INTERNATIONAL MONETARY FUND

The Effects of Climate and Conflict Shocks on Household Welfare

Niger

Yoro Diallo

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The Effects of Climate and Conflict Shocks on Household Welfare
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ABSTRACT: As livelihoods in Niger still depend to a large extent on agricultural production, shocks related to climate change and insecurity present a threat for the country's development path and are the main sources of vulnerability for the population in rural areas. This paper uses data from the latest household living standard survey to quantify the effects and interactions of these shocks on household welfare before proposing policy recommendations to enhance the resilience of households and the economy more generally. Our results show that when rainfall decreases by one standard deviation, per capita income falls by 11 percent. Furthermore, the impact of shocks on households depends on their adaptive capacity, which includes sufficient agricultural capital and income diversification. Without concrete adaptation measures, vulnerability to climate change is expected to increase in Niger, and human capital accumulation in poor household is also expected to deteriorate and could lead to a poverty trap.

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SELECTED ISSUES PAPERS

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THE EFFECTS OF CLIMATE AND CONFLICT SHOCKS ON HOUSEHOLD WELFARE[1]

As livelihoods in Niger still depend to a large extent on agricultural production, shocks related to climate change and insecurity present a threat for the country's development path and are the main sources of vulnerability for the population in rural areas. This paper uses data from the latest household living standard survey to quantify the effects and interactions of these shocks on household welfare before proposing policy recommendations to enhance the resilience of households and the economy more generally. Our results show that when rainfall decreases by one standard deviation, per capita income falls by 11 percent. Furthermore, the impact of shocks on households depends on their adaptive capacity, which includes sufficient agricultural capital and income diversification. Without concrete adaptation measures, vulnerability to climate change is expected to increase in Niger, and human capital accumulation in poor household is also expected to deteriorate and could lead to a poverty trap.

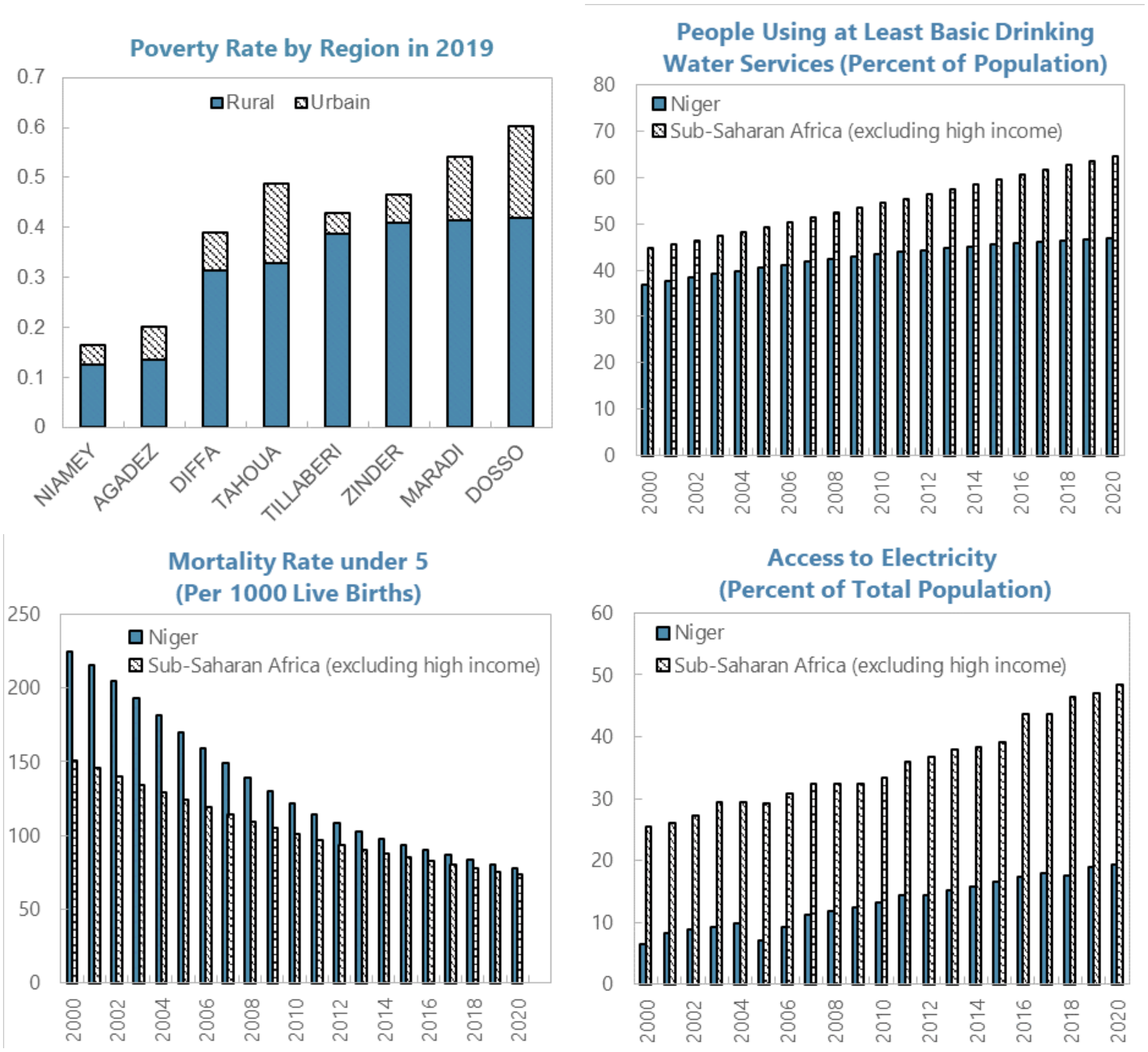
A. Background

1. The coexistence of multiple and regular shocks constitutes a threat to the development of Niger. Niger is dealing with the consequences of a triple crisis, arising from the country's long-standing security and climate change-related challenges and, more recently, a health crisis associated with the coronavirus outbreak (COVID-19) in 2020. Shocks related to insecurity and climate change are regular and difficult to contain. Moreover, climate change and insecurity are linked. Climate change can increase the incidence of conflict between socio-economic groups by increasing resource scarcity as well as competition for resources.

2. The confluence of these shocks renders the eradication of poverty extremely difficult. Development indicators in Niger point to high poverty and inequality, low human capital (figure 1), and an untapped demography dividend. Close to 41 percent of population lives below the poverty line and 83 percent of the population is located in rural areas. The poor are not evenly distributed across regions. Only 7 percent of the capital (Niamey) population is considered poor, while more than 45 percent of Dosso, Zinder, and Maradi population are poor**.** Inequality between regions and socioeconomic groups is also deepened with lack of basic infrastructure in remote areas. These vulnerabilities are deepened by the persistence of insecurity and the consequences of climate change.

[1] Prepared By Yoro Diallo (AFR). Canghao Chen (AFR) and Joanna Delcambre (Staff Assistant AFRC1) assisted with the formatting of the charts assisted with the formatting of the charts.

