

# Climate change, development, and conflict-fragility nexus in the Sahel

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# Abstract

More than 40 years after a catastrophic famine struck the region, the Sahel has once again become the focus of global attention. Poor economic performance, growing instability, and deteriorating climate conditions have combined to produce a vicious circle of increased poverty, instability, and communal violence. By drying out sources of livelihoods for populations mainly dependent on natural resources, climate change reinforces long-existing rivalries and increasingly triggers violence. In this paper, we argue that while climate change is a proximate cause of violence, institutional failures and clientelism<sup>1</sup> are the actual root causes.

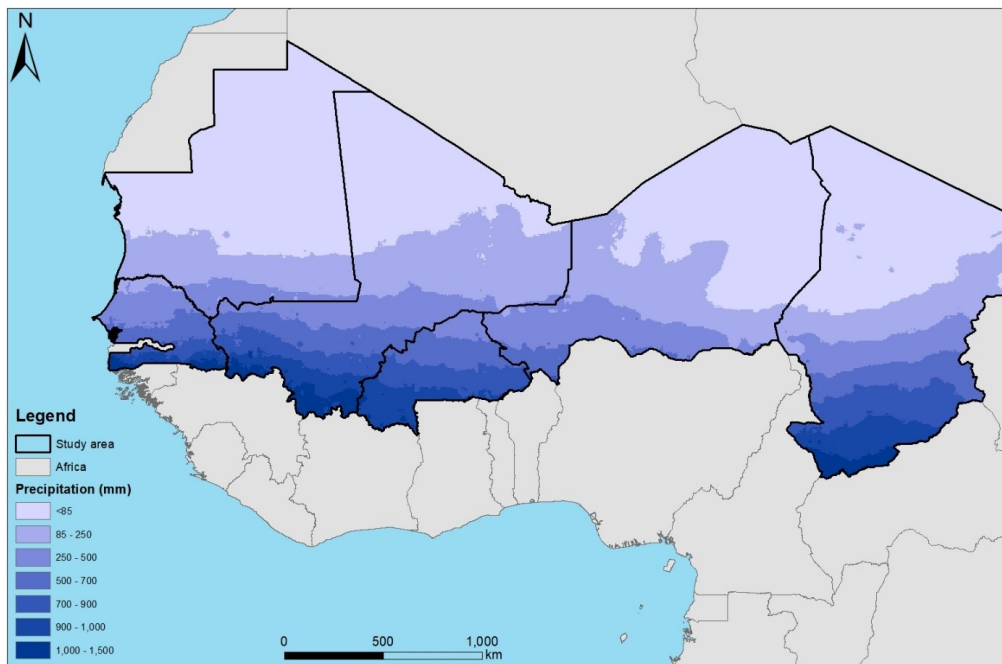
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<sup>1</sup> The Oxford Handbook of Political Science defines “political clientelism” as “giving material goods in return for electoral support, where the criterion of distribution that the patron uses is simply: did you/will you support me?”

# Introduction

Africa is a geographically diverse region represented by several types of climate zones spanning north to south. These different climatic domains are defined through rainfall and vegetation. West Africa is no exception: From the south to the north, climate ranges from tropical (very rainy) to Saharan (desert). West African climate systems varies from humid equatorial conditions in the south to arid conditions in the northern Sahelian countries. Rainfall varies from less than 200 mm/year in the arid zone to over 1,000 mm/year in the tropical zone. Interannual variations, such as droughts, floods, and other natural events also play an important role.

**Figure 1. Changes in average precipitation in the countries of the Sahel (average 1981-2019)**

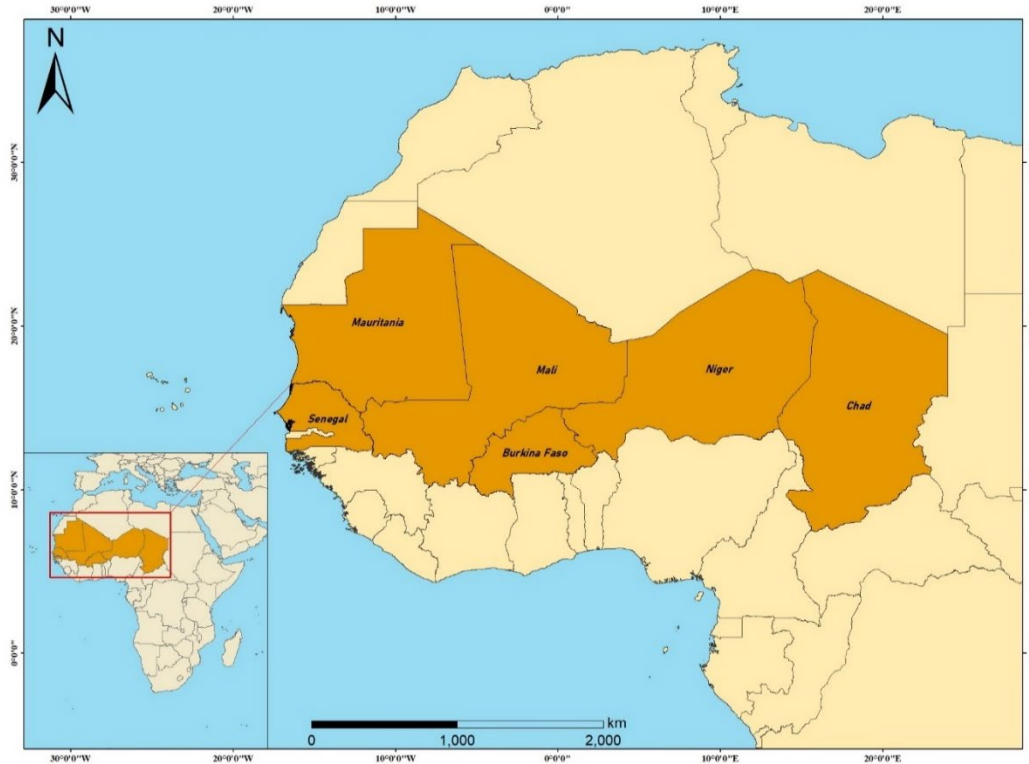


Source of data: CHIRPS, authors' calculation, and design.

Climatically, the Sahel is defined as the area between isohyets 200 and 600 mm (sometimes 150 and 500 mm) (CEDEAO-CSAO/OCDE, 2006). It stretches from the Atlantic Ocean on the west coast to the Red Sea on the east coast, passing through the heart of Africa (Mirzabaev et al., 2021). When the whole strip is taken into account, the Sahel is an area with a population of around 100 million of the most underprivileged, marginalized, and poorest people in the world (Meyer, 2017). It is difficult to speak holistically of a Sahelian region because the countries concerned in this report only cover part of the Sahel belt. Figure 1 underscores disparities in rainfall within and between countries in the Sahelian region. In most countries, the southern part is much greener than the north, but in all six countries

characterized as Sahelian, the Sahel belt tends to be much larger than the remaining (greener) parts of the territory. This study focuses only on the West African countries: Mauritania, Senegal, Mali, Burkina Faso, Niger, and Chad (Figure 2). By contrast, countries where the Sahel belt represents a smaller portion of the territory, such as Nigeria and Cameroon, are not covered.

**Figure 2. Location of the study area.**



Source: Authors' mapping.

Sahelian states share similarities with other African countries, but also have distinct geographic, economic, social, and political characteristics that are worth noting: They are more vulnerable to climate change due to its dependence on natural resources, have weaker socioeconomic indicators, and more political instability than other African countries. More than 40 years after a catastrophic famine struck the region, the Sahel has once again become the focus of international attention (Bossard, 2014). In the 1970s, severe drought and the resulting disaster prompted a large-scale humanitarian and development response. These situations are the result of a deteriorating climate and therefore a reduction in natural resources, particularly water.

