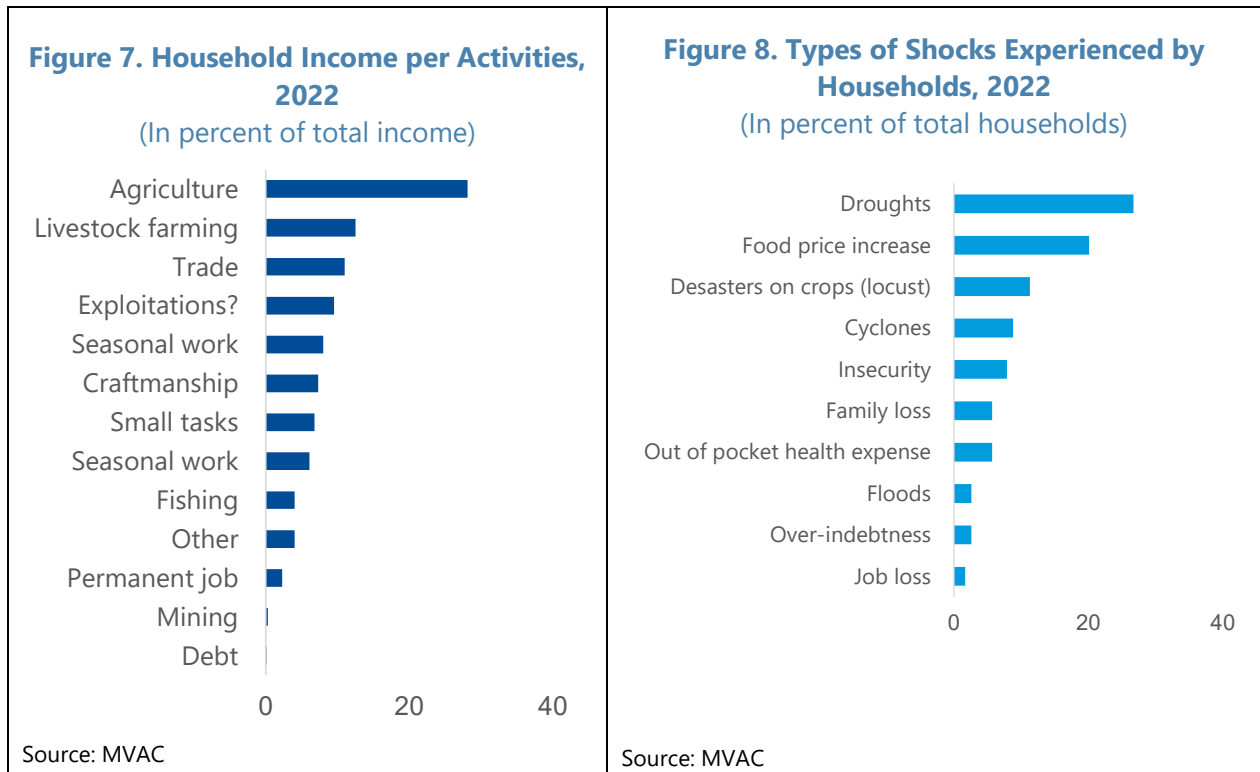


⁸ Madagascar Vulnerability Assessment Committee (mVAC): WFP, Unicef, FAO, BNGRC, ONN, MINAE, INSTAT, 2022. Evaluation Approfondie Multisectorielle Grand Sud de Madagascar. This assessment was made on 2477 households distributed in 250 Fokontany in the three regions of the Great South in order to inquire about living conditions, the evolution of the current campaign and to update of food security indicators in households.

to 4.3 members on average in rural areas at the national level and multidimensional poverty and the degree of deprivation are positively correlated with the number of individuals in the household (Figure 6). In areas with chronic vulnerabilities, above national average household size is an aggravating factor of precarious living conditions. On average, 78.5 percent of dwellings in the ten assessed districts are made of precarious materials (sheet metal, plank and others) in comparison to only 28 percent in the Betroka (regional granary area) where households' standard of living is moderately higher. Less than 15 percent of the Great South population attended primary education of which 35 percent dropped out of school, thereafter, leading to 80 percent of the regional population being very low qualified and about 45 percent analphabet, against 23 at the national level respectively. As a result, the inactive/active ratio is very high at about 48.4 percent in 2021 which puts households in risk of poverty trap and high vulnerability when disability exists.

6. Households diversify their activities in order to earn enough income. An average household resorts to more than 13 activity types to generate income over one month, while 75 percent are hit by at least one natural hazard (droughts, pests and cyclones), food price or insecurity shock over 6 months. Agriculture, livestock, and trade account for the largest share of disposable income⁹ (Figure 7). Rainfall deficit and drought account for most of the shocks affecting households in the ten districts of the Great South, followed by rising food prices and crop damage due to pests (Figure 8). Populations in districts with ports will be the least impacted by food price shocks as they can more easily access diversified food products and substitute their food consumption. Some districts with the lowest percentage of farming households affected by rainfall deficit and pests, diseases, locusts or caterpillars, have seen their cultivated areas reduced due to lack of means to protect their investments, hereby further hampering food production capacity. Half of the communities reported a 53 percent decrease in cultivated areas in 2021 compared to normal. Future production (high season) is expected to be 63 percent lower than normal due to weather conditions, pest infestation, the high cost of agricultural inputs, and the harvest coverage in terms of consumption varies between 1 to 5 months. In half of the districts, over-indebtedness is the fourth shock experienced by households as agricultural households borrow to buy additional seeds when the rain is delayed, and to buy food from traders between delayed cash transfer payments.

⁹ Nearly eighty-four percent (84 percent) of households practice agriculture, thirty-seven percent (37 percent) of livestock and about thirty-two percent (32 percent) for trade, the other activities cited are for the rest (mining operations and borrowing or debt are the least practiced by households).