Figure 1. Niger: Socioeconomic Indicators

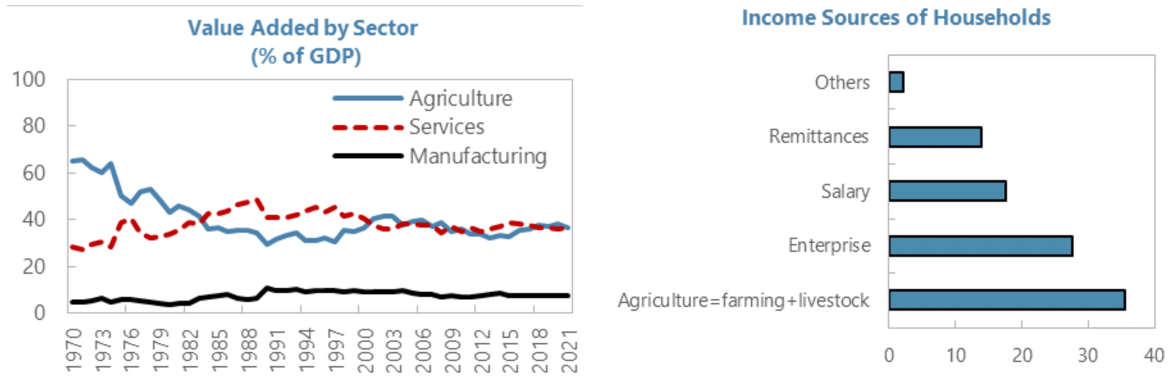


Source: WDI and IMF staff calculation

3. **Job opportunities are limited, and agriculture remains the main source of income for a large segment of the population.** Niger's economy is not diversified and depends primarily on rainfed agriculture, which accounts for 36.4 percent of GDP in 2021. Around 73 percent of the total active population is engaged in the agricultural sector (figure 2) and the sector remains mainly based on subsistence production. The main cultivated crops (Rice, Millet, Maize, Sorghum) are vulnerable to climate change, which directly affects quantities produced in period of shocks (during droughts, for example), but also crop yields and labor productivity (World Bank CCDR, 2022). Moreover, conflicts

cause the abandonment of farms in risky areas, the destruction of agriculture infrastructure, thereby reducing domestic food supply and increasing vulnerability to climate change.

Figure 2. Niger: Importance of Agriculture Sector in the Economy



Source: WDI and EHCVM 2019

4. **Rapid population growth is putting pressure on labor markets and reducing the opportunity costs of participating terrorist activities.** Annual population growth is estimated at 3.7 percent and in 2021 20 percent of the population was in the 15-24 age bracket. However, as these young people frequently lack access to labor market jobs because of a lack of marketable skills and limited job supply.

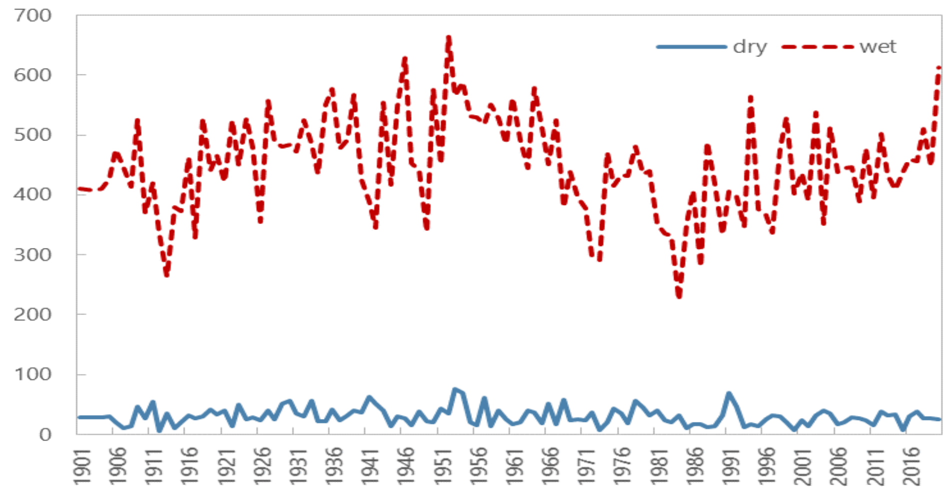
B. Stylized Facts on Shocks Experienced by Niger

Vulnerability to Climate Shocks

5. **Niger is facing increasing aridity, marked by high volatility of weather conditions during the growing season (figure 3).** The high volatility of rainfall makes it unpredictable and biases the decisions of economic agents, increasing their exposure to climate hazards, with the risk of losing crops, livestock, assets, and other productive resources.

6. **During the last century, the average annual temperature in Niger has increased significantly by 0.7 degree Celsius (figure 4)**. The increase in temperature over this period varies across regions, with Tillabery and Niamey recording the highest trend and Maradi and Zinder the lowest level in temperature increase. Over the same period, however, the change in annual rainfall does not appear to be evenly distributed across regions. Indeed, annual rainfall appears to be decreasing in each region, with the exception of Diffa and Agadez, where rainfall increased by 4.8 and 26.3 mm.

Figure 3. Niger: Cumulative Annual Rainfall by Season Over the Period 1901-2020[1]



Source: CRU database and IMF staff calculation
1/ Wet season includes June, July, August, September, and October; and Dry season includes November, December, January, February, March, April, and May.

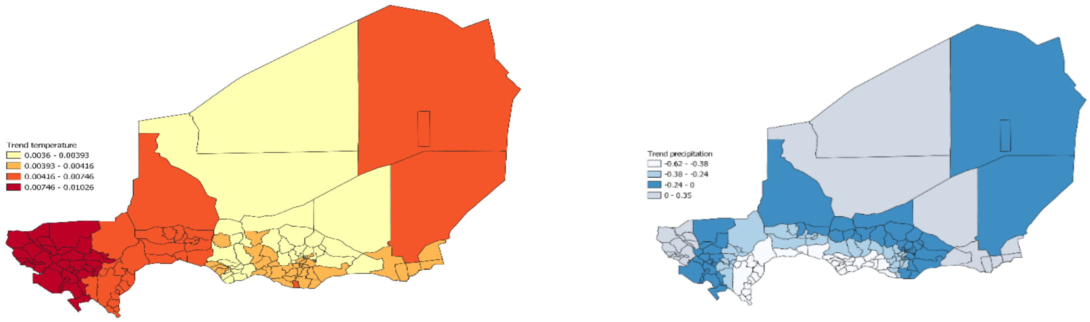
7. **Moreover, Niger has suffered different types of natural disasters over the past two decades.** Floods and droughts are the most frequent events. At least one of these types of disasters occurs in Niger every year. Extreme climate events can lead to large economic damages and human costs. According to the "Intended Nationally Determined Contribution (INDC)", the average losses due to droughts, in Niger, are estimated at over USD 70 million (0.6 percent of GDP). Drought episodes increase food insecurity, poverty, exposure to diseases like malaria, and the incidence of domestic conflicts (Diallo & Tapsoba, 2022). Furthermore, the poorest segments of the population are the most exposed to the consequences of climate change, due to their low capacity to adapt and their dependence on activities that are climate sensitive. Without any mitigation, natural hazards in Niger are projected to increase in frequency in the future (Sahel-CCDR 2022).

