CLIMATE CHANGE IN CHAD: CHALLENGES AND OPPORTUNITIES[1]

Despite having contributed minimally to global greenhouse gas emissions, Chad is highly vulnerable to climate change, which is already affecting the country. With most people depending on agriculture and livestock, urgent adaptation measures are needed to build resilience. Additionally, Chad's reliance on oil for revenue and exports means global mitigation efforts will require a push toward economic diversification and a shift to a low-carbon economy. Given limited fiscal space and high reform costs, pragmatic short-term prioritization, search for synergies, and increased financing from domestic, international, and private sources are essential. Strengthened and better targeting social protection will help safeguard the most vulnerable.

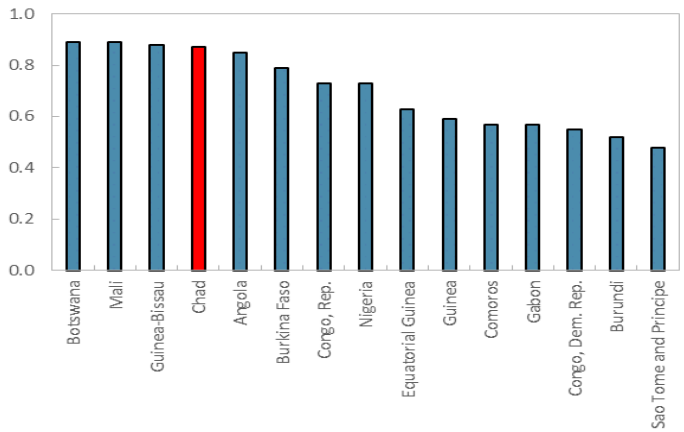
A. Climate and Socio-Economic Context in Chad

1. Chad, the fifth largest country in Africa, spans around 1.3 million km² and includes three bioclimatic zones. The Saharan zone in the north, a largely uninhabited desert, covers 47 percent of the territory. The Sahelian zone, in the central region, makes up 43 percent of the land and hosts 51 percent of the population, featuring poor soil and scrubland. The Sudanian zone in the south, with 10 percent of the territory and 47 percent of the population, exhibits more abundant vegetation.

2. Chad's economy is poorly diversified, relying heavily on natural resources, with agriculture, livestock, and oil production at its core. Agriculture and livestock collectively contribute about 40 percent of GDP and employ roughly 75 percent of the population. Agriculture is mainly rainfed and subsistence-based, while livestock production relies on natural pastures and crop residues, with live cattle as a key export. Chad is also a significant oil producer, holding Africa's 10th largest oil reserves, estimated at 1.5 billion barrels (Uneca, 2016). In 2022, oil contributed 28 percent of GDP, 78 percent of exports, and 67 percent of government revenues.

Text Figure 1. Chad: Export Concentration Index (ECI), 2021

(15 countries with the highest ECI in SSA)



Source: UNCTAD

Notes: Index ranges from 0 (Homogeneously distributed) to 1 (Highly concentrated on a few products).