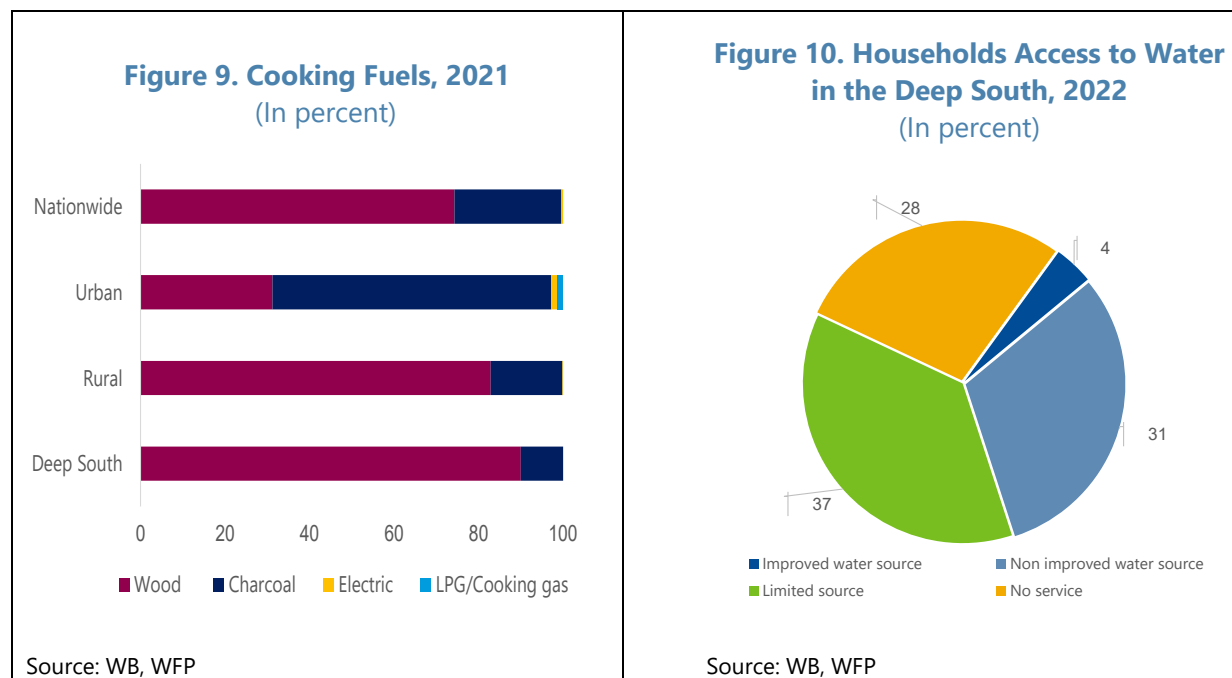


7. Women-led households are more vulnerable to food insecurity. Thirty-five percent of the households in the Great South are led by women, in comparison to 24 percent at the national level. In some Southern regions, the share of women head of households is about twice higher than the national average, due to the migration of men for economic reasons for periods longer than 6 months. A large share (37 percent) of households includes only one parent (separated, divorced, widowed and single) with a majority headed by women. Households headed by women [are poorer on average and therefore] spend relatively more on food than those headed by men. In addition to socio-economic factors (wealth at the household level), female-headed households have a higher risk of being severely food insecure compared to male-headed households as these households lack a more stable source of income in the absence of spouses¹⁰. Larger households are more likely to be food insecure as they have more members to feed. Also, food insecurity in the Great South is also associated with a lack of access to improved water services. The hardship of fetching water from unprotected water supply points beyond the 30-minute journey time (including waiting time) is the responsibility of 95 percent of women.

8. Poor energy sources and heavy reliance on primary biomass and charcoal increase vulnerability to food and climate shocks. The strong dependence on biomass --the direct use of wood as fuel is 76 percent in rural and 87 percent in the Great South (Figure 9)--with slow and difficult renewal due to the context of drought exposes communities in the short and medium terms to a risk of fuel shortage and damages the environment and population health, which in turns increase vulnerability to climate change (see next section), and the related price increase impacts

¹⁰ From the Agricultural Production and Food Insecurity Assessment (EPASA), October 2022, an in-depth analysis of the factors that explain food insecurity (moderate and/or severe).

households' already low purchasing power. Lack of income generation opportunities during drought and COVID-19 pandemic have pushed more people in rural areas to be involved with the commerce of charcoal, for trade in major cities and villages, putting more pressure on the rare forests of Southern Madagascar, and increase vulnerability to climate shocks. Acute respiratory infection affects 6.8 percent of children aged 6-59 months in the ten districts of the Deep South of Madagascar¹¹. According to the World Bank, the productivity cost of the use of fuelwood for cooking borne by women is estimated at USD 4.71 billion annually, due to lost productivity from extended time spent on cooking-related tasks, including fuel collection, cooking, and stove cleaning.



9. Access to quality water in the Great South is extremely limited, impacting population health through drinking and cooking. Only 4.2 percent have access to a quality water supply from an improved water source, compared to 27.7 percent at the national level. Almost one-third of women in charge of fetching water go to long distance to water sources, directly to the pond or the river where water quality is low (Figure 10). As a result, diarrheal diseases, and febrile illnesses from all causes, including malaria, affect respectively 18.3 percent and 66.2 percent of children aged 6–59 months in the ten districts of the deep south of Madagascar.