Table 1. Niger: Cumulative Variation of Climate Conditions Over 1901-2020

Regions	Precipitation (mm)	Temperature (degree celcius)
Agadez	4.84	0.53
Diffa	26.31	0.49
Dosso	-53.36	0.79
Maradi	-52.08	0.47
Niamey	-14.58	1.02
Tahoua	-34.35	0.62
Tillabery	-13.16	1.05
Zinder	-26.31	0.47
Niger	-27.77	0.67

Source: CRU database and IMF staff calculation

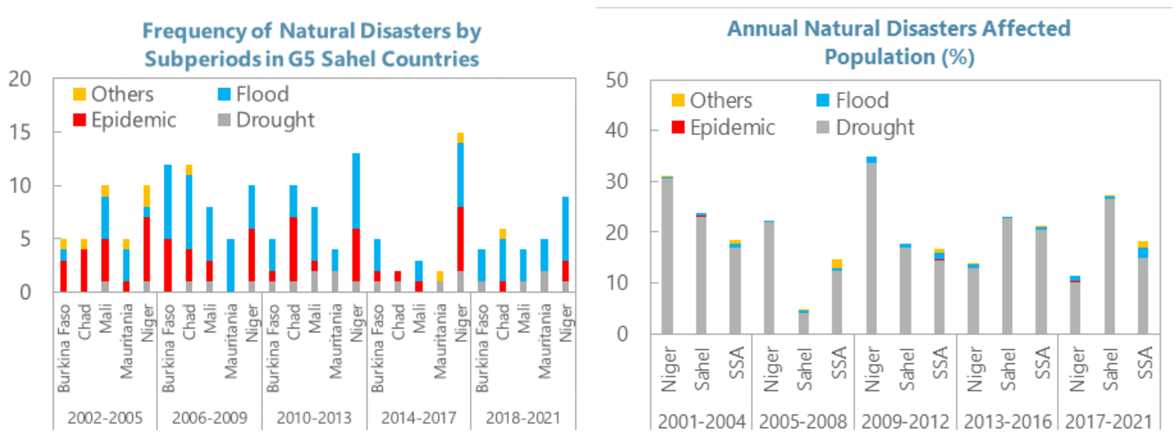
Figure 4. Niger: Annual Variation of Temperature and Precipitation Across Departments Over the Period 1901-2020[1]



Source: CRU database and IMF staff calculation

For each region and both climate variables, the trend is obtained by estimating the following equation: $\boldsymbol{Y_t} = \boldsymbol{\alpha} + \boldsymbol{\beta}.\boldsymbol{t} + \boldsymbol{\varepsilon_t}$, with Y_t climate variables (average annual temperature and annual cumulative precipitation), t year variable (1901, 1902, ..., 2020); ε_t residual term. Parameter $\boldsymbol{\beta}$ is the measurement of trend, which measures the annual variation of temperature (precipitation) over the period 1901-2020.

Figure 5. Niger: Natural Disasters Frequency and Consequences in the Sahel Countries, 2002-21



Source: EMDAT database and IMF staff calculation

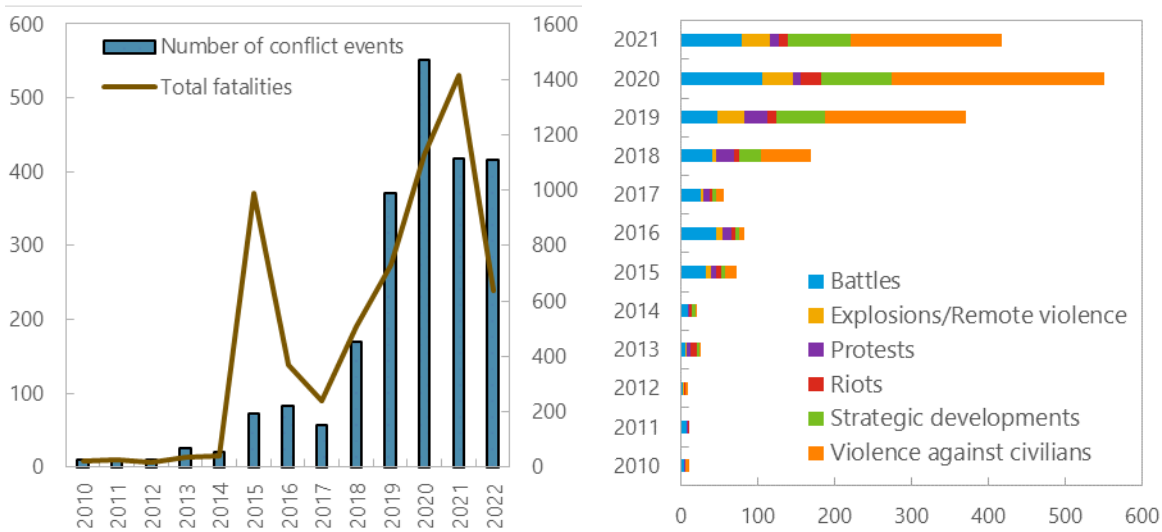
Insecurity Profile

8. **Similarly, to other Sahelian countries, Niger continues to face a large number of conflict events with a significant number of associated fatalities**. The number of conflict events and total fatalities are estimated at 2,209 and 6,140, respectively, in cumulative terms since 2010. Conflict could

take many forms and violence against civilians appears to be the most frequent form (Figure 6, right panel).

9. Conflict events are not evenly distributed across regions in Niger. Incidents of violence are mainly concentrated in the southern and eastern regions, particularly in Diffa, Maradi, and Tillabery. These are the regions in which a large share of productive activities take place, including agricultural production and trade with the neighboring countries. These regions also suffer from the spillover effects of growing instability in neighboring Nigeria, Mali, Burkina Faso, and Chad.

Figure 6. Niger: Number and Fatalities of Conflicts by Type, 2010-22[1]



Source: ACLED database and IMF Staff calculation.