The Sahel region is particularly vulnerable to climate change, as the region's climate is becoming warmer and more unpredictable, while it experiences faster long-term population growth (Link et al., 2015). With climate change, natural disasters are expected to become both more frequent and more intense (Defrance et al., 2017), while desertification, drought, flood, and sea-level rise threaten the availability of crucial natural resources (Krystel et al., 2007; Bastien and Gemenne, 2016; Gemenne et al., 2017). This is particularly troubling in a region where people's livelihoods and resilience are so heavily dependent on natural

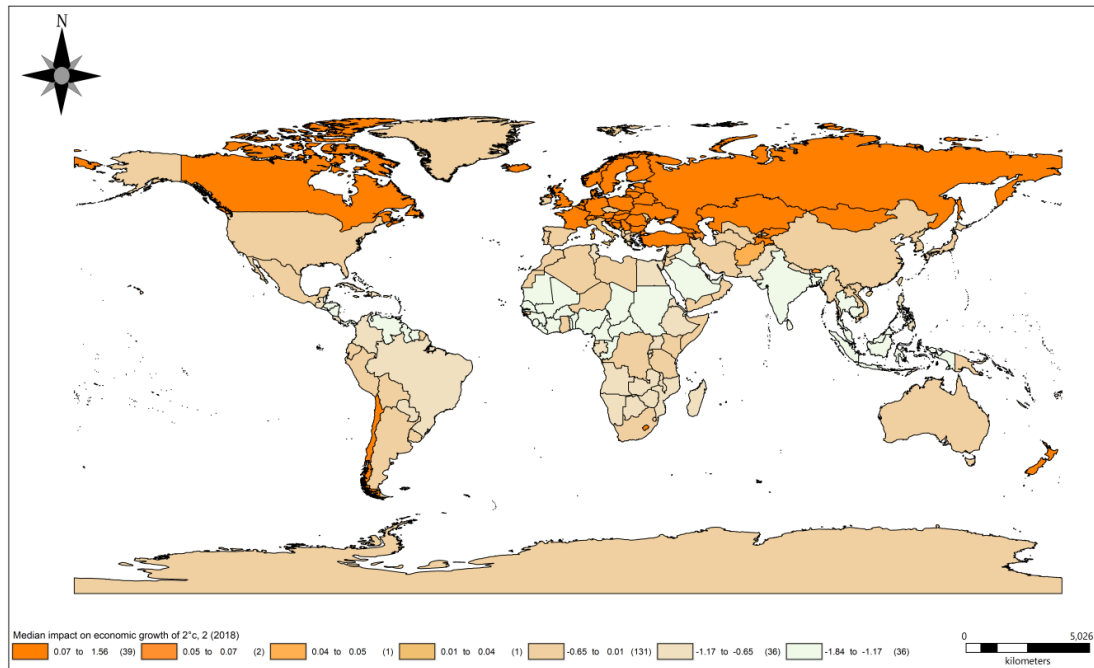
resources: Increased degradation of the environment means increased vulnerability (Diop, 2007, Lam et al., 2012), likely resulting in secular changes.

Total exports from the Sahel are limited to just a few commodities, per capita income levels are lower than in other parts of Africa, and up to 80 percent of the population subsists on less than \$2 per day. Fertility rates and population growth are skyrocketing—with youth representing more than 65 percent of the labor force—and the population is largely unemployed or underemployed. It is not only access to employment that is threatened by these demographic trends; living standards are declining and infrastructure cannot keep up. Weak governance, political unrest, and threats from radical Islamist groups all contribute to regional instability, culminating in widespread conflicts and massive losses of livelihoods that have resulted in significant population displacement.

The situation in the Sahel—and in Africa in general—perfectly captures the paradox of global climate change inequality: The regions that have contributed the least to global greenhouse gas emissions become the most impacted by climate change, as shown in Figure 3. Conversely, the countries that have contributed the most to greenhouse gas emissions (i.e., those in the northern hemisphere) are least affected by climate change because they are less dependent on natural resources and have many climate adaptive options. Moreover, within the most affected countries, the poorest and more vulnerable people are hit harder, as they often live in marginal lands and have less safety cushions.

In comparison to other regions of the world, African countries—and those in the Sahel in particular—are heavily dependent on agriculture, which includes livestock, fishing, and farming. All these industries are largely reliant on the availability and predictability of natural resources like water, which are increasingly threatened by climate change. Thus, the people of the Sahel are particularly vulnerable to the adverse effects of climate change.

**Figure 3. Projected impact on annual GDP per capita growth under global 2° Celsius temperature increase<sup>2</sup>**



Source: Philosophical Transactions of the Royal Society, 2018. Mapping by author.

In this paper, we argue that conflicts in the Sahel are usually caused by multiple factors, including governance, clientelism, and ethnic and religious tensions, with climate change amplifying these factors and contributing to an increase in violence. In other words, we argue that climate change, through its impact on livelihoods and global development, is an aggravating factor rather than a root cause for the conflicts in the Sahel. While section I reviews the literature on climate change and conflict, section II looks at recent climate trends in Africa as they relate to food security, and section III discusses the relationship between food insecurity and conflict in the Sahel. Section IV highlights the institutional failures in the Sahel and how they have induced conflict in the region, specifically pointing to the role of climate change in intensifying unrest. Finally, section V highlights the case study of Mali, which exemplifies how climate change is compounding existing social contradictions and triggers violence in weak institutional settings.

<sup>2</sup> As compared to a situation of no additional warming.

# I. The climate change/conflict nexus: Highly heterogeneous literature findings

There is strong evidence that climate change is simultaneously drying up sources of livelihoods and fueling conflict. One body of literature makes a direct connection between recent climate trends and violent conflicts in the Sahel (Miguel et al., 2004), characterizing migration and hostility as strategies deployed in response to increasingly scarce resources. However, another large body of literature contends that failing institutions and demography are more to blame in driving conflict than climate-related scarcity.

The idea that climate change is positively associated with civil conflict has received a great deal of empirical support in the literature. In their seminal paper, Miguel, Satyanath, and Ernest Sergenti (2004) document a strong negative effect of climate change on conflict, finding that a 1-degree Celsius temperature increase yields an increase in civil war incidences by 4.5 percent in the same year. Combining climate model projections with past conflicts in Africa, Burke et al. project a 54 percent increase in armed conflict incidences by 2030, or an additional 393,000 conflict-related deaths on the continent. According to these authors, temperature increases have reduced African staple crop yields by 10-30 percent for every 1 degree of warming. Miguel (2005) takes this a step further and shows that income shocks, such as drought or flood, lead to large increases in the number of people accused of witchcraft and relatedly murdered in Tanzania.

While Miguel and coauthors offer by far the most direct evidence of climate change driving conflict, the general idea that difficult living conditions cause violence is central to many policy analyses. The World Bank (2003) considers difficult economic conditions as the main driver of civil conflict, which explains why civil war is so concentrated in the poorest countries in the world. Along the same lines, Fearon and Laitin (2003) and Collier and Hoeffler (2004) confirm that economic opportunity structure, rather than religious or ethnic intolerance, is the most important determinant of conflict. According to these authors, the higher the level of income per capita, the lower the risk of civil war. Therefore, after controlling for per capita income, ethnically or religiously diverse countries are no longer at higher risk of conflict (Collier and Hoeffler 2004). Likewise, Sambanis (2004) underscores income and population size as the two main determinants of conflict, while Sambanis (2002) contends that poverty is the single main determinant of conflict. Similarly, both Elbadawi and Sambanis (2002) and Fearon (2005) find that countries exporting primary commodities (a proxy for low-income countries) are at higher risk of conflict. When the number of youths in the total population is high, the impact of poor economic conditions on conflict is even greater. Blattman, Fiala, and Martinez (2013) find that a higher share of unemployed or underemployed youths increases crime and social instability. Likewise, some studies show



that a sheer size of poor, unemployed young men weakens social bonds, reduces civic engagement, and heightens the risk of unrest among the population (World Bank 2007, 2010, 2012; Blattman and Miguel 2010).

While a large body of literature emphasizes economic reasons for violence, another set of literature disputes this and emphasizes alternative sources of conflict. In Theisen, Gleditsch, and Buhaug's (2013) review of the major economic literature on climate change and conflict, they underscore the lack of agreement among authors and the presence of many conflicting empirical results. Indeed, institutions are seen as the central drivers in conflict rather than scarcity. Meanwhile, Raleigh, Choi, and Kniveton (2015) find that weak institutions or state capacity, proxied by the protection of property rights, rule of law, and efficiency of the legal system, are fundamental causes of civil war. They found that once institutions are included as explanatory variables of civil war, income has no direct or indirect statistical effect, in most models.

Alexander and Harding (2005) confirm that country institutional trajectories affect the incentive for insurgency, rebellion, and other forms of political violence. They find that once we control for institutions and unobserved country differences, income becomes statistically insignificant in predicting the likelihood of civil war breaking out. They further conclude that institutional factors such as a state's level of modernization, capacity to provide collective security, and ability to enforce the law and crack down on insurgent groups matter more than the opportunity costs of combatant mobilization. These institutional factors also point to the roles played by political instability, rough terrain (e.g., places where rebels can hide easily, such as mountains), and large population size, in encouraging migration and insurgency.