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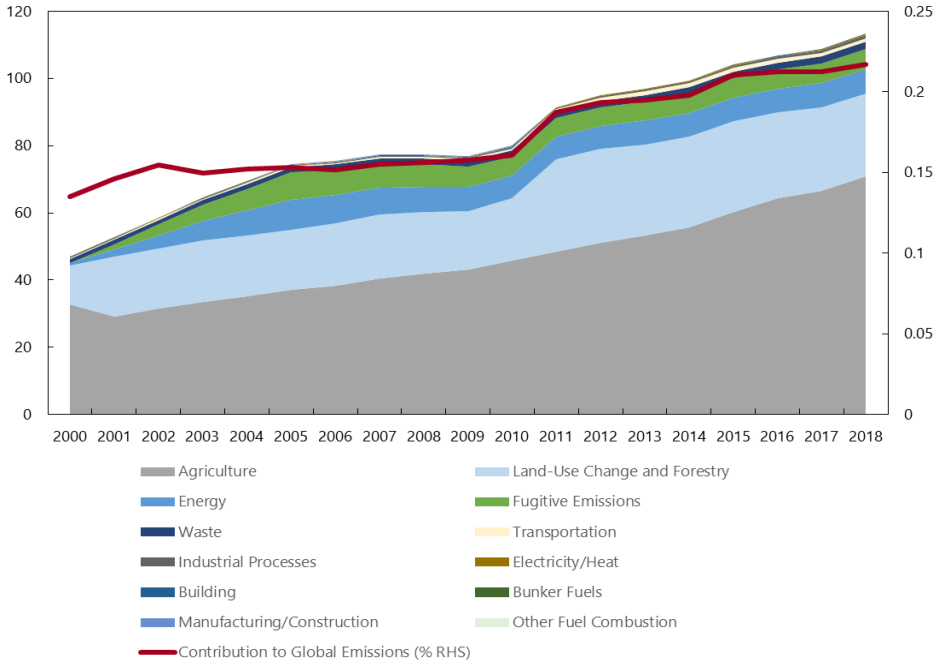
3. While Chad contributes very little to global greenhouse gas emissions in absolute terms, climate change poses major challenges to its development. Although Chad's greenhouse gas emissions are minimal, at just 0.2 percent of the global total, climate change poses significant development challenges.[2] With 76 percent living in rural areas, agriculture, land use change, and forestry contribute 96 percent of Chad's emissions. The country ranks low on development indicators, with 35 percent of the population living in extreme poverty. Inequalities are exacerbated by limited infrastructure: only 12 percent of the population has electricity access (just 1.3 percent in rural areas). Heavy reliance on charcoal and wood further impacts health and the environment through deforestation and pollution (World Bank, 2023).

Text Figure 2. Chad: Greenhouse Gas Emissions, 2000–18

(MtCO2e)



Source: Climate Watch: https://www.climatewatchdata.org/

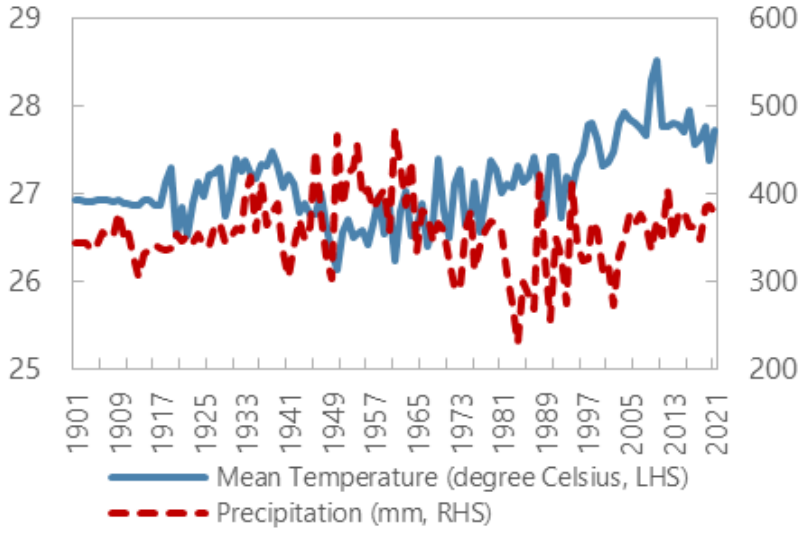
B. Vulnerability to Climate Shocks

4. Chad is among the most vulnerable countries to climate change, with impacts already evident (G5 Sahel Country Climate and Development Report, 2022). According to the IMF-Adapted ND-GAIN Index 2021, Chad ranks the second lowest globally in vulnerability and among the lowest in preparedness. Its vulnerability stems from a hot climate and an economy heavily dependent on agriculture and livestock, coupled with inadequate means for adaptation. Chad is one of the hottest countries in the world, and average annual temperatures in Chad have risen by over 0.5 degrees

[2] Emissions from the oil industry are not included in this estimate. They will be incorporated in the upcoming revision of Chad's Nationally Determined Contributions (NDC), which may considerably increase emission estimates.