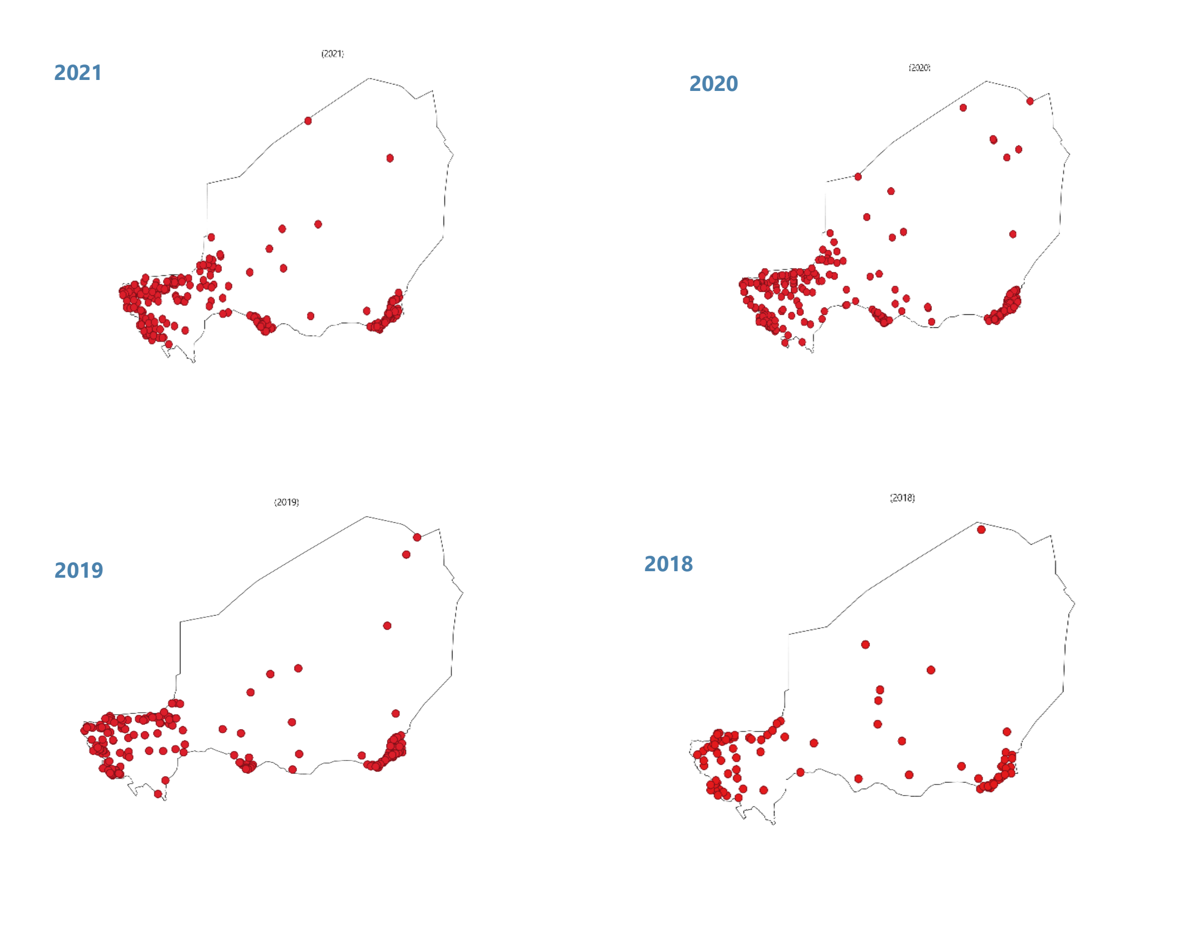
1/ The latest available data for 2022 is up to August 13.

10. Niger is characterized by a multiplicity of conflict risk factors. Conflict in Niger is mainly explained by the following factors (UNDP, 2014):

Access to resources: natural resources availability, including land, water, and pastoral resources, has been decreasing in Niger (figure 8). This situation has been exacerbated by recurrent episodes of drought in the country and has led to competition between communities for access to these resources. In addition, the governance system suffers from a lack of an effective resource management, particularly in rural areas.

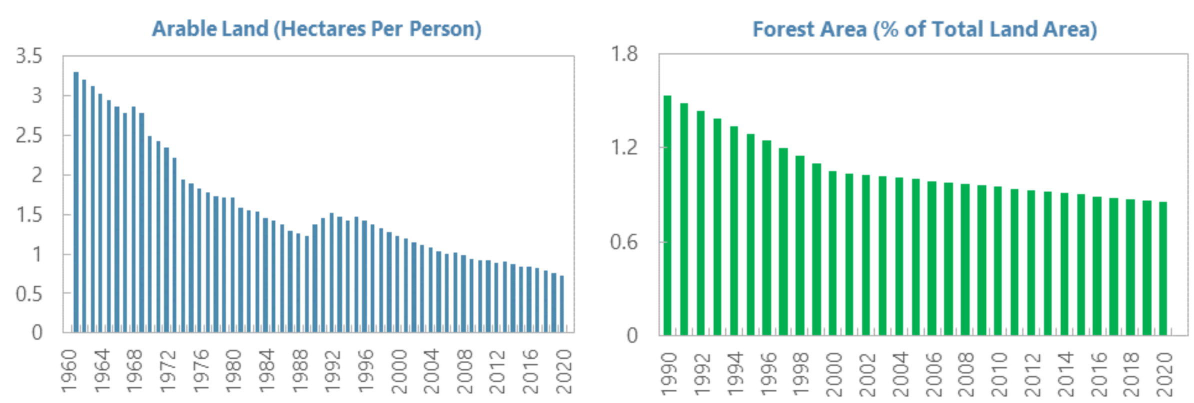
- *Rapid population growth*: low levels of education coupled with a limited capacity of the labor market to absorb the large number of young people, increases vulnerabilities to recruitment into armed rebel groups, particularly for young males.
- *Rise of religious intolerance*. The rise of Jihadist movements in the Sahara and Boko Haram on the border with Nigeria also constitutes a threat to stability in Niger.

Figure 7. Niger: Evolution of Geographic Position of Conflicts



Source: ACLED database and IMF staff calculation

Figure 8. Niger: Availability of Natural Resources Over 1960-2020

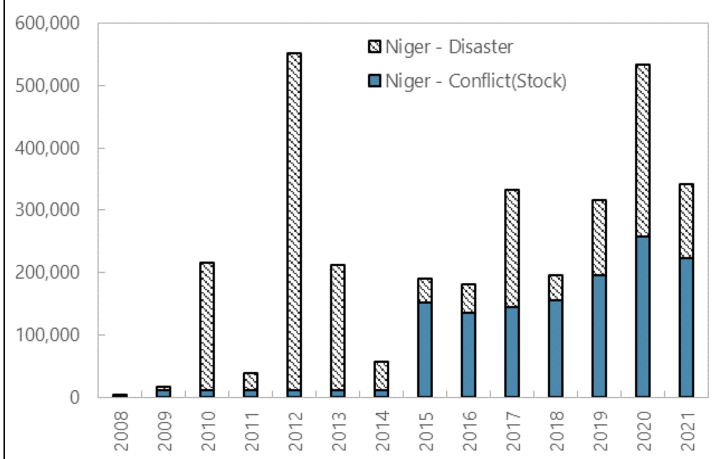


Sources: WDI database and IMF staff calculation

Economic Consequences of Climate and Conflict Shocks

11. The effects of conflict and climate shocks are significant at both the micro and macro levels. At the macro level, episodes of weather shocks are associated with higher food inflation, food shortages, low GDP growth, increasing displacement of people from rural to urban areas, and increasing of current account deficits, added to the constraints it causes on government budget for a response plan setting. For example, cereal production was reduced by 38%, 11% in 2021 and 2005, respectively, following the droughts episodes that occurred during these years. Moreover, conflicts have similar macroeconomic effects on the volatility of GDP growth and lead to crowding out of priority spending. GDP growth is, on average, reduced by 2.5 percentage points in times of conflict in SSA countries (IMF, 2019). At the microeconomic level, these shocks could also increase school dropout rates, lead to the abandonment of farms in affected areas, affect households' welfare, including their income and consumption levels.

Figure 9. Niger : Total Number of Internal Displacements



Source: Internal Displacement Monitoring Centre and IMF staff calculation

C. Estimating the Effects of Shocks on Well-Being

12. Against this background, this paper analyzes the socio-economic effects of climate and conflict shocks in Niger. The paper focuses on the effects of shocks on household income, consumption, poverty, food insecurity and human capital. In addition, the paper assesses household adaptation capacities to these shocks.