Structural Issues in the Food Value Chain

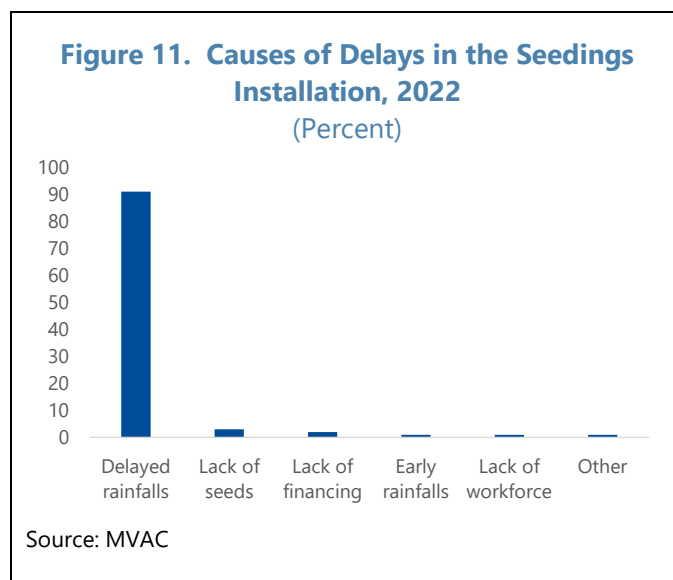
Agriculture

¹¹ INSTAT, UNDP. Analyse de la Pauvreté Multidimensionnelle à Madagascar, February 2021.

10. A survey¹² led by the Vulnerability and Assistance Committee identified the main obstacles to agriculture as perceived by farming households in the Great South. Climate is the first obstacle for a very large majority of the municipalities surveyed. The second impediment is the presence of pest followed by the high cost of agricultural inputs. the non-existence or the poor condition of infrastructure to support agricultural production (dams, irrigation canals) were identified as a third factor.

11. The strong prevalence of small farm holders (less than 100 acres) does not allow for food self-sufficiency.

Agricultural techniques employed are generally traditional and essentially depend on natural conditions (rainfall). Among the households in the ten surveyed districts of the Deep South, 45 percent operate less than 50 acres, 34 percent between 50 to 100 acres and only 21 percent have more than 100 acres. In the South, the access to arable land is problematic as a great majority of the land is limestone, which worsens the impact of the rainfall deficit. In addition, some parts of the South are also affected by sand winds (Tiomena), which sand up the land, making agriculture impossible in some areas.



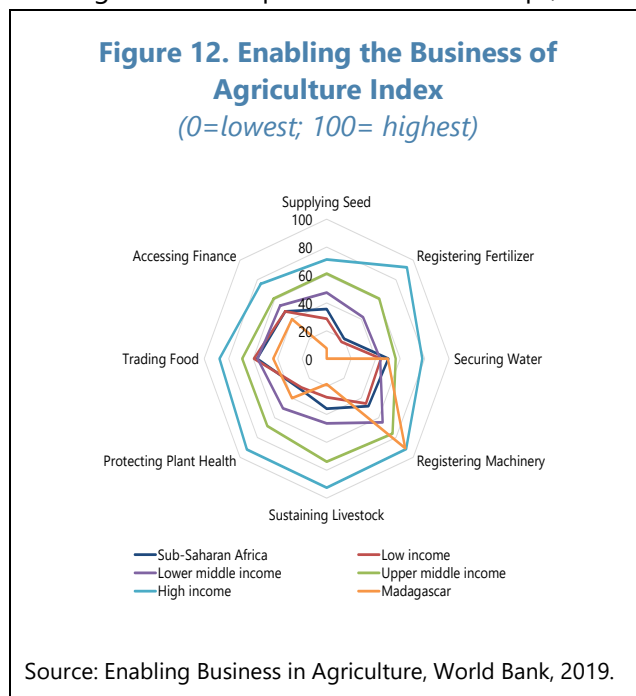
12. Framers struggle to anticipate seeding due to rainfall unpredictability. Significant weather variability (delay of rain, drought, etc.) leads to delays in seeding and low production because of non-adaptation to change, which results in the lack of control over the planting of crops, in particular the monitoring of agricultural calendars (Figure 11). Some crop diversification was observed, and more water resilient crops, such as maize, millet, sorghum, cassava and sweet potato serve as substitutes or supplements for rice during the lean season.

13. Low mechanization is a major constraint to higher agricultural production. Farming households use their own family labor and sometimes employees for seeding and other agricultural work. Although registering machinery is not assessed as an impediment to doing business in agriculture, low mechanization owing to a lack of equipment and energy access impacts production yields. Selling productive livestock is one of the common crisis strategies employed by households when they run out of food or have insufficient resources to purchase food during the lean season.

14. The lack of agricultural inputs and high prices constrain agriculture productivity and the ability to overcome lower rainfall shocks. The Great South suffers from a real lack of seed

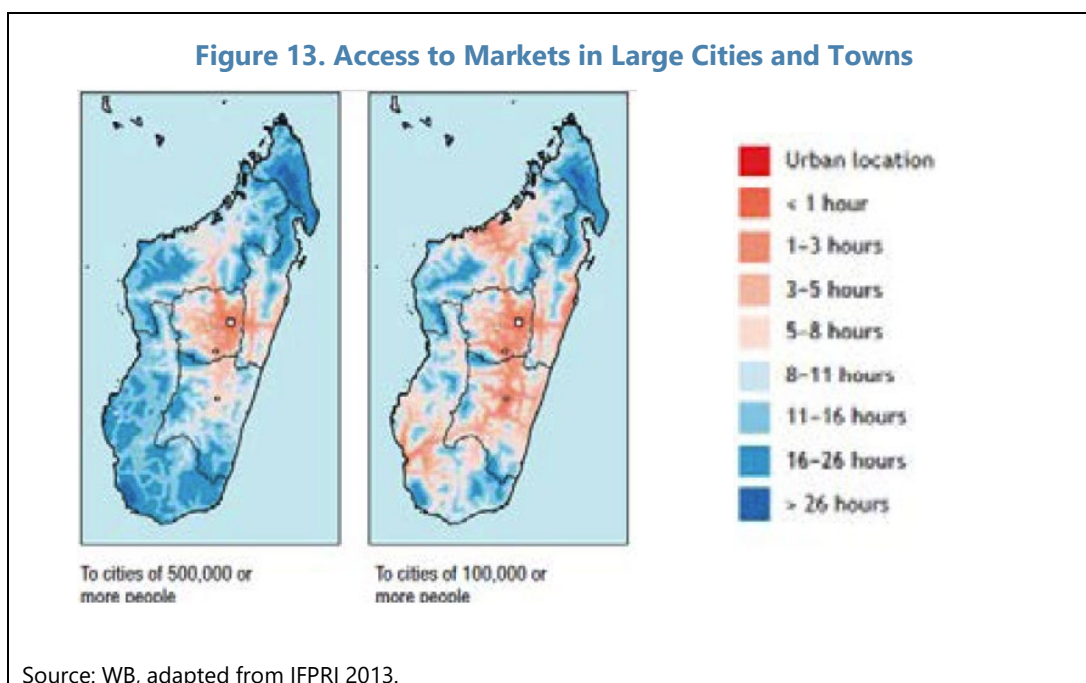
¹² Madagascar Vulnerability Assessment Committee (mVAC). Evaluation Approfondie Multisectorielle de la Sécurité Alimentaire – Grand Sud de Madagascar, April 2022. The analysis covers 2477 households spread over 250 Fokontany in the three regions of the Great South.