Celsius since the 1990s, nearly double the global average (Chad National Adaptation Plan, 2021; World Bank Environmental Diagnostic Report for Chad, 2022). Meanwhile, rainfall has become more irregular. Without decisive action, global temperatures could increase by an additional 2.2 degrees Celsius by 2100 (World Bank, 2021).

Text Figure 3. Chad: Mean Temperature and Precipitation, 1901–2021

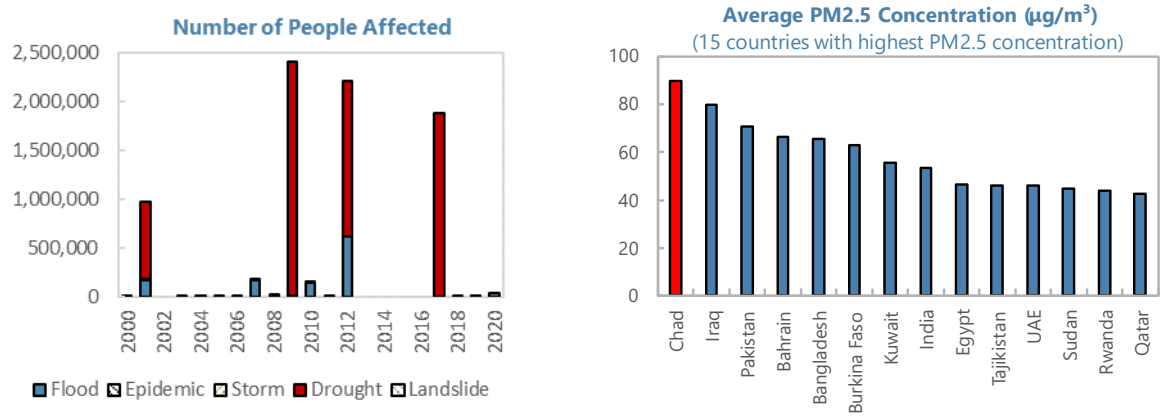


Source: CRU database and IMF staff calculations

5. The detrimental effects of climate change include desertification, water resource loss, and soil and habitat degradation. Natural resource depletion in Chad is nearly three times the Sub-Saharan average (World Bank, 2022b). Climate-related damages were estimated at 12 percent of GDP in 2019 (World Bank, 2022b), while projected annual losses reach more than 10 percent of GDP by 2050 under a pessimistic dry-climate scenario (G5 Sahel CCDR, 2022).

6. Chad faces frequent natural disasters and severe air pollution, impacting much of the population. Floods and droughts are common; in 2022, pluvial and fluvial floods affected 1.3 million people (over 7 percent of the population), while 2024 floods impacted as many as 1.7 million. Without mitigation, disaster frequency in the Sahel is expected to rise (G5 Sahel CCDR, 2022). Nearly all Chadians are exposed to PM2.5 levels above WHO guidelines, with air pollution ranking as the third leading cause of premature death. Major contributors include energy and transport sectors, and open waste burning (State of Global Air, 2019).

Text Figure 5. Chad: Natural Disasters and Air Pollution

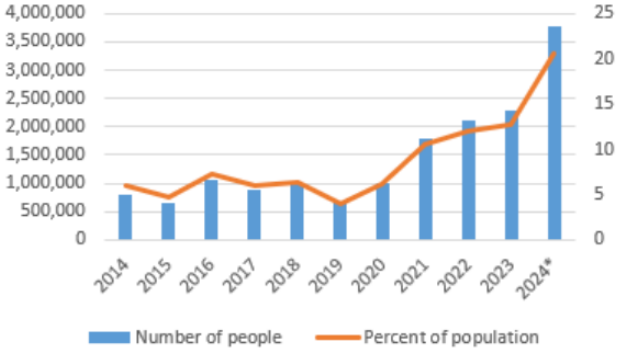


Source: EMDAT and IQAir

Notes: The World Health Organization updated Air Quality Guidelines (WHO, 2021) recommend annual mean concentrations of PM2.5 not exceeding 5 micrograms per cubic meter.