Another set of literature (Slettebak 2012) goes a step further and contends that people tend to unite in the face of adversity, rather than fight among themselves. Furthermore, Ostrom (2007) and Young (2011) show that institutions can shape human interactions and prevent conflicts during periods of scarcity. Taking a different tack, Witsenburg and Adano (2009) underscore the "the paradox of plenty" in the case of Kenya: Rather than dryness, it is the abundance of water that generates conflict around natural resources. Djankov and Reynal-Querol (2010) put forward the same idea in the following terms: "The wetter the season, the more people are likely to die in violent livestock raiding. In other words, more conflicts and killings take place in wet season times of relative abundance, and less in dry season times of relative scarcity when people reconcile their differences and cooperate." They add: "Remoteness and inaccessibility of the terrain weaken government initiatives to provide adequate security, but local arrangements moderate conflicts when scarcity peaks." The work of Raleigh and Kniveton (2012) identifies wet conditions as negatively affecting conflict; similarly, Hendrix and Salehyan (2012) show that wetter periods in Africa have a higher correlation to violent conflict than dryer periods. Thus, according to this subset of the literature, climate change, which is associated with extreme deviations in rainfall (creating both dryer and wetter conditions), is highly associated with the likelihood of conflict.

## II. Climate change, migration, and conflict in the Sahel

Certain studies have shown how global climate change causes drought and desertification, which leads to resource scarcity and migration, as well as the emergence of new and old conflicts (Benjaminsen and Svarstad, 2021). While migration and conflict are both in reaction to deteriorating climate conditions, they also tend to reinforce each other. One of the most recognized determinants of migration is conflict, which also results in institutional fragility. By drying out sources of livelihoods in Africa, climate change will likely directly affect migration by pushing people to leave, and indirectly drive conflict over increasingly scarce resources (Mbaye, 2020). A 2015 survey undertaken by Mamane in Niger shows that Nigerian rural households (Table 1) first responded to deteriorating climate conditions by selling reproductive animals and durables, then by pulling children from school, and finally by migrating from their homes. In other literature, conflict is also found to be a widespread coping strategy in response to climate change.

**Table 1. How do Sahelian households adapt to climate change? Case study of Niger**

<i>Response to shocks</i>	<b>Number</b>
<i>Migration</i>	604
<i>Sale of reproductive animals</i>	692
<i>Sale of durables</i>	183
<i>Sale of productive goods (e.g., cattle, cart, and plough)</i>	178
<i>Sale of land</i>	79
<i>Student dropout from school</i>	22

Source: Mamane, 2015.

Although climate change does matter in explaining migration and conflict, alternative drivers, such as demography, social networks, and level of economic development, also influence the type and intensity of interactions between migration and conflict. The role of violence in the decision to migrate internally or to flee to another country depends on people's perceptions of how likely they are to be victims of persecution (Moore and Shelmann, 2006). In civil wars opposing the state and rebels, the latter might tend to protect civilians to gain their support—in this case, people will be likely to seek refuge in their own home countries rather than attempt to emigrate. In addition to the geographic distance and rough border terrain, emigration will also be affected by conditions in neighboring countries: Political institutions, the availability of paid work, cultural similarities, and levels of violence in nearby countries will all play a role in determining how many migrants become refugees versus internally displaced people.

Displaced civilians often find themselves implicated in warfare by virtue of their ethnic, religious, professional, or political identities or loyalties to one side or the other. Some conflicts put indigenous “sons of the soil” against recent migrants from other parts of the country. In such cases, which often correspond to rural-rural displacement, migrants are usually members of a dominant ethnic group in search of land or government jobs and enjoy the support of the state.

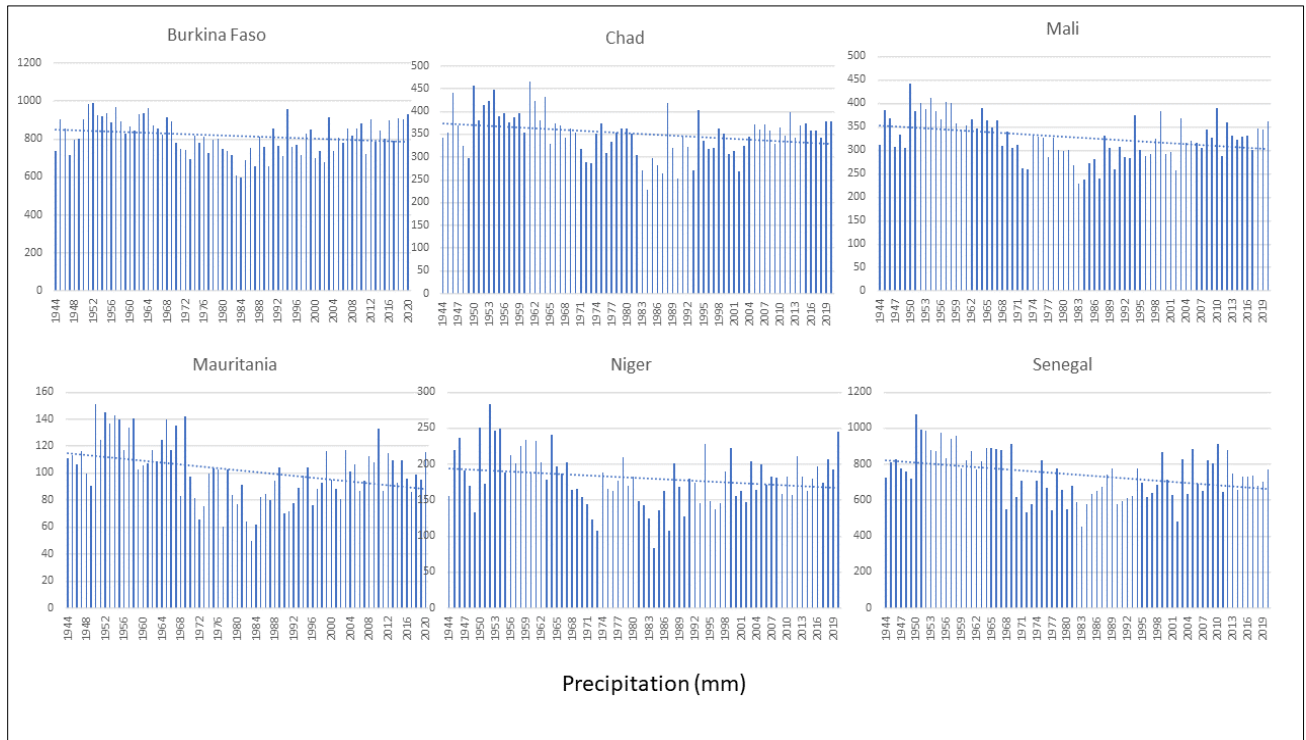
Violence can also be classified according to its site, which directly impacts displacement: “Home violence” is violence in residential areas and increases displacement, whereas “road violence” is violence along migration routes and decreases displacement (Schon, 2016). Perceptions and expectations about home and road violence, as well as actual levels, affect migration decisions. When conflicts break out, it is usually wealthier or better-connected civilians who are the first to flee (Schon, 2018).

Demography is a significant factor in both conflict and migration. Population size and growth are associated with poverty, and in this respect are causative of violence (Goldstone, 2002). Some evidence suggests that while countries with larger populations are at higher risk of conflict in general, the countries with larger youth cohorts tend to have deadlier conflicts. In addition, certain demographic trends are found to be more directly implicated in conflict: a labor force growing faster than the job market, a fast-growing, educated youth population that aspires to obtain scarce, elite positions, unequal growth rates between ethnic groups, urbanization that outpaces employment opportunities, and patterns of in-migration that shift the ethnic balance of a region.