security and assistance does not follow local farming practices. Seeds supply accessibility is much lower than in other low-income countries. If a first sowing fails and requires a second attempt, farmers are in great difficulty to obtain seeds and only 10 percent of farmers use certified seeds. The low harvest of previous agricultural seasons did not allow for a satisfactory replenishment of seeds and the low purchasing power of farming households penalize any attempt to source seeds from markets due to inflation driven by structural high demand. Provision of seed accounts for 3.5 percent of all assistance received by households and 34.5 percent of households received it. In the Southern part of Madagascar, less than half of the inhabitants have access to phytosanitary products due to affordability and availability issues. Other agricultural inputs such as organic fertilizers, chemical fertilizers, phytosanitary products and agricultural equipment, are available but often unaffordable, and fertilizers are not registered (Figure 12).



15. The hydro-agricultural network is inadequate for irrigation in the whole island and particularly in the Great South and the existing infrastructure mostly requires rehabilitation work. The low access to water sources for irrigation and to irrigation equipment force most of farmers to rely almost exclusively on rainfalls. The short period during which it rains (a few hours to a day at most) significantly limits the yield of cultivated area. Farmers are hesitant to invest in the purchase of equipment or the adoption of improved techniques, given that the level of production has been low in recent years. This leads to a weak performance of the sector which does not evolve.

16. The inadequacy of road infrastructure in rural areas limits access to markets and the distribution of food production. Farmers produce mainly for self-consumption and only sell production surpluses to meet their daily needs for non-agricultural products (soap, salt, sugar, lighting, etc.). Agricultural products for sale are not always processed and do not undergo any specific post-harvest conservation treatment, which make them more perishable in a context where transportation time and need for storage is high. The production and service infrastructures are outdated or even non-existent in some rural areas (Figure 13), and while rehabilitation activities were planned, inflation led to an increase in the price of construction materials (particularly cement and iron) and transportation costs (about 44 percent in July 2022), penalized these rehabilitation activities.



Livestock and Fishing

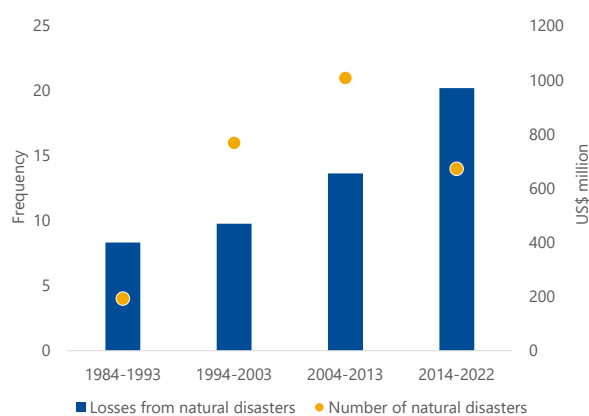
17. Livestock represents a relatively small share of rural households' revenue but is a storage of value. Livestock farming is closely linked to agriculture with about 62 percent of households practicing it but also constitutes savings, as products are only sold in cases of extreme necessity, illness or death and generates only 12.5 percent of revenues. Along with crop production, it constitutes the basic element of the economy and is an important source of income for the rural population. The species reared in the Great South are poultry, in particular local breed hens, small ruminants such as sheep and goats, and cattle. The breeding methods remain mainly traditional. Zebus play an important role in religious practices.

18. Insularity and climate change constitute the main bottlenecks in the fishing sector. Fishermen experience difficulties in selling products and decrease in prices due to insularity. The lack of equipment and the high price of inputs is challenging, as incomes from fishing do not ensure funding for the maintenance and renewal of equipment. A short survey of few fishermen conducted by the WFP in Ambovombe, Androy revealed the need for fish conservation equipment: cold rooms or transformation tools for smoking or drying fish. In many places, the fish must be sold the very same day, unless it will be wasted. This also limits the exportation to other areas of the country and abroad, while the regions where the fish sector is more developed (Tulear) benefit from foreign investors activities.

D. Climate Related Food Insecurity Will Increase in the Medium-Term

19. Madagascar is one of the most vulnerable countries to climate change and one of the least prepared to absorb the shocks. Madagascar's exposure to recurrent natural disasters¹³ inflicts recurring economic losses and threatens food security. Madagascar has been historically hit by a tropical cyclone every 0.9 years on average, while droughts and floods¹⁴ take place every 2.7 and 3 years respectively (EM-DAT, 2022, Figure 14). Natural disasters destroy capital and reduce output in the short run while also lowering potential growth in the long run. They reduce revenues and create spending needs, thereby worsening deficits, and increasing public debt. Although there is significant uncertainty on the future frequency of tropical cyclones, floods and droughts, their impact is expected to increase as the variance of temperature and precipitations rise. For instance, a typical tropical cyclone could become 18.4 percent more damaging by 2050 (Acevelo, 2016). A single weather disaster can significantly raise food insecurity, especially given agricultural productivity is already less than half the global average¹⁵. Looking ahead, a similar or stepped-up frequency and intensity of adverse weather events will further hamper food production and distribution (including damaging effects on transport routes) exacerbating food shortages and fuel food inflation with severe cascading consequences for the economy, hence the urgent need to improve resilience to climate shocks (Figure 15).