Methodology

13. A cross-sectional econometric model is used to quantify the relationship between climate, conflict, and well-being indicators. The incidence of climate and conflict shocks is measured at communal level and merged with household survey data, including household socioeconomic indicators. Climate and conflict variables are respectively from Climate Research Unit (CRU) and Armed Conflict Location and Event Data (ACLED) databases. To understand the relationship between these shocks and household welfare, the following econometric model is estimated:

$$Y_{ij} = \alpha + \beta_1 . Shock_j + \beta_2 . X_{ij} + \beta_3 . Rural_{ij} + \varepsilon_{ij} \qquad (1),$$

where Y represents the vector of selected welfare indicators that includes *income per capita, total consumption per capita, food consumption per capita, non-food consumption per capita, poverty status,* *food insecurity status, and school failure*[2]. i and j represent subscripts for households and communes in the survey sample, respectively. $Shock_{ij}$ is the measurement of shocks (climate or conflict) observed in commune *j*. Regarding climate shock variables, we consider the level of annual precipitation and then its deviation from the average of the past five years[3]. The conflict shock is measured through the total fatalities induced by conflicts. *X* is a vector of control variables to capture households' characteristics such as: *age, gender,* and *the level of education* of *the household head*. We also control for household size and the residential location ($Rural_{ij}$[4]). $\mathcal{E}$ is the residual term. For the dependent variable's *poverty status, food insecurity status, and school failure,* we estimate equation (1) with a probit model. The dependent variable is therefore the probability that the household is poor, food insecure, or that a child is failing in school.

Results

14. The income elasticity to rainfall is estimated at 0.33, which indicates that when rainfall decreases by one standard deviation, per capita income falls by 11 percent. Table 2 presents the baseline results. The coefficient associated with the rainfall level is significant at the one percent level. A one percent increase in the total cumulative annual precipitation level is associated with a 0.33 percent increase in per capita income (column 1). To follow the literature, we test the robustness of our result by also using the level of rainfall in the previous agricultural calendar year as the climate shock variable (column 2). The elasticity of per capita income to the precipitation level in the previous year is estimated at 0.39 percent and significant at one percent.

15. The income elasticity to rainfall is larger for farm income and for the value of agricultural production. We found that a one percent increase in cumulative annual precipitation during the current or previous agricultural season is associated with an increase in agricultural income per capita of 1.9 and 2.4 percent, respectively. When we consider agricultural production rather than income as the dependent variable, we find similar results, but the elasticities appear to be larger (2.3 and 2.8 percent for the current and previous year of the agricultural season respectively, columns 5 and 6). In addition, the value of agriculture production is more sensitive to the level of precipitation during the wet season than during the dry season. Elasticities are estimated at 2.3 and 0.9 in the wet and dry seasons, respectively.

[2] The analysis is based on the latest living standard household survey of Niger: "Enquête Harmonisée des Conditions de Vie des Ménages (EHCVM)". The EHCVM is a nationally representative survey including 6,024 households. Two waves were considered in the survey administration. The first wave was fielded between October 2018 and December 2018, while the second wave occurred between April 2019 and July 2019. Each wave has covered half of the total sample. The two-wave approach was chosen to account for seasonality of consumption. The survey database provides information on the characteristics of households and the community in which they live. The household questionnaire covers ten sections: (i) demographics; (ii) education; (iii) health, (iv) employment, (v) income sources and saving, (vi) consumption expenditures, (vii) food security (viii) agricultural activities, (ix) migration and remittances, and (x) poverty. The community questionnaire gathers information on (i) community characteristics, (ii) infrastructures, (iii) agricultural activities, (iv) community participation, and (v) prices of food items.

[3] Climate shock variable is computed with a Z score indicator as follows: $Zscore_{jt} = Abs\,(\frac{Rain_{jt} - \overline{Rain_{last5years}}}{SD_{Rain_{last5yers}}})$

[4] $Rural_{ij} = 1$, if household i in commune j lives in a rural area.

16. However, the elasticity of income with respect to the rainfall level depends on the income level. Dividing our sample into two groups by the median income level, we found that the income elasticity to precipitation is significant for the bottom half, while it is not significant for the rest (columns 9 and 10). Indeed, the sample comprising households below the median income consists primarily of farmers and is mostly located in rural areas that are more vulnerable to weather conditions.

17. Results for the control variables are consistent with the findings of the literature on the determinants of household welfare. The results indicate that the education level of the household head is positively correlated with household total income per capita, and negatively associated with the likelihood to be in a food insecure and poverty situation. Moreover, the education level of the household head is positively correlated with total household income per capita, and negatively associated with the probability of being food insecure and poor. Furthermore, we find that households living in rural areas and female-headed households have lower welfare than those living in urban areas and male-headed households, respectively.