7. Climate change has worsened food security and intensified inter-communal conflicts over scarce natural resources. Key crops like millet, maize, rice, and sorghum are highly climate-sensitive, impacting yields and labor productivity (G5 Sahel CCDR, 2022). Volatile rainfall and severe floods in 2022 and 2024 have disrupted agricultural production, pushing food insecurity from 2.1 million people in 2022 to unprecedented 3.8 million in 2024 (projected under Cadre Harmonisé). Rapid population growth (3.1 percent in 2023) and stagnant crop yields strain resources, while climate-driven land and water shortages exacerbate conflicts between farmers and pastoralists.

Text Figure 6. Chad: Food Security, Lean Season
(2014-2024)



Source: Cadre Harmonisé (March 2024), WEO and IMF staff calculations.

Note: The numbers refer to the population experiencing food crisis, emergency, or famine (phases 3-5). Lean season refers to June-August.

8. Poor households, women, and youth are most impacted by climate change. These segments of the population are concentrated in climate-sensitive activities but have limited resources and low education, hindering adaptation. Disadvantaged households also tend to have fewer coping strategies for food insecurity (Box 1), in the face of climate change.

Box 1. Chad: Climate Change and Food Security

Food insecurity is a structural issue in Chad, influenced by its geographic and climatic conditions and farming practices. The country has three distinct rainfall zones: the Saharan north (100 mm/year), the Sahelian center (100 to 800 mm/year), and the Sudanese south (over 800 mm/year). Agriculture, reliant on basic technology, is the main source of food, with low and stagnant crop yields. Dependence on irregular rainfall during 3 to 4 months each year makes agriculture vulnerable. Lake Chad, which has already shrunk dramatically, is forecasted to disappear in the next 20 year at its current rate of use (NASA, 2017). Climate variability, especially in the Sahelian zone, leads to recurrent food insecurity.[1] Increasing desertification is causing the low rainfall line to move southward by 60 km each decade, exacerbating food insecurity across the Sahel, where climate change has resulted in environmental degradation and famine.

A recent study by Topeur (2023) highlights the relationship between climate factors and food insecurity in Chad, while identifying households' coping strategies. Using food consumption data from the World Food Program's annual National Food Security Assessment (2015-2019) alongside climate data, the study reveals that climate conditions—both objective (rainfall) and subjective (self-reported disasters)—significantly correlate with food security, even after accounting for various socio-economic factors.[2, 3] Increased rainfall typically reduces food insecurity, while living in drier regions or experiencing drought raises its likelihood.[4]

The study also finds that certain economic factors enhance food security, suggesting people draw on their skills and resources to cope: higher literacy rates among household heads, access to communication and transportation equipment, and ownership of livestock or valuables all make it less likely to be food insecure. Other coping mechanisms include reducing food quantity and quality, limiting meal frequency, and borrowing food or money, which can be thought of as last resort measures. Consequently, food insecurity disproportionately impacts disadvantaged and vulnerable populations.

[1] According to Thomas and Nigam (2018), Chad, is among the countries most affected by the expansion of the Sahara Desert.
[2] Food insecurity is assessed through the food security index, which is a combination of food consumption, economic vulnerability, and asset depletion.
[3] This survey data by WFP is representative at the country and province level.
[4] Floods (self-reported), however, do not exhibit a statistically significant econometric relationship with food insecurity, albeit in some years there is a simple bivariate association.