Figure 14. Historical Frequency of Total Losses from Natural Disasters in Madagascar



Source: EM-DAT, 2022 database.

Note: Includes the latest World Bank GRADE damages estimates for the Madagascar the 4 climate disasters from January 22 to February 23, 2022: Tropical Depression Invest 93S, Tropical Cyclone Batsirai, Moderate Tropical Storm Dumako and Tropical Cyclone Emnati.

20. Madagascar is exposed to a large variety of climate shocks that climate change will likely exacerbate. Higher temperatures, rising sea levels, droughts, floods, storms (especially severe ones such as cyclones), and acidification (Figure 16) weigh on agricultural yields and weaken the nutritional value of food.

¹³ According to the EM-DAT database, Madagascar is mainly subject to cyclones, floods, and droughts. Viral diseases and insect infestations are not considered in this analysis.

¹⁴ All floods are associated to cyclones (which is the main disaster type). There is only 1 historical occurrence of flash floods in EM-DAT and about half of all reported cyclones did generate floods. Historical cyclones' damages include floods.

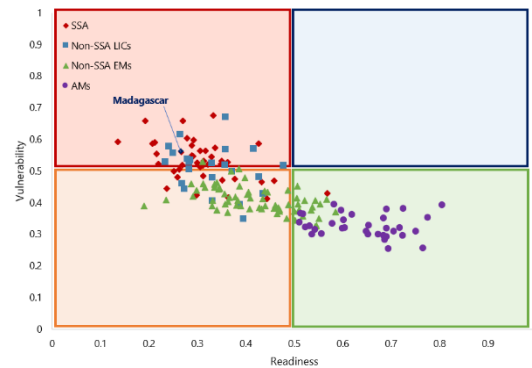
¹⁵ Fuglie and others (2020), Ritchie (2022).

21. Climate change is expected to decrease agricultural production through three channels: (i) the loss of cultivable land because of erosion, more intense rainfall, cyclones, and floods (Llopis 2018); (ii) a decline in land productivity due to more severe drought and drought-induced pests including locust outbreaks; and (iii) the loss of labor productivity caused by extreme heat (Rakotondravony et al. 2018) which has already fallen by USD 95 per worker over the past 20 years (World Bank, 2022). Floods and tropical cyclones can reduce the volume of capital inputs by damaging agricultural infrastructure.

22. The slow-moving effects of climate change have been reducing the volume and productivity of the natural capital in Madagascar, in both terrestrial and marine ecosystems. Tree growth and reproduction have been affected, and the marine ecosystem has been impacted by coral bleaching, seagrass loss, fisheries loss, ocean acidification, and so forth (Cochrane et al 2019). The changes in natural capital have directly harmed the sectors of agriculture, fisheries, and tourism. The silting up of reservoir dams and irrigation canals linked to environmental degradation leading to erosion and climatic hazards, reduces the storage capacity of the water necessary for the irrigation of rice crops.

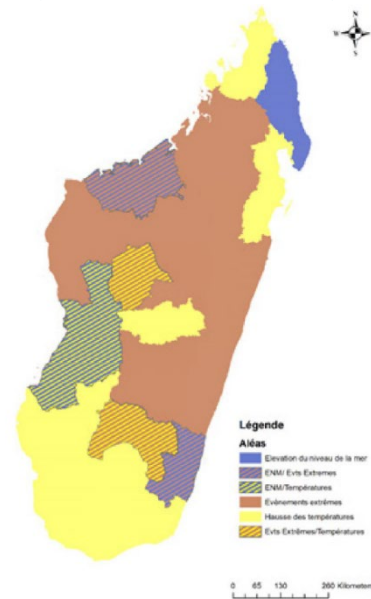
23. Human footprints affect resilience to climate shocks. Poor land use practices and land degradation across the country exacerbate the risks from extreme events and are the largest contributors to Co2 emission. Agriculture contributes to 16 percent of Co2 emissions as subsistence agriculture destroys forest and wetland carbon stocks rapidly. Deforestation destroys ecosystems and degrades dunes fixation, generating the silting up of crops. Vulnerability to climate change also impacts mangroves and coral reefs, with Madagascar being highly vulnerable to coral bleaching and reef loss (Figure 17) while the blue economy has a large potential for food diversification and new source of income for households, conditional on large investments in infrastructure and equipment.

Figure 15. Vulnerability and Readiness to Climate Change



Source: Notre Dame Global Adaptation Initiative, 2020. Note: Readiness measures a country's ability to leverage investments and convert them to adaptation actions (higher is better). Vulnerability measures a country's exposure, sensitivity and capacity to adapt to the negative effects of climate change (lower is better).

Figure 16. Major Climatic Hazards by Regions



Source: National Adaptation Plan, 2021

E. Policy Recommendations to Reduce Food Insecurity

Emergency Preparedness and Response

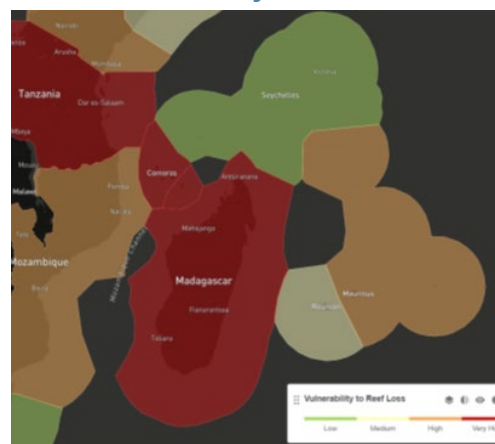
24. The authorities have set up various emergency responses to the cyclonic disasters, droughts and food inflation. The authorities capped the prices of 4 main imported products: rice, oil, sugar, and cement, (without paying explicit subsidies) from April to July 2022 to contain the transmission of international inflation. In 2022, 4.7 million people benefited from cash and in-kind humanitarian and development partners' assistance for food and subsistence (Figure 18).