# III. Recent trends in climate variability in the Sahel and their impacts on food security and conflict

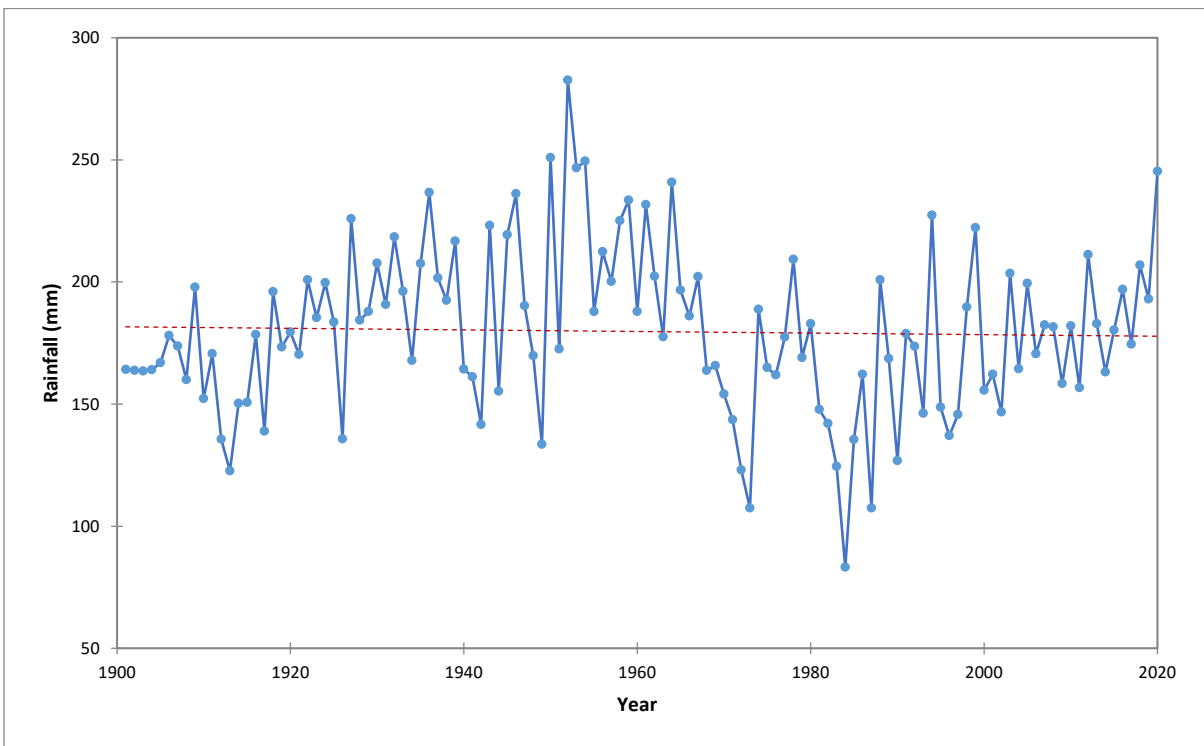
The climatic variability in the Sahel can be explained by looking at the rainfall and temperature data of recent years. The differences in rainfall from one area to another may not have changed, but the trends have notably shifted over the years. Figure 4 shows long-term precipitation variations in the Sahel, displaying a very clear pattern of an erratic and decreasing trend. As sea levels rise and floods, drought, and other natural disasters increase, food insecurity also rises, which in turn threatens security—both directly and indirectly through migration. In the Sahel, the main effects of climate change are increased temperatures and more variable rainfall, as shown above. The case of Niger is worth singling out, with a clear tendency of an increasing rainfall appears from 1980 onward (Figure 5). This “regreening” pattern is also observed in the other Sahelian countries, in recent years. The increase in rainfall is estimated at around 20 mm for Mali, Niger, and Chad, while Burkina Faso and Senegal have seen larger increases—around 30 mm. This is in line with the findings of Descroix et al. (2013) and Bodian et al. (2014), who all underscore a clear pattern of regreening in the Sahel after many years of drought. By contrast, in different areas of Burkina Faso precipitation has become much scarcer in recent years (Figure 6). After a remote sensing study from 1981 to 2011, the regreening patterns seen across pastoral Gourma (Burkina Faso) were deemed highly significant over the entire time frame, particularly with the inclusion of subsequent years following the 1983–84 drought (Dardel et al., 2014). However, despite being supported and proven by studies, the greening theory remains controversial and unproven.

**Figure 4. Average annual precipitation in Sahelian countries**



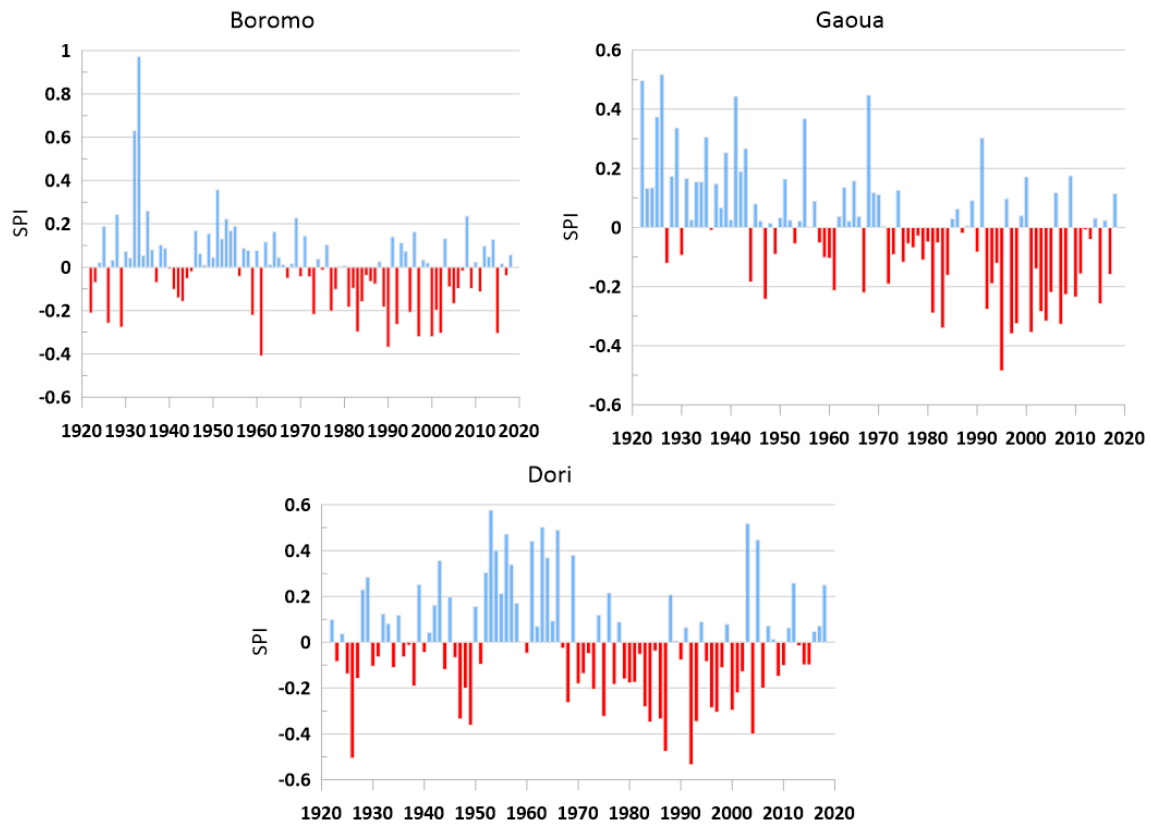
Source: KNMI, authors' calculation.

**Figure 5. Long-term analysis of rainfall in Niger (1901 - 2020)**



Source: World Bank, authors' calculation.

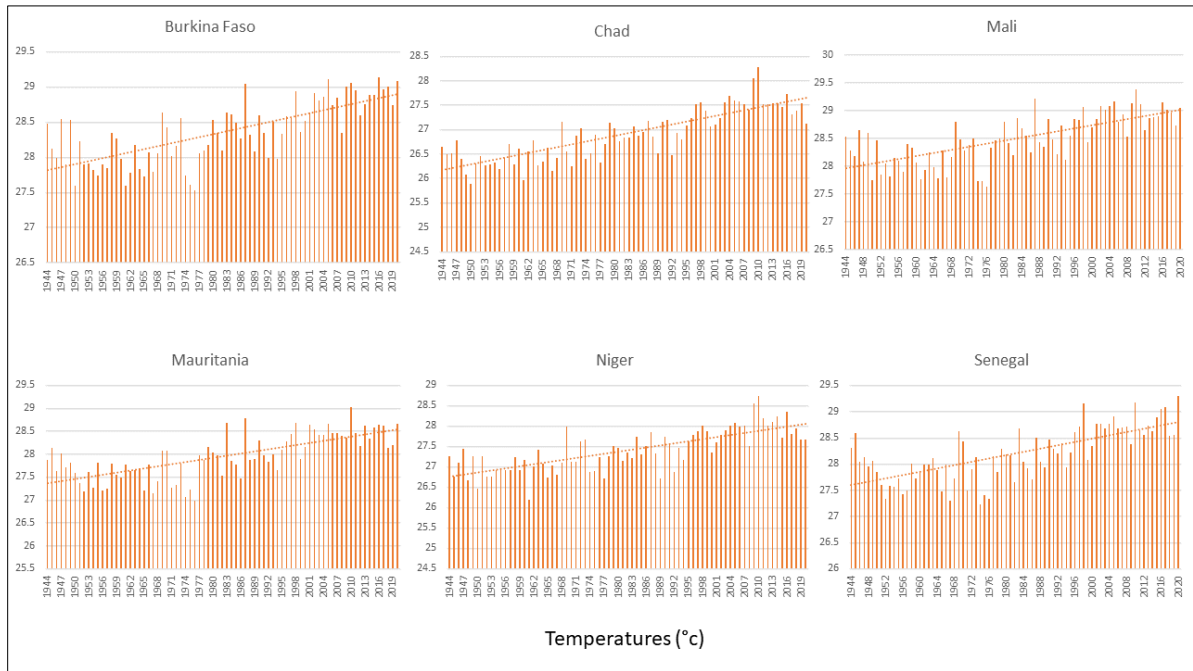
**Figure 4. Standard precipitation index for locations in Burkina Faso, 1922 to 2020**



Source: KNMland data, authors' calculations.