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C. Climate Change Policies in Chad

9. The government's climate action strategy is outlined in its Nationally Determined Contributions (NDC, 2021) and National Adaptation Plan (NAP, 2021). These documents communicate Chad's climate efforts internationally and align with its "Vision 30: The Chad that we want" strategy, developed in 2017 to reflect the government's commitment to achieving development objectives by 2030, including to improve living conditions, reduce inequalities, conserve resources, and adapt to climate change.

10. Given its minimal greenhouse gas (GHG) emissions and high climate vulnerability, adaptation is an urgent priority for Chad, requiring acceleration of the NAP implementation process. As global temperature containment efforts remain limited, climate anomalies are likely to worsen. Authorities should accelerate NAP implementation, prioritizing it at the highest decision-making level, intensify financing efforts, and develop a more comprehensive NAP to address gaps in

data, cost-benefit analysis, governance weaknesses, build capacity for green budgeting, and include a gender dimension.

11. Consistent with its Paris Accord commitments, Chad must prepare for a transition to a greener, more diversified economy. While global climate efforts may eventually reduce Chad's climate risk, the shift away from oil will challenge its oil-dependent economy and public finances. Global oil demand is expected to decline from 2040 (Republic of Congo, Selected issues, 2021), with Chad's oil production forecasted to peak in 2028 and decrease by 1 percent annually thereafter. Rapidly developing green growth sectors would help dampen the impact of reduced oil production and support the country's climate mitigation goals.

Box 2. Chad: Government Framework for Climate Action

The National Determined Contributions (NDC) aim to implement adaptation measures and mitigate GHG emissions, aligning with the Paris Agreement's goals for a low-GHG economy. Chad's NDC, revised in 2021, targets a 19.3-percent reduction in GHG emissions by 2030, based on 2010-2018 data. It estimates a total cost of US$11.7 billion for 2021-2030—US$5 billion for adaptation and US$6.7 billion for mitigation—with domestic financing of approximately US$1.7 billion. The upcoming NDC revision will include the oil sector's climate impact, likely increasing funding needs.

The National Adaptation Plan (NAP) from 2021 integrates climate change adaptation into planning and budgeting for climate-sensitive sectors. Its priority areas are: 1) Agriculture and livestock; 2) Environment and forestry; 3) Water, hygiene, and sanitation; 4) Renewable energy; 5) Gender and social protection; 6) Education and communication; 7) Risk and extreme weather management; and 8) Aquaculture and fisheries.

Priority adaptation options for these areas were identified based on effectiveness, feasibility, cost/benefit ratios, and stakeholder consultations at national and regional levels.

D. Policy Recommendations

Climate Change Policies in Chad Should be Guided by the Following Considerations

12. With limited financing and low climate preparedness, Chad urgently needs effective, targeted adaptation measures, seeking synergies with mitigation and transition where possible. Energy policies are crucial not only for transitioning to a low-carbon economy but also for adaptation. Energy reform underpins other actions; for instance, improving irrigation requires reliable electricity access, necessitating a new energy plan that includes renewable sources to meet rising demand.

13. Climate action in Chad requires substantial public investment, which must be fully integrated into its public investment management framework. The NDC outlines key projects to achieve mitigation and adaptation goals, including renewable power generation, energy-efficient infrastructure, waste treatment plants, railroads, and public transport improvements. However, scaling up such investments is costly and risky, making an effective, transparent, and efficient public investment management system essential for building a low-carbon, climate-resilient economy.

14. With high climate action costs and limited resources, financing is critical for Chad. Adaptation and mitigation costs are estimated at $11.7 billion for 2021–30 (NDC, 2021), and expected to rise further as more granular data becomes available and the oil sector's climate impact is properly accounted for. Limited fiscal space and debt concerns, compounded by declining oil revenues amid a shift to cleaner energy, make it essential to attract donor and private sector support.

15. Social protection must be strengthened to support those most affected by climate change. Most of Chad's population depends on climate-vulnerable agriculture and livestock for subsistence, sectors that are also major GHG contributors. This dual role complicates mitigation efforts, which may have regressive effects.