Table 2. Niger: Regression Baseline Results

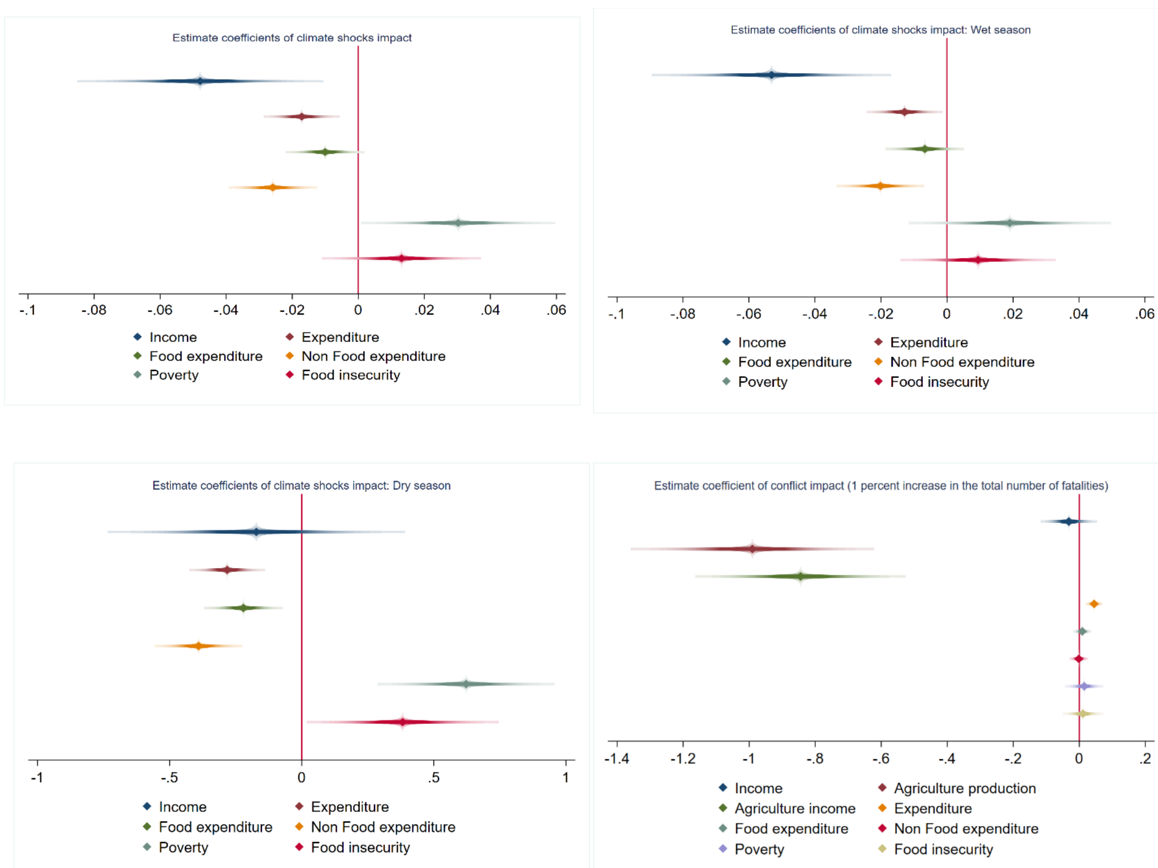
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Total Income per capita	Total Income per capita	Agriculture Income per capita	Agriculture Income per capita	Production value agriculture	Production value agriculture	Production value agriculture	Production value agriculture	Total Income per capita	Total Income per capita
Precipitation 2017	0.330***		1.963***		2.276***				-0.023	
	(0.077)		(0.203)		(0.237)				(0.035)	
Precipitation 2018		0.388***		2.371***		2.751***				-0.067*
		(0.098)		(0.274)		(0.322)				(0.039)
Precipitation 2017 (wet)							2.330***			
							(0.250)			
Precipitation 2017 (dry)								0.924***		
								(0.123)		
Mediane (=1)#Precipitation 2017									0.898***	
									(0.145)	
Mediane (=1)#Precipitation 2018										1.191***
										(0.170)
Mediane (=1)									-8.042***	-9.974***
									(0.872)	(1.049)
Education HH	0.135***	0.139***	-0.295***	-0.277***	-0.326***	-0.305***	-0.317***	-0.329***	0.067***	0.068***
	(0.027)	(0.027)	(0.039)	(0.038)	(0.046)	(0.045)	(0.045)	(0.048)	(0.022)	(0.022)
Age HH	0.002	0.002	-0.008**	-0.007*	-0.005	-0.004	-0.004	-0.009*	0.001	0.001
	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.002)	(0.002)
Gender HH	-0.308***	-0.306***	-1.965***	-1.949***	-2.129***	-2.111***	-2.120***	-2.197***	-0.097	-0.093
	(0.099)	(0.099)	(0.192)	(0.192)	(0.215)	(0.215)	(0.215)	(0.213)	(0.088)	(0.088)
Size	-0.068***	-0.068***	0.182***	0.178***	0.306***	0.302***	0.305***	0.327***	0.016*	0.015*
	(0.010)	(0.010)	(0.019)	(0.019)	(0.022)	(0.022)	(0.022)	(0.022)	(0.009)	(0.009)
Rural	-0.693***	-0.705***	5.454***	5.375***	6.377***	6.284***	6.314***	6.960***	0.071	0.060
	(0.102)	(0.103)	(0.274)	(0.273)	(0.323)	(0.323)	(0.322)	(0.316)	(0.078)	(0.077)
2.vague	0.291***	0.292***	0.588***	0.596***	0.555**	0.565**	0.553**	0.565**	0.170***	0.172***
	(0.077)	(0.078)	(0.210)	(0.212)	(0.237)	(0.240)	(0.237)	(0.253)	(0.054)	(0.054)
Constant	9.974***	9.566***	-8.276***	-11.057***	-10.353***	-13.590***	-10.507***	0.221	12.348***	12.611***
	(0.511)	(0.637)	(1.263)	(1.713)	(1.468)	(2.006)	(1.523)	(0.650)	(0.250)	(0.277)
Observations	5,895	5,895	5,895	5,895	5,895	5,895	5,895	5,895	5,895	5,895
R-squared	0.060	0.059	0.396	0.392	0.428	0.424	0.428	0.397	0.354	0.357

Robust standard errors in parentheses. The errors have been clusterized by grappe, icluding regions. All dependant variables and climate are in logarithm. Thus the coefficients correspond to an elasticity. *** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff calculation

18. In addition, climate shocks have a negative effect on household living standards, including consumption levels, poverty, and nutritional status (figure 10). Climate shocks measured as a deviation from the average rainfall of the previous five years, reduce per capita income, and total household consumption levels. The coefficients associated to these two variables are significant at the one percent level and estimated at -0.05 and -0.02. This suggests that for every unit increase in the climate shock indicator, households' income and consumption decrease by 5 and 2 percent respectively. Looking at the composition of consumption, we found that food consumption is reduced by 1 percent, while non-food consumption is reduced by 3 percent. In other words, a one standard deviation decrease in annual precipitation will reduce total consumption, food consumption and non-food consumption, by about 5, 2.2, and 6.6 percent respectively. It seems that when facing a shock, households prefer to smooth their consumption level by reducing consumption of non-vital goods. Moreover, the results show that climate shocks increase the probability of being poor and food insecure.

Figure 10. Niger: Estimates of the Effects of Climate and Conflict Shocks on Household Welfare Indicators



Source: EHCVM 2018/19, and IMF staff calculation

19. When the number of conflict related deaths increases by 10 percent[5], farm income and the value of production decrease by 10 and 8 percent respectively. Indeed, we found that a one percent increase in conflict-related deaths is associated with a decrease in farm income and the value of production by 1 and 0.8 percent, respectively. These coefficients are both statistically significant at the one percent level. Nevertheless, the coefficients for the other dependent variables—namely *total consumption, poverty status, and food insecurity status*— are not statistically significant, although they have the expected sign.

20. Weather shocks can also lead to a reduction in human capital. Table 2 shows the effects of climate and conflict variables on the probability that a child in the household will not succeed in school. A one standard deviation decrease in annual rainfall reduces the probability of school failure by around 2 percentage points. The marginal effect is larger when the climate shock is observed during the agricultural growing season rather than the other months of the calendar year. Conflict does not seem to have a significant effect on school failure even the associated coefficient sign is positive.

Table 3. Niger: Impact of Climate and Conflict Shocks on School Failure Likelihood

	School failure likelihood (percentage points)					
	dy/dx	std. err.	z	P>z	[95% conf.interval]	
1 sd derease of annual precipitation	1.7***	0.004	2.090	0.036	0.000	0.015
1 sd increase of precipitation (Wet season)	2.7***	0.010	3.210	0.001	0.012	0.052
1 sd increase of precipitation (Dry season)	-0.1	0.005	-1.060	0.289	-0.015	0.005
1 percent increase in total conflict fatalities	0.004	0.004	0.820	0.411	-0.005	0.012

Source: EHCVM database and IMF staff calculation

21. Moreover, the impact of shocks on households depends on their adaptation capacity. We estimated the effect of shocks as a function of the level of agricultural capital and household income diversification:

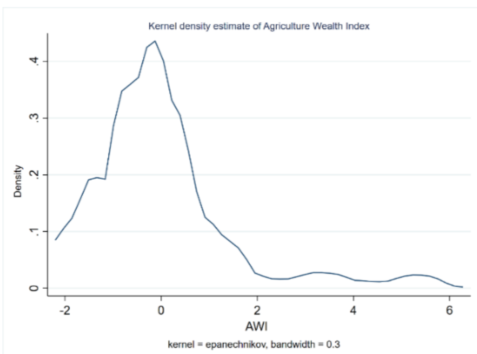
- **The level of agriculture capital is essential to mitigate the adverse effects of shocks (figure 11).** We constructed an Agricultural Assets Welfare Index (AAWI) using a Principal Component Analysis (PCA). This exercise allows us to identify households that are deprived of the materials (e.g., p*lows, axes, ploughing animals, irrigation schemes, etc.*) needed for production. The AAWI distribution shows that the level of capital of a large proportion of farmers in Niger is very low. The econometric estimation results show that the AAWI increases the level of agricultural

[5] A 10 percent increase in the total number of fatalities corresponds on average to about one additional death in our sample.

productivity and mitigates the impact of climatic shocks and conflict incidents on agriculture production.