25. The National Risk and Catastrophe Management Bureau (BNGRC) needs adequate financial and human resources to improve the crisis response at the local level. Historical data show that the budget allocation was often revised down from the LFI and amounts allocated end-up being significantly lower, except for transfers in 2020. The LFI 2023 allocates a budget of MGA 15.6 billion to the BNGRC and projects an increase to MGA 19.8 billion in 2024 and MGA 22.4 billion in 2024. The BNGRC was set up as an administrative public institution under the technical supervision of the Ministry of the Interior and Decentralization.

26. The extension of the social safety net in preparation for shocks should aim to operationalize a flexible and responsive single registry, scale up school feeding programs and support financial inclusion. Measures should include:

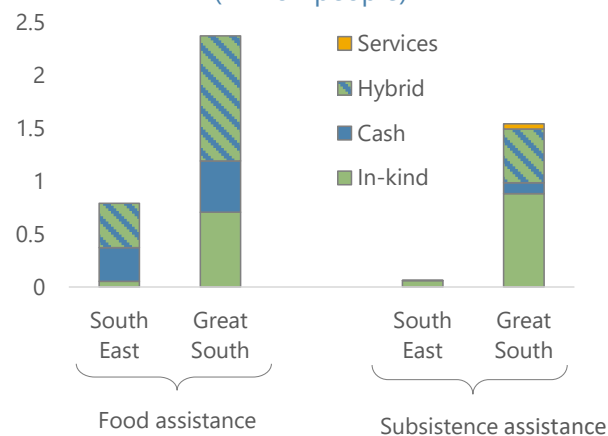
- Harmonizing the targeting approaches and eligibility criteria, using community platforms for targeting beneficiaries and establishing evidence-based triggers for shocks and having a systematic response during lean seasons/hurricane seasons built into the system.
- Extending the social safety net to prevent people from adopting negative coping strategies and depleting their assets and help households maintain access to food and essential

Figure 17. Vulnerability to Coral Reef Loss



Source: Resource Watch West Indian Ocean.
 Note: The Social Vulnerability index is based on the combination of the Reef Dependence index, Adaptive Capacity index, and exposure to reef threats (i.e., the Reefs at Risk integrated local threat index). The Reef Dependence index is based on the following inputs: reef-associated population, reef fisheries employment, reef-associated exports, nutritional dependence on fish and seafood, reef-associated tourism, and shoreline protection. An adaptive capacity index to reef loss based on the following inputs: economic resources, education, health (life expectancy), governance, access to markets, and agricultural resources.

Figure 18. Development Partners' Assistance Beneficiaries, 2022
 (Million people)



Source: Cluster SAMS Assistance.

services for health and education during times of crisis. There is strong evidence that households receiving transfers through social safety nets spend more on food, which leads to increased food security.

- Further develop conditional cash transfers and social safety nets, remove financial barriers and promote health care, nutrition services and appropriate food and nutritional products.
- Scale up food supply to schools based on local production, use school feeding programs to reach shock-prone families, and provide family rations, while promoting school retention. Develop food education and vegetable garden training.

27. Measures to strengthen preparedness and collaboration between the central government, local authorities, communities, and international partners include:

- **Early warning system:** establishing a monitoring and early warning system on climate, hydrological, geological, vulnerability monitoring mechanisms to anticipate extreme weather events and floods, as well as health monitoring systems to detect epidemics.
- **Develop emergency response plans:** local authorities and communities should work with humanitarian organizations to develop and implement emergency response plans that include evacuation strategies, back-up mechanisms and support for the most vulnerable. Plans should also include provisions for the prevention and management of emergency-related conflicts.
- **Integrate the prevention of food security risks into strategies to combat climate change:** local authorities and relevant organizations should work together to develop strategies that include measures for the agriculture sector development and to prevent food security risks linked to climate change, such as crop diversification and improved resilience of food production systems, integrated management of natural resources, education programs to raise awareness of the impacts of climate change; promote sustainable agricultural practices.
- **Put in place programs to reduce the vulnerability of rural communities:** programs can include activities to strengthen the resilience of rural communities such as the promotion of food security, the diversification of sources of income and access to basic services, such as drinking water and health care, as well as social protection mechanisms for the most vulnerable people.
- **Strengthen the coordination of international aid within national structures** for the efficient management and flexibility of resources: this includes i) partnership for research and development, ii) funding for sustainable initiatives and iii) cooperation for the implementation of policies and programs to support vulnerable populations.

28. Establishing a regional/community grain reserves for activation during lean periods or times of shocks to address gaps and limited reserves at the household level. Reserves are

an effective mechanism for rapid intervention and the modalities can be varied and adapted to the context.

Policies to Address Structural Food insecurity, Improve Food Chains and Addressing Challenges Posed by Climate Shocks

29. Developing sustainable and climate-smart agricultural practices can help improve food systems resilience to climate shocks, including the use of conservation agriculture, drip irrigation and water management systems. It includes protecting agricultural land by preventing urban expansion on agricultural land, promoting sustainable land management and the implementation of policies to support smallholder farmers with training and communication for agricultural practices that preserve soil organic matter. This would also require greater education and awareness among the population and policy makers. Diversifying agriculture can help build resilient food systems to climate shocks or market disruptions. It can also increase food security by increasing crops variety.

30. Structural weaknesses of the food value chain can be addressed by providing access to affordable fertilizers and strengthening locust control would support food production and agriculture productivity. Access to agricultural services and equipment must be strengthened through the Agricultural Development Fund.