These Considerations Inform the Following Policy Recommendations

E. Prioritization and Search for Synergies

16. One important adaptation priority is improving the quality, accessibility, and utilization of weather information to enhance preparedness and support disaster risk management. Promoting sustainable and efficient agricultural land use can also help reduce emissions. It is essential to develop a weather monitoring and forecasting system that delivers timely data to farmers and herders, informing production decisions and minimizing climate-related losses. Enhancing early warning systems is critical for mitigating damage from climate shocks. A comprehensive approach is necessary to tackle threats to agriculture, water, and the environment. This includes preserving natural capital, increasing productivity, and supporting mitigation efforts through carbon capture. For instance, agroforestry incorporates trees into agricultural landscapes, which enhances biodiversity, improves water quality and soil health, and sequesters GHG. Additionally, it provides shade and wind protection, bolstering crop resilience to extreme heat, thereby reducing irrigation needs and lowering energy consumption.

17. Inefficient energy subsidies should be phased out to redirect resources toward targeted climate policies and investments in renewable energy, such as solar power. These subsidies represent a significant fiscal burden, estimated at 1.6 percent of GDP in 2022 (IMF FAD technical assistance mission). Eliminating them would help fund the necessary investments in resilient infrastructure and renewable energy, addressing the climate impact of fossil fuels and reducing fiscal impact of fuel use for power production. This shift could also modernize the agricultural sector, as improved electricity access is essential for irrigation in rural areas. Additionally, expanding access to clean cooking options would benefit both mitigation efforts and overall development.[3]

[3] To meet the clean cooking targets set out in the NDC 2021, a total investment of around US$36.3 million—of which US$8.6 mill publicly funded, while US$27.7 mill funded by the households—is needed each year in Chad (World Bank 2022a).

18. Enhancing governance and transparency of the energy sector will boost efficiency, reduce tax vulnerabilities, and improve the business environment. Encouraging private sector development alongside increased public investment can create new growth engines to mitigate the impacts of the global transition away from oil. Conducting environmental impact assessments for new projects will also help minimize emissions.

F. Public Investment Management

19. The IMF's C-PIMA technical assistance in 2022 provided policy recommendations to enhance public investment management in relation to climate change. At the request of the authorities, the IMF conducted a public investment management assessment (PIMA), using a diagnostic tool to evaluate institutional readiness and identify gaps in governance concerning climate change.

Box 3. Chad: C-PIMA 2022

The IMF's C-PIMA technical assistance mission in 2022 assessed Chad's public investment management (PIM) system, identifying strengths and weaknesses.

- Strengths include:
  - i. Establishment of the Directorate of Environmental Education and the Fight against Climate Change (DEELCC) to raise awareness about climate among ministries.
  - ii. Integration of some actions from the 2021 National Determined Contribution (NDC) into sectoral strategies.
  - iii. Requirement to analyze the environmental impact of investment projects.
- Weaknesses include:
  - i. Lack of methodologies for the ex-ante assessment of climate impacts and risks on infrastructure.
  - ii. Absence of financing mechanisms for managing infrastructure climate risk.
  - iii. A disaster risk reduction strategy developed but not formally approved.

Three urgent IMF recommendations for Chad's PIM system include:

i. Develop a better three-year public investment program, prepared by the Ministry of Finance, Budget, Economy and Plan (MFBEP), and the National Commission for the Management of Public Investments (CONAGIP).
ii. Provide guidelines for assessing infrastructure maintenance requirements that incorporate the impact of climate change,
iii. Standardize project appraisal methodologies, including climate impact assessments.

Additional recommendations aim to enhance the link between planning and budgeting for capital expenditures, improve infrastructure financing supervision, and strengthen the management cycle of public investments, essential for climate change adaptation.