- **Households' income diversification could reduce their vulnerability to shocks (table 4).** To measure the concentration of household income, we calculated a Herfindahl-Hirschman Index (HH-income) on the various possible sources of household income, including wages, transfers, agriculture, entrepreneurship, etc. The average of the index is estimated at 0.70, which means a higher concentration of income on a single activity (about 30 percent of households have only one source of income). We interact this variable with the shock variables (climate and conflict), and the estimation results show that households with more than one source of income are better able to cope with the shock compared to those with only one source of income. However, the results are more significant for climate shocks than for the conflict variable.

Figure 11. Niger: Distribution of AAWI Shows Poor Agriculture Capital Significancy



VARIABLES	(1) log(agriculture Income per capita)	(2) log(agriculture production value per capita)	(3) log(agriculture Income per capita)	(4) log(agriculture production value per capita)
log(rainfall)	3.082***	3.645***		
	(0.362)	(0.429)		
log(fatalities)			-1.198***	-1.436***
			(0.125)	(0.145)
Mediane (AAWI)=2	8.939***	13.432***	2.288***	2.586***
	(2.851)	(3.894)	(0.180)	(0.196)
Mediane (AAWI)=2#log(1+rainfall)	-1.037**	-1.696***		
	(0.455)	(0.619)		
Mediane (AAWI)=2#log(1+fatalities)			1.062***	1.336***
			(0.144)	(0.160)
Control variables	yes	yes	yes	yes
Observations	4,590	4,590	4,590	4,590
R-squared	0.338	0.376	0.315	0.356

Robust standard errors in parentheses. The errors have been clusterized by grappe, icluding regions. Control variables include education, age,and gender of household head, and household size and residence place (urban/Rural). *** p<0.01, ** p<0.05, * p<0.1

Source: EHCVMA, and IMF staff calculation

Table 4. Niger: Income Diversification Mitigates the Adverse Effects of Shocks

VARIABLES	(1) Total income pc	(2) Total consumption pc	(3) Total food consumption pc	(4) Total non- food consumption pc	(5) Total income pc	(6) Total consumption pc	(7) Total food consumption pc	(8) Total non- food consumption pc
Climate shock	-0.120	-0.207***	-0.137**	-0.333***				
	(0.257)	(0.054)	(0.060)	(0.058)				
HH-income	0.343**	0.079***	0.053*	0.095***	-0.120	0.043**	0.021	0.059***
	(0.136)	(0.030)	(0.032)	(0.036)	(0.079)	(0.018)	(0.021)	(0.021)
Climate shock#HH-income	-0.886***	-0.163**	-0.130*	-0.191**				
	(0.300)	(0.067)	(0.077)	(0.083)				
Conflict					-0.101**	0.049***	0.048***	0.049***
					(0.049)	(0.011)	(0.011)	(0.013)
Conflict#HH-income					0.186***	-0.015	-0.007	-0.023*
					(0.053)	(0.011)	(0.013)	(0.013)
Constant	11.382***	13.743***	13.192***	12.855***	11.938***	13.440***	12.902***	12.521***
	(0.316)	(0.067)	(0.066)	(0.081)	(0.242)	(0.050)	(0.050)	(0.062)
Observations	5,823	5,823	5,823	5,823	5,895	5,895	5,895	5,895
R-squared	0.061	0.528	0.383	0.558	0.055	0.517	0.375	0.545

Robust standard errors in parentheses. The errors have been clusterized by grappe, icluding regions. *Climate shock* is measured as the deviation of rainfall to its past five years average level; *Conflict* is the logarithm of total fatalities and *HH-income* is the income concentration index. Control variables include education, age,and gender of household head, and household size and residence place (urban/Rural). *** p<0.01, ** p<0.05, * p<0.1.

Source: EHCVM and IMF staff calculation

D. Policies to Build Resilience and Sustain Livelihoods

22. There is a need to invest in the expansion of irrigation to withstand the challenges of climate change. The lack of large-scale irrigation infrastructure prevents farmers to adequately cope with increasingly frequent drought episodes. Less than one percent of agricultural land in Niger is irrigated. While the country only benefits from a short rainy season of three months, tapping into its huge underground water potential would strengthen the resilience of the agricultural sector. In addition, the Government could increase water sources for agriculture by investing in the creation of runoff water reservoirs and their use for irrigated crops.

23. Improving access to renewable energy equipment could contribute to close the country's energy gap and modernize the agricultural sector. Limited access to electricity is a major obstacle to the use of irrigation pumps in rural areas—more than 80 percent of the population has no access to electricity, and only one percent of the rural population has regular access to electricity. While the cost of extending the electrical grid to remote areas might be high, Niger's renewable energy potential (solar, hydropower, and wind) could be tapped to close this gap in partnership with the private sector. Although the government has adopted a national electricity access strategy, its implementation remains critical.

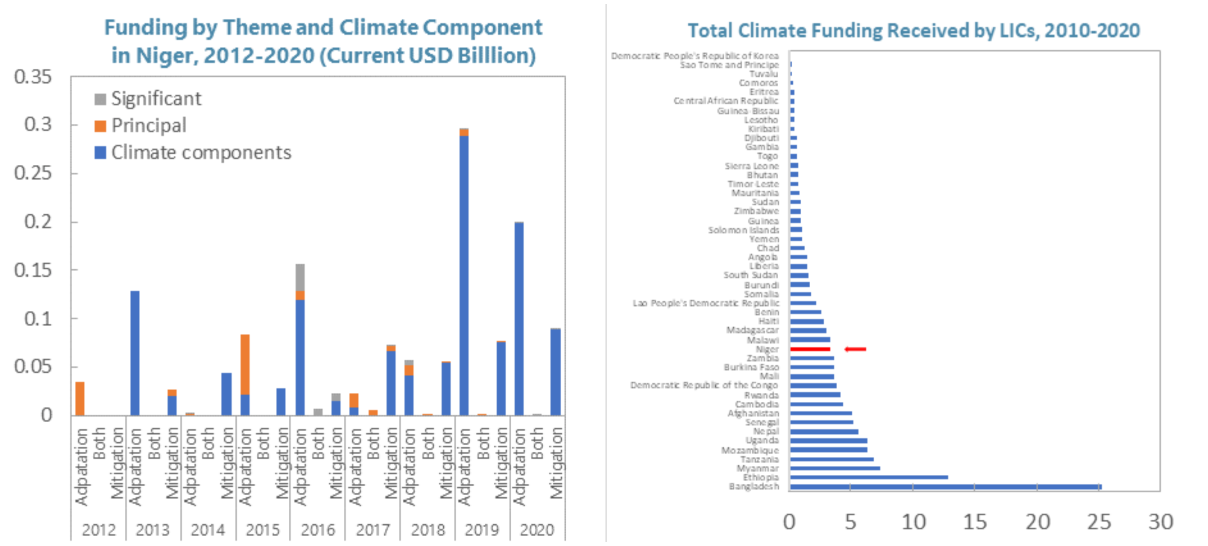
24. Facilitating access and use of appropriate weather information could increase preparedness. The development of a weather forecasting system that could provide weekly, monthly, and seasonal forecasts to farmers can be extremely useful before, during and after a climate shock. Such information system could help households better prepare their adaptation responses and better mitigate the damage caused by the shock. With low literacy rates among rural populations, the government could support the transition from traditional indigenous weather forecasting systems to the use of modern climate information in rural areas by scaling up agriculture extension services. This could also directly support community-based disaster risk reduction programs (Iticha & Husen, 2019).