31. Energy-Water-Food Nexus and digital innovation in rural areas such as the rapid rural transformation project which establishes a hub to provide remote communities with scalable services can stimulate community growth and development. This may be supported by off-grid green energy solution with a capacity of 25kW as an entry point for various services like, supply of drinking water, internet connection, access to digital classrooms, access to information sharing (climate, agriculture, health, etc.), processing and conservation equipment to develop agricultural value chains, entrepreneurial opportunities, and facilitating access to local public administration services.

32. Some measures can reduce reliance on biomass as a cooking fuel and increase reforestation. Favoring more modern and cleaner cooking fuels and technologies, to decrease deforestation, CO₂ emissions and negative impacts on health due to harmful smokes. Moreover, increasing the share of renewable energies in the national energy mix, including for isolated grids still relying on fossil fuels would reduce CO₂ emissions, fuel costs and exposure to volatility of international markets. These measures should be implemented along with accelerating reforestation interventions at scale such as green belt, dune fixation, promote alternative energy sources to reduce pressure on the forest, and strengthen livelihoods to ensure forest sustainability.

33. Important investments are needed to rehabilitate and develop the road network, irrigation systems, electricity, and telecommunications infrastructure thereby addressing the root causes of food insecurity and facilitating the distribution of food, cash transfers and other goods. Investing in rural infrastructure, including the construction of water reservoirs, irrigation

facilities and rural roads to facilitate access to markets by strengthening market connectivity to help farmers sell their production, and access to public and financial services.¹⁶

34. The gradual removal of distortive exoneration on rice imports may boost local production competitiveness on the domestic market and can incentivize investment in the sector. Imported rice is exempt from custom duty and the tax expenditure is estimated at MGA 124bn (0.2 percent of 2021 GDP)¹⁷. The import of other milled or semi-milled rice – lightly processed products – dominates total rice imports with over 92 percent of the total for 2019, 2020, and 2021. The authorities rely on imported rice to stabilize prices in a context of insufficient domestic supply, but customs tax exemptions are not appropriate or effective in controlling or stabilizing rice prices and a comprehensive tax reform of the sector would be needed to boost production. The exemption of rice from domestic VAT accounts for almost three-quarters of total domestic VAT tax expenditures and amounts to 4.7 times the tax expenditure on imported rice. Small producers would not be affected by the removal of the VAT exemption as they fall under the VAT applicability threshold while larger cooperatives could deduct VAT on intrants from tax declarations. At the sectoral level, agricultural inputs (including for crops and corn and soybean seeds) are largely exempt from domestic VAT, and imported agricultural materials and equipment also benefit from significant VAT exemptions.

35. Improving nutrition can be achieved by improving access to nutritious and affordable food, through greater local production and food supplementation programs for the most vulnerable households. Promoting the economic inclusion of the most disadvantaged populations by providing economic opportunities, such as vocational training programs and microcredits would help people lift themselves out of poverty and reduce food security.

Improving Green PFM and C-PIMA to Invest in Long-Term Resilience and Mobilize External Financing

36. Improving planning and implementation of the policies to address food insecurity and build resilience to climate and climate change requires accounting for natural disasters in baseline macro-fiscal projections. The 2023 Budget Law (LF) does not unfortunately integrate climate shocks in the baseline projections underpinning the budgeting exercise nor a climate risk analysis to the baseline. The principal caveat with regards to climate-macroeconomic programming are:

- Official macroeconomic and fiscal projections do not factor in climate and climate change risks even though the country is being consistently and increasingly hit by natural disasters.

¹⁶ See Box 4 in the Staff report for the 2022 Article IV Consultation and Third review under the ECF on Improving the Financial Inclusion of Smallholder Farmers.

¹⁷ IMF Technical Assistance Report, November 2021. Réformes Fiscales pour Accroître les Recettes.

- Consistency and realism across all the overarching documents of the country's climate strategy should be ensured. Growth projections reflect the authorities' objectives and are not adjusted for possible climate shocks.¹⁸
- The macroeconomic impacts of climate are only mentioned in a paragraph of the Annex of the LF, among the risks lists of risks to the real economy.
- The LF 2023 misses a discussion on contingency plans for budget reallocation in the case of a series of severe climate events during the 2022/2023 cyclonic season, or on the role of public policies to address the *Kere* (chronic food insecurity in the Great South). Additional spending needs are dealt with in a reactive and ad-hoc manner, through supplemental budgets and emergency donor funding, rather than pre-emptively through contingency measures (e.g., adequate provisions commensurate to the expected level of risk) in initial budgets.
- An annex dedicated to climate risk should provide an overall picture of all the policies in place at the Primature and the line ministries and their financing as a basis for planning and to manage public resources efficiently.
- A comprehensive reporting on implementation progress and use of funds (currently lacking) for climate mitigation and adaptation is essential for better policy management and unlocking future financing.

37. Ongoing public financial management (PFM) and public investment management (PIM) reform efforts provide an opportunity to increase the hitherto very limited focus on climate and include:¹⁹

- Strengthening the relations between the Ministry of Environment, Ministry of Economy and Finance, and line ministries at the planning stage, and mainstreaming climate change concerns into comprehensive sectoral strategies.
- Identifying those infrastructure assets most vulnerable to climate change and defining maintenance methodologies by main sectors, building on efforts in the road sector.
- Defining a methodology to integrate climate change into ex-ante project assessments and criteria for project prioritization.
- Introducing climate budget tagging e.g., through the ongoing work on the public investment manual, to create capability for identifying and tracking spending on adaptation and mitigation, and to create and gradually enrich a document or annex dedicated to climate change in the annual budget.

¹⁸ See Box 3 in the Staff Report for the 2022 Article IV Consultation and Third Review under the ECF on Strengthening Budget Credibility.