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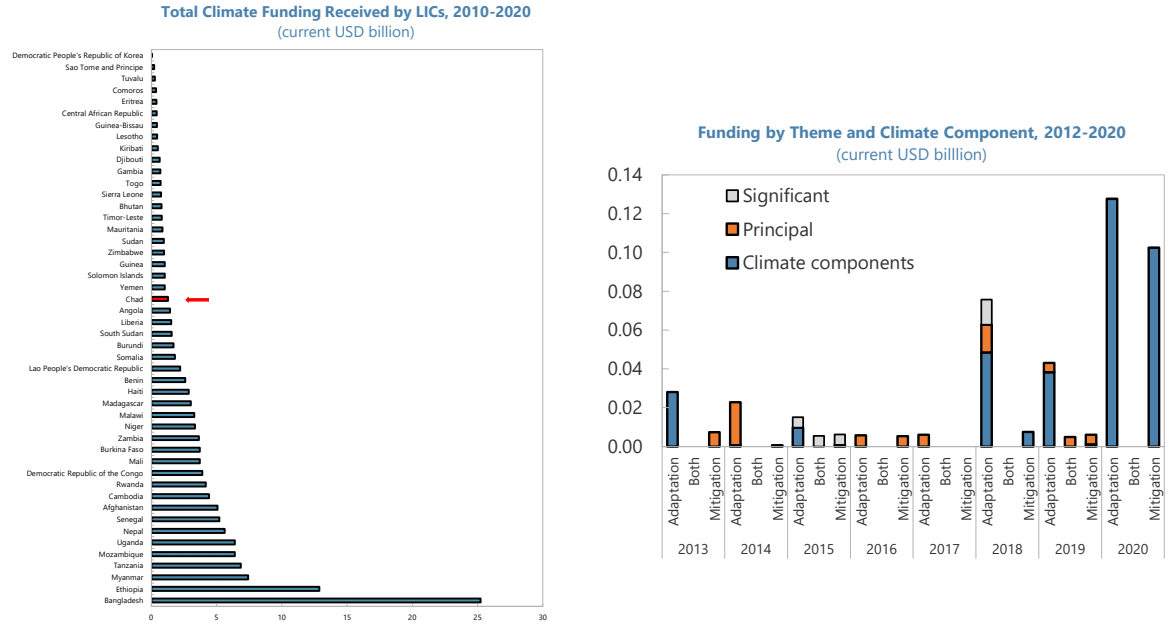
G. Financing

20. Chad must secure financing to address climate change risks, requiring increased national budget allocations, external financing from donors and climate funds, and private sector investment. While important, enhancing public resources through revenue mobilization, improving spending efficiency, and cutting energy subsidies—backed by IMF technical assistance—will not suffice, even with donor support. Additional climate finance and private sector involvement are essential. For a discussion of potential climate financing sources, see Box 4.

21. The government should create fiscal space for climate investments while ensuring debt sustainability. It could reprioritize climate spending, currently under 1 percent of the budget (CCDR 2022), and broader development policies to foster inclusive and resilient growth. Additionally, exploring carbon credits and climate-linked debt instruments, along with potentially utilizing the IMF's Resilience and Sustainability Trust (RST) for regulatory reforms, could enhance resilience to climate change.

22. Access to international climate funds is crucial given limited fiscal space. From 2010 to 2020, Chad received a total of US$1.3 billion in climate funds, with recent increases mainly aimed at financing adaptation. An order of magnitude more is needed during the current decade.

Text Figure 7. Chad: Access to International Concessional Climate Funds



Source: OECD Climate Change – OECD DAC External Development Finance Statistics
Notes: "Both" corresponds to multiple focus projects that have components of adaptation and mitigation.