The effect of climate change on temperatures is much more direct than its effects on rainfall (Figure 7), with temperatures clearly rising almost everywhere in the Sahel.

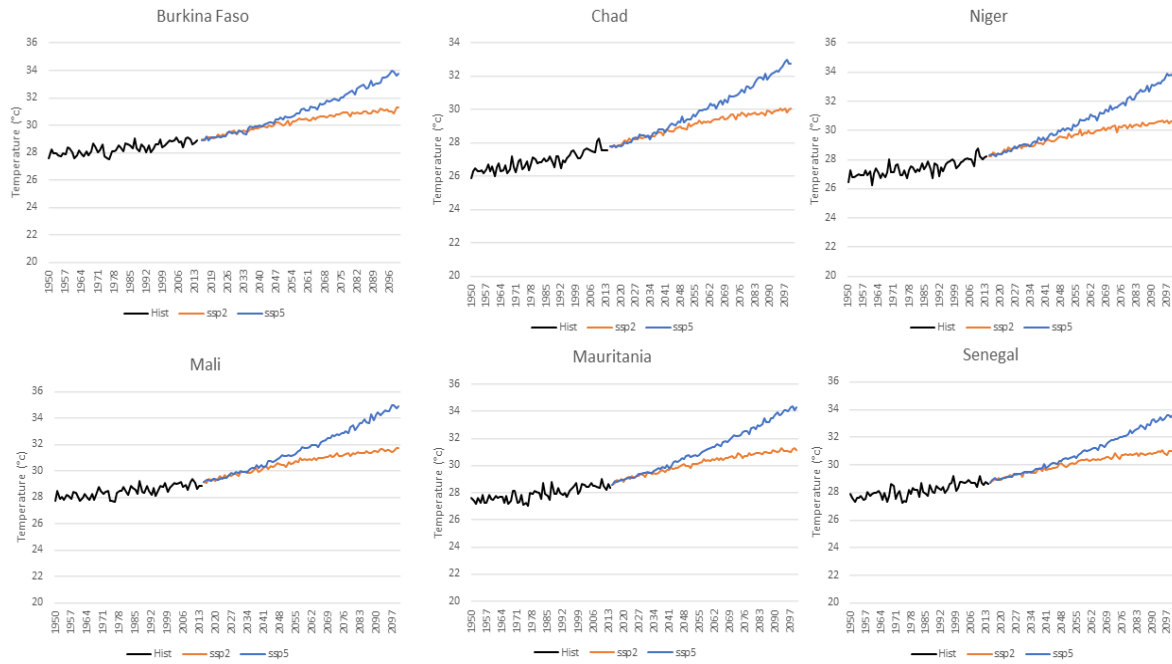
**Figure 5. Average annual temperatures in Sahelian countries**



Source: KNMI, authors' calculation.

The Coupled Model Intercomparison Project 6 was used to project the various countries under study (CMIP6), for four greenhouse gas emissions concentration trajectories (O'Neill et al., 2014), by 2100. All simulations (Figure 8) indicate significant increases in temperature for Sahelian countries by 2100.

**Figure 6. Historical and futures temperatures in the Sahelian countries**



Source: KNMI, authors' calculation.

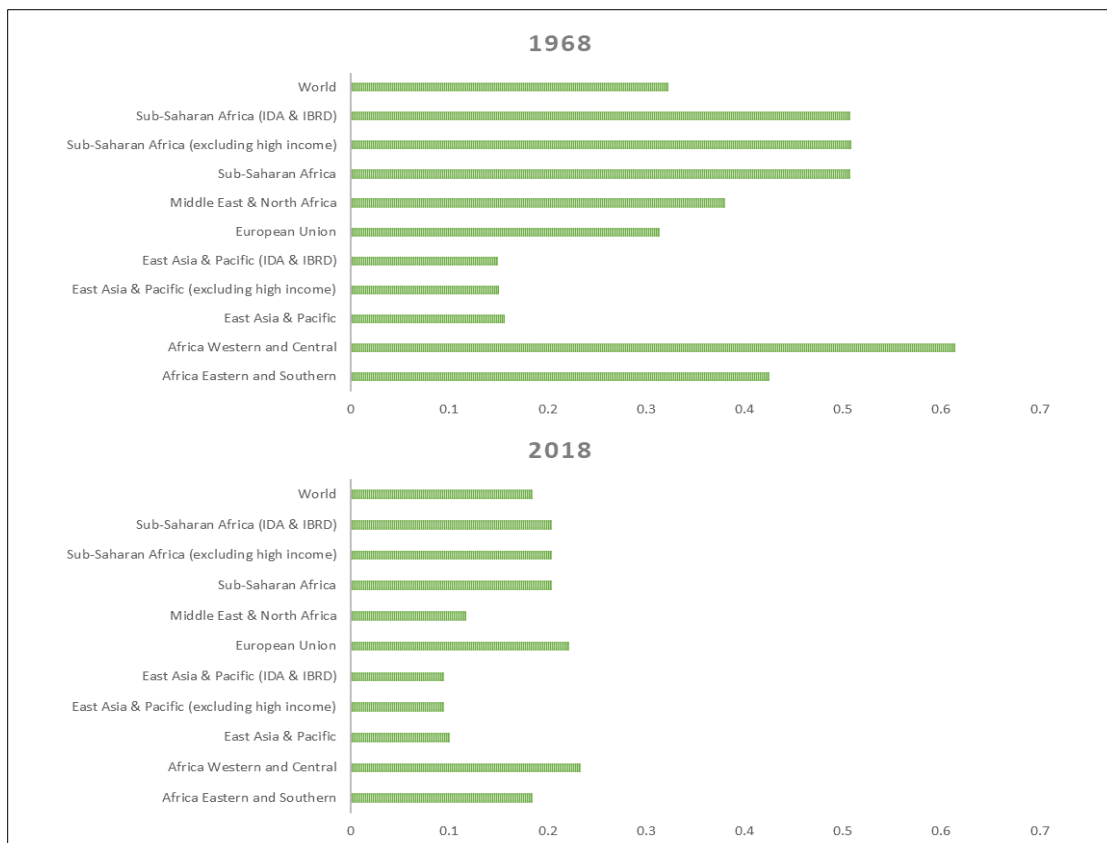


# IV. Agriculture and climate variability

As temperatures rise, both agricultural yields and water resources are negatively impacted, as discussed in section III. The continent has less arable land than any other region of the world apart from desertic regions, and that arable land is becoming increasingly scarce as a result of climate change (IPCC, 2007).

From 1968 to 2018, the availability of arable lands has considerably decreased (Figure 9). These changes can be attributed to the climate variabilities that occurred since 1971, as reported by several studies on climate change in the Western and Central Africa.

**Figure 7. Comparison of arable land availability over time in 1968 and 2018**



Source: FAO, authors' calculation.