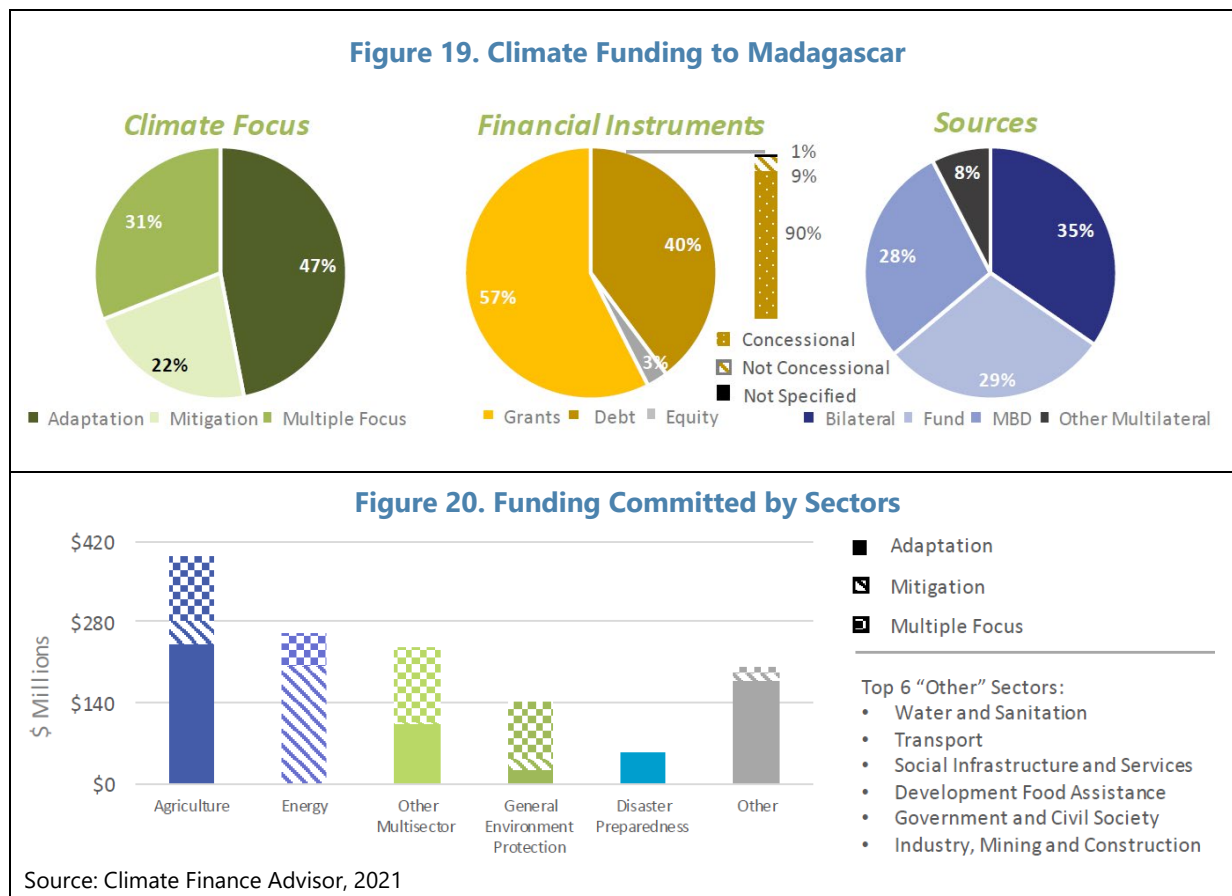
¹⁹ See IMF, Madagascar Climate Macroeconomic Assessment Program, 2022.

38. The 40-months Extended Credit Facility (ECF)²⁰ arrangement supported by the IMF, focuses on sustaining inclusive growth and addressing long-term fragilities through maintaining macroeconomic stability, improving governance, and creating fiscal space for much-needed investment in physical and human capital. Among the program objectives, improving budget execution and public financial management in general is a prerequisite for more effective fiscal policy, particularly in responding to shocks. Strengthening social safety nets and social policy management tools are important objectives of the program and monitored through performance criteria and the development of a shock-responsive cash transfer program is an authorities' commitment. Capacity development to achieve these objectives is provided through an extensive PFM technical assistance program, in particular with a long-term resident expert on the budget expenditure tagging. Finally, Madagascar benefitted from an SDR allocation of US\$322 million on August 23, 2021, that can be used²¹ to finance the implementation of the water pipeline project in the Great South and other PEM objectives related to food security, adaptation to climate change and sustainable development, providing exemplary practices in public procurement contract awards apply.

39. International financing can be unlocked by improving the knowledge of the donor landscape and the capacity to meet requirements for receiving financing. This can be complemented by measures to tap private sector finance by facilitating risk assessment and transparency of the policy environment. The OECD climate finance database reported US\$1.29 billion in climate funding for climate related projects committed to Madagascar between 2015 and 2019, mainly focused on the agriculture, energy, and other multisector sectors. Bilateral and multilateral climate funds, such as the European Development Fund (EDF) and the Green Climate Fund (GCF), provided approximately US\$377 million (29 percent) of this funding (Figure 19 and 20).

²⁰ [Request for a 40-Month Arrangement under the Extended Credit Facility-Press Release; Staff Report; and Statement by the Executive Director for Republic of Madagascar.](#)

²¹ See Box 1 of the [First Review under the ECF arrangement Staff Report](#) for details on the "Modalities of the Use of the SDR Allocation for Budget Financing".



40. More resilient infrastructures to climate shock could considerably reduce the reconstruction costs and free financial resources and human effort for other development needs. As a result of the four tropical storms in Madagascar in 2022, the total damage in the infrastructure sector (mainly roads and railways) has been assessed around USD170 million (according to the Global Rapid Damage Estimation (GRADE) Report for Madagascar, February 2022). If the roads and railways had been more resilient, the damage would have been reduced by USD85 million²². On the other hand, adaptation investment could cost between USD25 million and USD115 million, depending on the cost assumption (the LMIC average is 5 percent, while the Madagascar has assumed 25 percent in general), so may have paid off from one year’s climate events alone.

²² See Table 4 of the CMAP for description of “Major infrastructure investments in adaptation: costs and benefits”.

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