23. As a low-income, fragile country with weak capacity and governance, Chad faces significant challenges in accessing foreign financing, including international climate funds. Key areas of concern for financing providers include data quality, governance, debt, and public financial management (PFM). These weaknesses hinder Chad's ability to apply for direct access to climate funds, which would improve project control, stakeholder engagement, and technology transfer. For the time being, indirect access may be the only option due to limited time and capacity for accreditation and project management. Issuing climate-linked debt instruments may require greater creditworthiness than Chad possesses. Additionally, implementing debt-for-nature swaps is

complicated by the need for thorough preparation, strong government engagement, and management capacity. Accessing international carbon credit schemes is also challenging due to the need for substantial investments in emissions monitoring. Lastly, obtaining climate-related insurance is difficult due to a lack of reliable data on climate risks and an underdeveloped insurance sector.

24. Chad should implement policies to mobilize climate finance, foreign direct investment, and private investment. Key reform areas to attract financial resources include:

- Improving the quality, availability, and timeliness of data.
- Enhancing the effectiveness of laws, governance, debt management, and PFM to support project preparation for climate finance.
- Utilizing the new multi-year public investment plan (2023-2026) to mandate the integration of sustainability objectives in investment and infrastructure development.
- Developing a well-structured climate investment plan, as outlined in the NDC, to prioritize and outline financing for specific reforms.

Box 4. Chad: Financing Climate Action in Chad

In principle, Chad could tap into four key sources for financing climate action, alongside domestic revenue mobilization: (1) concessional financing; (2) climate-linked debt instruments; (3) international carbon credit schemes; and (4) climate-related insurance schemes (see IMF Staff Climate Notes, 2022).

i. **Concessional financing** includes grants or loans at low-interest rates. International climate funds like the Green Climate Fund (GCF) and the Global Environment Facility (GEF) offer such financing, accessible directly through accredited national or subnational entities or indirectly via institutions like the UNEP or UNDP.

ii. **Climate-linked debt instruments** would enable Chad to raise funds at lower interest rates by issuing debt tied to environmentally friendly projects. The reduction in interest rates for these "green" bonds is known as the Greenium. Debt-for-nature swaps are another option, though challenging to implement.

iii. **International carbon credit schemes** could allow Chad or its companies to earn credits for greenhouse gas reductions, which can be sold internationally. However, their effectiveness is debated, and they require substantial investments in emissions monitoring and verification.

iv. **Climate-related insurance schemes** offer protection against losses from extreme weather or climate risks. For instance, crop insurance can shield farmers from droughts or floods.

While these financing sources present opportunities for Chad to combat climate change, accessing them will likely require significant improvements in administrative capacity, governance, and data provision.

H. Social Protection

25. The development of a robust social protection framework should complement climate policies with well-targeted support. The poorest, particularly women in agriculture, are most vulnerable to climate change due to limited access to land and resources. To enhance the effectiveness of social support, efforts must focus on promoting digitalization and establishing a unified social register to identify vulnerable populations. Additionally, the authorities could explore developing a climate risk insurance market by subsidizing premiums within the social protection framework.

I. Summary and Conclusions

26. Given Chad's acute vulnerability to climate change, it is imperative that the government accelerates the implementation of policy measures for adaptation, as well as mitigation and transition. Authorities should prioritize immediate adaptation measures, such as enhancing weather information systems and improving disaster risk management. With agriculture being the backbone of Chad's economy, addressing climate-related challenges through sustainable practices, including agroforestry, is crucial to maintaining food security and promoting resilience among vulnerable populations. The integration of climate considerations into national policies and planning frameworks will be essential to mitigate the adverse impacts of climate change on both natural and human systems.

27. Furthermore, achieving meaningful progress requires a comprehensive approach to financing. Chad must unlock diverse funding sources, including national budget allocations, bilateral donor funding, international climate funds, and private sector investments. Strengthening governance and transparency in public investment management will facilitate effective use of these funds, while fostering inclusive strategies that engage local communities in decision-making processes. Creating a financing window dedicated to the most vulnerable, fragile, low-income countries should be considered, combined with technical assistance to increase Chad's capacity to prepare its financing requests. This would pave the way for a more resilient and sustainable future, ultimately contributing to a diversified Chadian economy that mitigates reliance on fossil fuels.

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