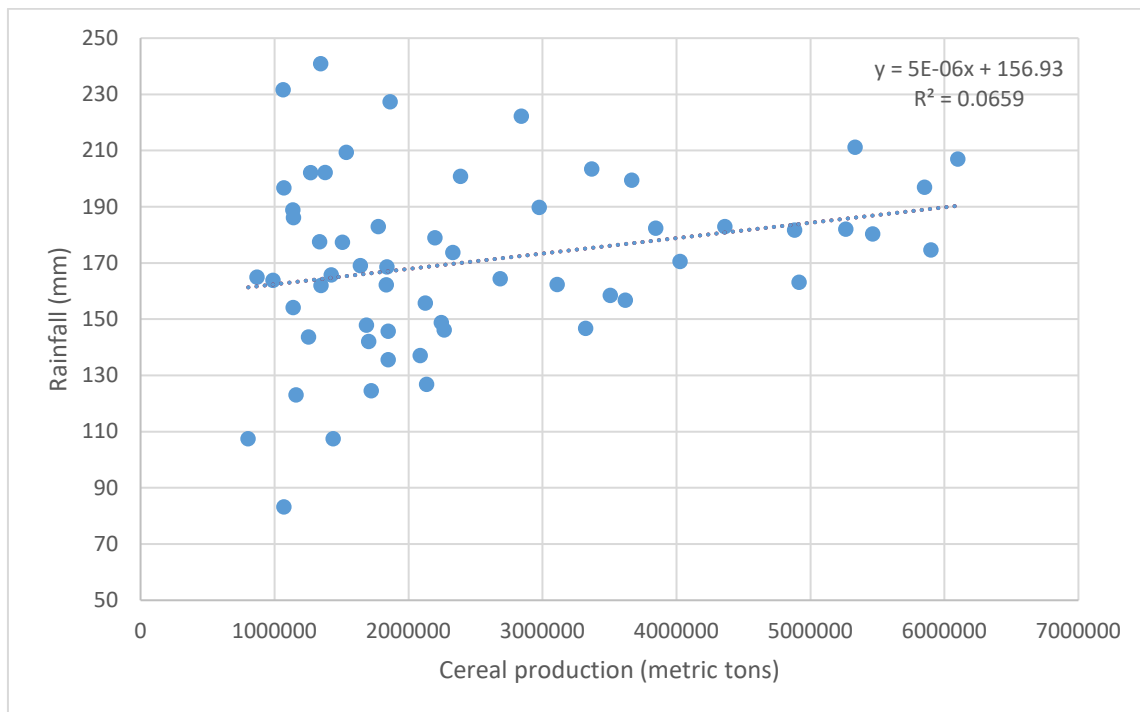
According to several estimates, climate change has been very detrimental to Africa's agricultural industry. Ohiomu & Ozor (2021) employed statistical and econometric approaches to highlight the direction of climate change, as well as the pattern of

relationships and consequences that climate change has on agricultural production and food security. These varied approaches revealed that climate change is growing into a more severe problem in sub-Saharan Africa, with long-term implications on agricultural production. Variations in agricultural production caused by climate change and other factors are leading to soaring food prices in the Sahel and may jeopardize food security.

While many of the countries of the Sahel are landlocked, Mauritania and Senegal are coastal nations. In Africa, as elsewhere in the world, coastal areas tend to offer more economic opportunities, and therefore are more densely populated than inland regions. By some estimates, Africa's populations in Low Elevation Coastal Zones (LE CZs) will rise by 3.3 percent annually between 2000 and 2030—more than double the global average rate. While around 30 million Africans live in the flood hazard zones of the Atlantic and Indian Oceans, 2 million are likely to be flooded each year. Flooding caused by rising sea levels leads to inland coastal areas experiencing saltwater intrusion and negatively impacted river salinity, which decreases available drinking and irrigation water and makes off-season agriculture and freshwater fishing more challenging.

Using data from Niger, the impact of climate change on cereal production is further highlighted (Figure 10). The figure shows a positive, but very weak relationship (0.25) between rainfall variation (a proxy for climate change) and cereal production in Niger, which also implies there may be other factors involved in the variation of cereal production, besides climate change.

**Figure 8. Correlation between rainfall and cereal production in Niger (1961-2018)**



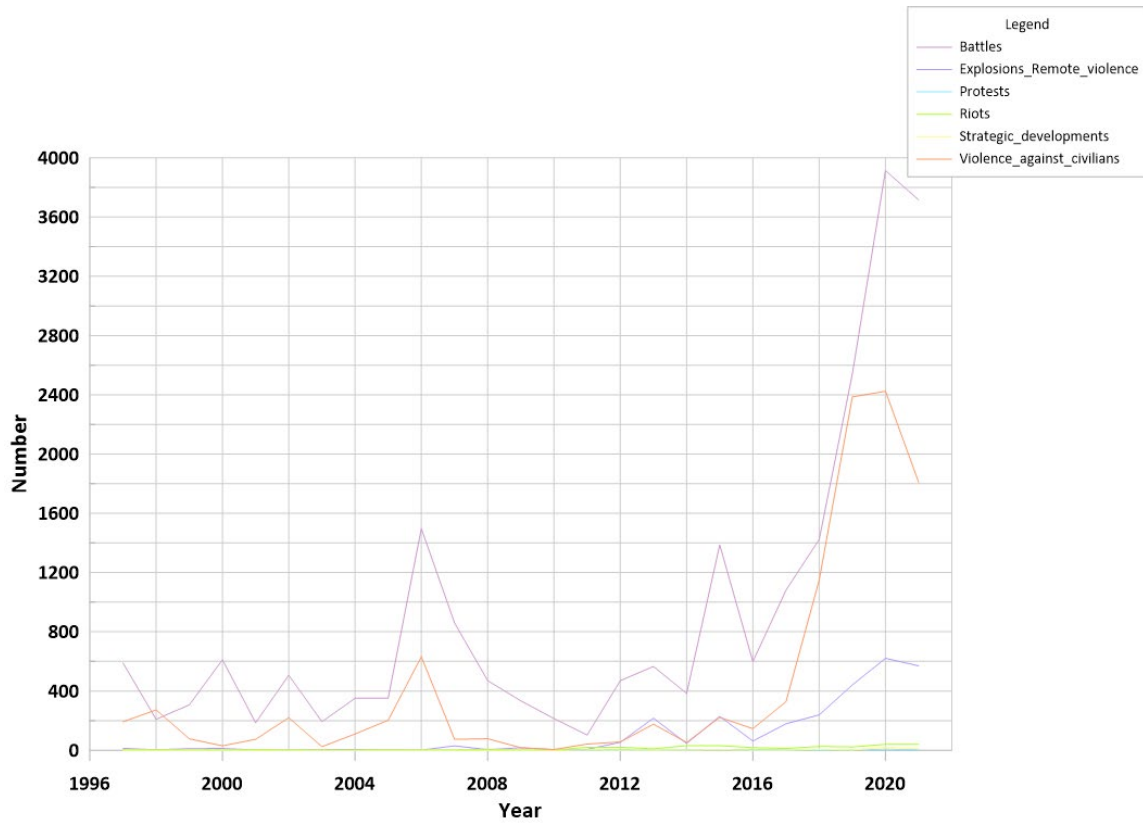
Source: KNMI and FAO, authors' calculations.

Overall, climate change could cost Africa a loss of agricultural output between 17-28 percent versus 3-16 percent at the global level; as a consequence of this loss of output, food security is put at further risk. According to the Economist Intelligence Unit's Global Food Security Index (GFSI), Sahelian countries rank poorly in terms of food security: Out of 113 countries, Mali is ranked 86th, Senegal 87th, Burkina 97th, Niger 104th, and Chad 108th. Despite the various drivers of food insecurity in the Sahel, climate change is probably among the most impactful factors.

# V. Climate change, favoritism, and conflict in the Sahel

In parallel with rising temperatures and erratic rainfall, the incidences of violence have been rising in the Sahel recently. At the regional level, all types of violence (battles, remote violence, protests, riots, and violence against civilians) began rising in 2010 (Figure 11). Looking at country-level violence reveals very interesting specificities. In Chad, violence was rampant in the early 2000s, then sharply declined between 2005 and 2010, only to start rising again in 2010 (Figure 12). This evolution is in line with the country's long history of violence and instability, which temporarily halted during most of President Idriss Deby Itno's reign, and then resumed with the outbreak of Jihadist activities following the death of Muamar Al Gaddafi in 2011. In Burkina Faso, violence was almost nonexistent until 2010, and then started increasing significantly in 2016 (Figure 13). In Niger, Mali, Mauritania, and Nigeria, a similar trend can be observed, with violent outbreaks starting in 2010 and spanning onwards (Figure 12). Finally, in Senegal, we observe an erratic trend in violence incidences reflecting the government's handling of the Casamance crisis. Since 1982, the government of Senegal has been confronted with a rebellion seeking independence in the southern part of its territory. However, this movement has nothing to do with the spread of Jihadism in the Sahel since the beginning of the 2010s. In dealing with this rebellion, the government alternates between peace negotiations and military showdowns, resulting in a succession of peace periods followed by military confrontations in the south of the territory.