25. The development of a robust social protection framework can support and sustain the mitigation efforts against climate shocks and conflict. Programs targeting climate-related vulnerabilities for example, by subsidizing the premium for climate insurance services-could be integrated into the existing social protection system. Moreover, an effective social safety net should improve access to basic infrastructure, including education and health, thereby reducing the vulnerability of people, especially youth, and preventing them from joining an armed group. Increasing the effectiveness of social protection in Niger will also require taking steps to promote digitalization and the creation of a single social registry [*see SIP on Social protection efficiency*].

26. Fostering private sector development is crucial to diversifying household income sources. Our results have shown that the main transmission channel of climate shocks on household income is high exposure to the agricultural sector. The development of the private sector could therefore contribute to diversifying income sources of households, and thus strengthen their capacity to smooth the effects of shocks on their consumption and reduce the risk of being food insecure. Furthermore, deepening financial inclusion is crucial for households to initiate new activities in addition to agricultural production. In this context, the full operationalization of the existing financial inclusion funds (FDIF and FONAP), digitization of enterprise creation procedures, and the simplification of the tax code initiated by the authorities should create a favorable environment for private sector development.

27. Access to international climate funds is crucial given limited fiscal space. The implementation of Niger's climate adaptation and mitigation strategy is estimated, for the period 2021-2030, to cost USD 9.9 billion. Access to climate finance instruments could be part of the solution to address these costs. Such financing is diversified and includes concessional funds, green and sustainable/social bonds, debt-for-climate swaps, and climate insurance schemes, provided by multilateral and bilateral donors. Over the 2010-2022 period, Niger has received a total of USD 3.3 billion in climate funds (figure 12). Niger's access to these funds requires strengthening the country's governance and risk management framework in order to meet the access criteria. For example, the authorities could develop a climate investment plan that could be an advocacy tool for donors.

Figure 12. Niger: Access to International Concessional Climate Funds



Source: OECD Climate Change - OECD DAC External Development Finance Statistics.

Notes: "Both" corresponds to multiple focus projects are those that have components of adaptation and mitigation.

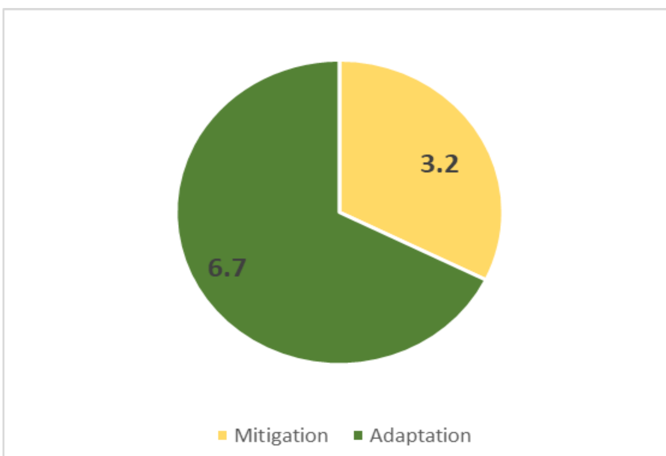
28. Strengthening the social contract between the government and the population is an important factor to enhance internal stability. Investing in and providing access to essential infrastructure (roads, electricity, health etc.) in both urban and rural areas is essential to maintaining the social fabric. The adequate selection and prioritization of public investments in these areas are important for improving the living conditions of the population. Furthermore, the government must continue to fight corruption and strengthen governance. This would protect property rights and facilitate the management of natural resources, which is a major cause of conflict between communities. For example, the creation of transboundary institutions for land and water management could be extended for reducing conflict risks in resource-scare regions (Busby, 2018).

The role of such institutions would be to manage the allocation of natural resources —including during shock times—and facilitate dispute resolution between communities.

Box 1. Niger: Government Adaptation Strategies Against Climate Change

Although the contribution of Niger to greenhouse gas (GHG) emissions is low, the country is experiencing the consequences of climate change. The Government is engaged in implementing actions to address this**.** In 2016, Niger submitted its National Determined Contribution (NDC) after ratifying the Paris Agreement. The objectives of the NDC are to implement, at the same time, measures of adaptation to climate change and GHG mitigation. The main pillars of Niger's NDC aim to encourage the adoption of climate-smart agriculture techniques (*weather information, early warning system, index-based agriculture insurance, management of risks and disaster, etc.*) and expand the use of and access to modern and clean energy services for all by 2030. In 2021, the authorities have revised their NDC to define its governance, including the creation of institutions to oversee the implementation of the strategy. While the government is making efforts to mobilize domestic resources, there are still financing gaps to achieve the NDC goals. The total cost of the NDC over the next decade (2021-2030) is estimated at US$9.9 billion, with the government contributing 26.4 percent and donors expected to fund the rest.

Figure 13. Niger: National Determined Contribution Cost, 2021-30 (USD Billion)



Source: Niger NDC, 2021

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Annex 1. Descriptive Statistics of Variables

Table 1. Niger: Descriptive Statistics of Variables

Variable	Observations	Mean	Std. dev.	Min	Max
Dependent variables					
Total income per capita	5,895	236293.10	644891.90	0.00	19700000.00
Total agriculture income per capita	5,895	24405.29	68310.66	0.00	2157387.00
Total agriculture production per capita	5,895	28157.82	79820.46	0.00	2316477.00
Total expenditure per capita	5,895	489712.40	553085.10	49807.36	12400000.00
Total food expenditure per capita	5,895	265623.50	213293.60	11761.77	2924820.00
Total non-food expenditure per capita	5,895	224088.90	387547.20	16633.63	10400000.00
poor	5,895	0.32	0.47	0.00	1.00
Food insecurity	5,871	0.24	0.43	0.00	1.00
School failure	6,051	0.11	0.31	0.00	1.00
Shock variables					
Total rainfall 2018	5,895	501.82	167.19	53.29	816.31
Total rainfall 2018 (wet)	5,895	476.37	154.44	47.23	741.69
Total rainfall 2018 (dry)	5,895	25.46	19.69	0.21	97.51
Z-score precipitation shock 2018	5,895	2.21	2.50	0.02	10.25
Z-score precipitation shock 2018 (wet)	5,895	2.28	2.57	0.03	11.03
Z-score precipitation shock 2018 (dry)	5,823	0.34	0.21	0.03	1.04
Conflict fatalities 2018	5,895	7.67	32.89	0.00	250.00
Interaction variables					
AAWI	4,640	0.00	1.45	-1.90	5.98
Income concentration index	5,895	0.71	0.26	0.00	1.00
Household characteristics					
Age (Household head)	5,895	44.53	14.69	15.00	100.00
Gender (Household head)	5,895	1.16	0.37	1.00	2.00
Education (Household head)	5,895	1.79	1.73	1.00	9.00
Household size	5,895	5.86	3.09	1.00	34.00
milieu (Rural=1)	5,895	0.75	0.43	0.00	1.00