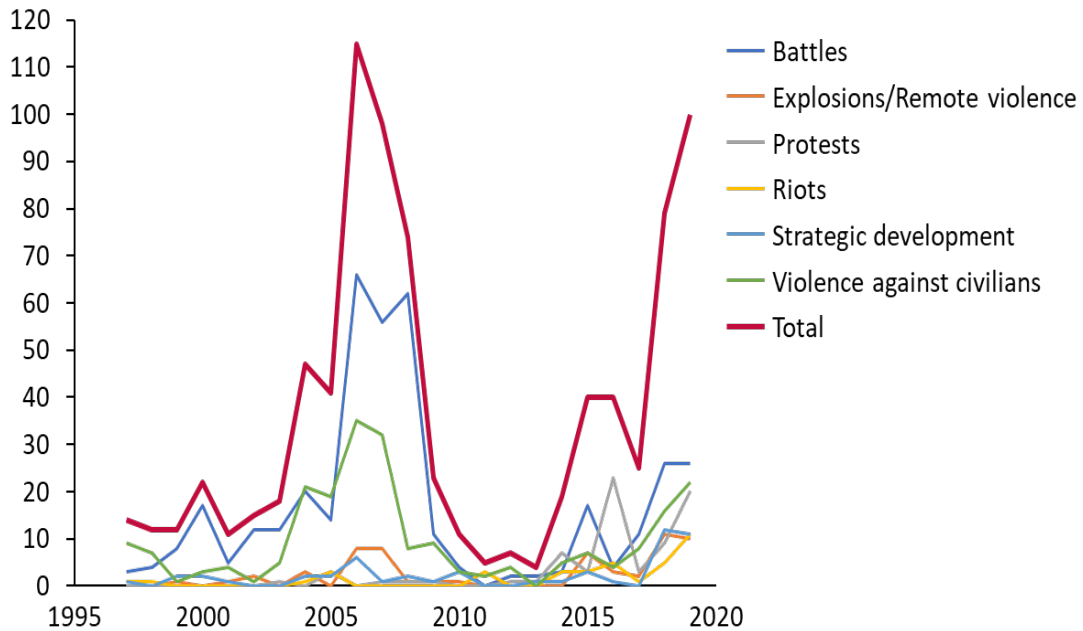
**Figure 11. Evolution of conflicts in the Sahel, 1997-2019**



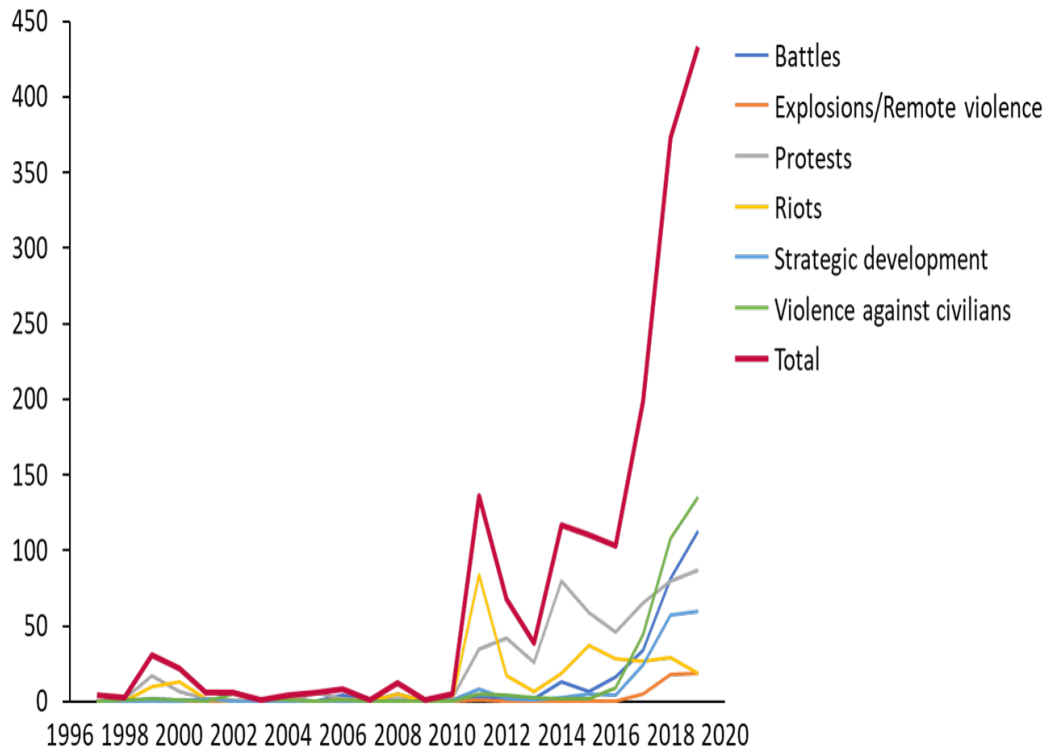
Source: ACLED, and authors' calculations.

**Figure 12. Conflicts in Sahelian countries**

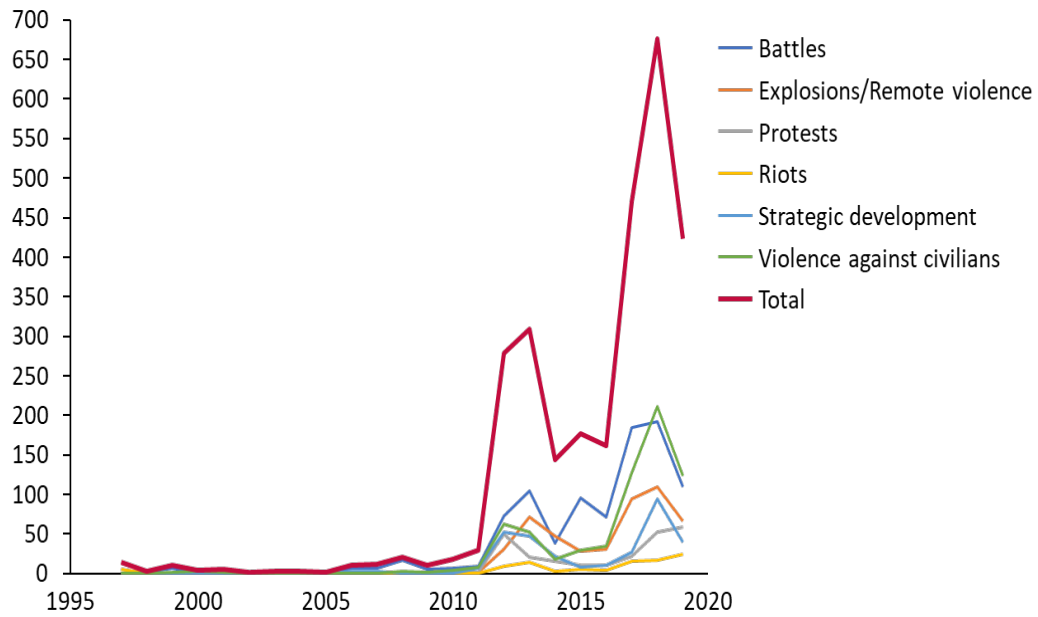
Chad, 1997-2019



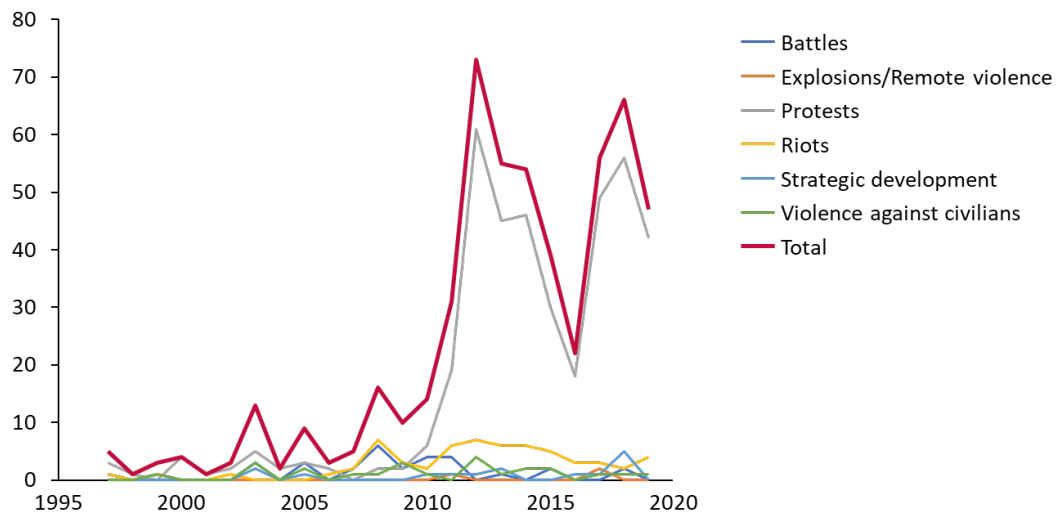
### Burkina Faso, 1997-2019



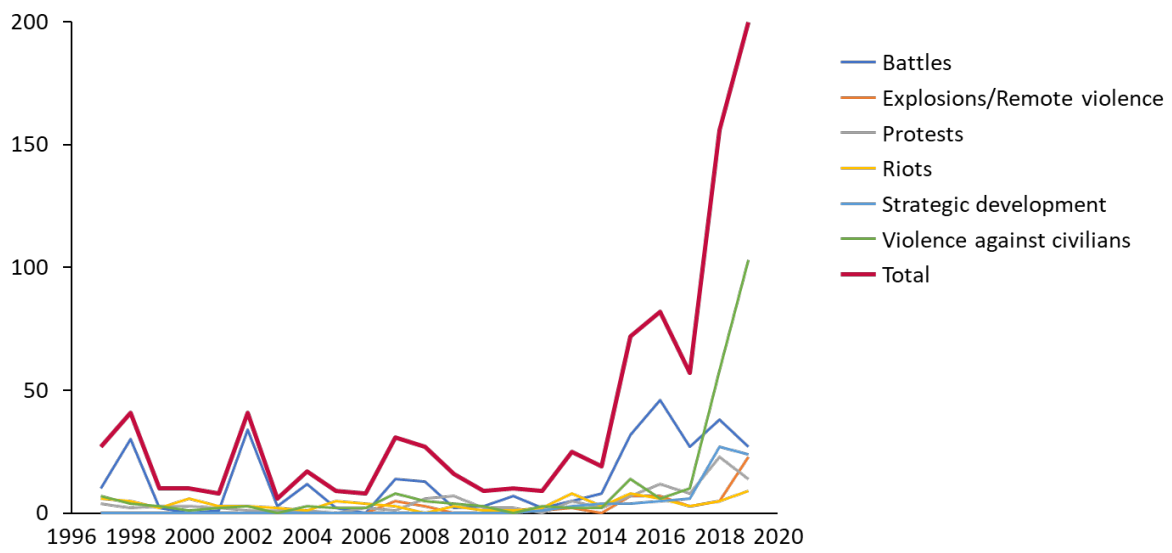
### Mali, 1997-2019



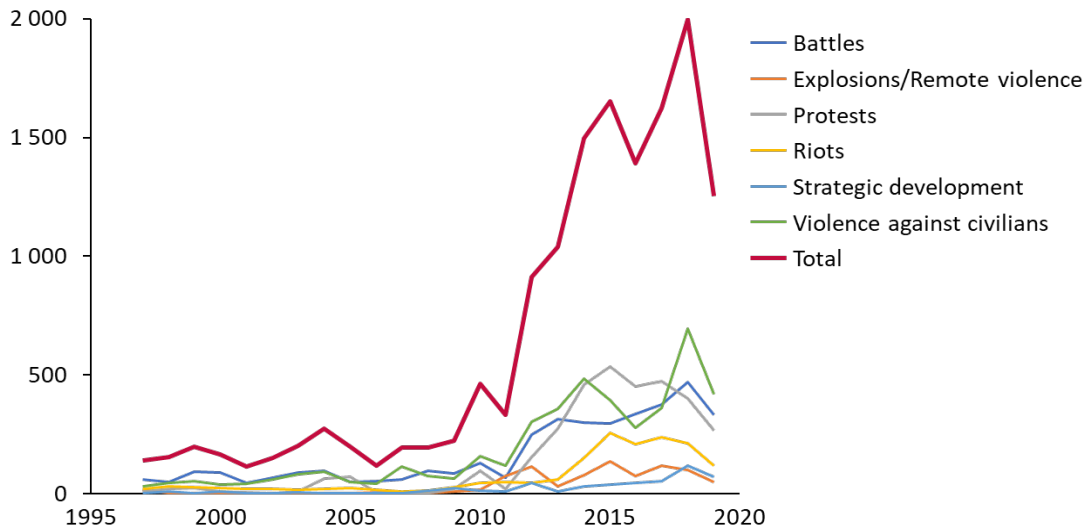
### Mauritania, 1997-2019



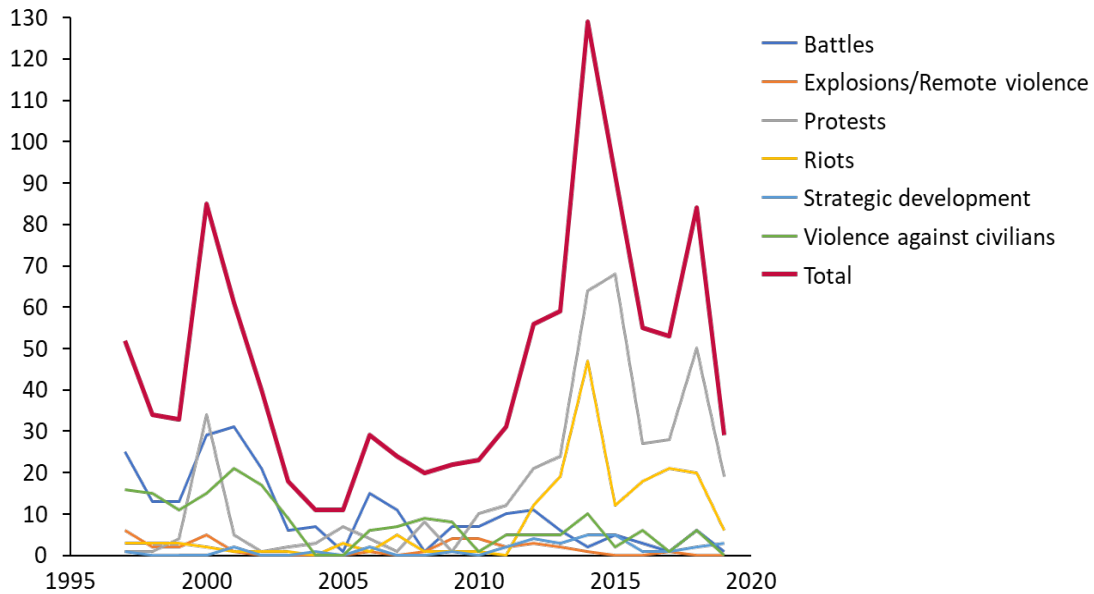
### Niger, 1997-2019



## Nigeria, 1997-2019



## Senegal, 1997-2019



Source: ACLED, and authors' calculations.

The fact that rates of violence began to skyrocket in 2010 demonstrates that although climate change can be a significant amplifier of conflict, many other factors are clearly implicated. State failure is increasingly the main driver of conflict in the Sahel and is primarily manifested in governments possessing only limited control over their territories, especially in remote and inaccessible areas. Mali is a perfect example of this: Just a third of the national territory is under the official government's control. This lack of full territorial control prevents states from providing basic services to populations located in these remote areas. Many authors have noted that levels of service provision and political representation in remote areas are well below average in Africa (Coast, 2002).



Moreover, due to the clientelism that characterizes most African regimes, governments often unduly favor the districts and certain ethnic groups that vote for them and sideline groups that are less closely connected to themselves and their own interests. Using data both from the Horn of Africa and the Sahel, Raleigh finds that politically marginalized (“irrelevant”) groups are excluded from the political agenda and usually settle in underdeveloped areas. These marginalized groups are typically too weak to deploy violence against the government, but they tend to do so against other rival communities. According to some estimates, up to 65 percent of ethnopolitical minorities in Africa are disadvantaged in terms of their access to top positions in politics, civil service, and military. Moreover, up to 70 percent of the political and economic segregation faced by these groups is more severe than the global average (Scarritt and McMillan, 1995: 328-329). Likewise, Miguel and Zaidi (2003) validate the patronage hypothesis in African democracies, which means that resource provisions in these countries are mostly shaped by clientelist relationships with interest groups and political connections with some districts. They further break down the hypothesis into three dimensions: Presidentialism with high power concentration, clientelism that rewards clients (by awarding them public sector jobs, favorable budget allocations, licenses, contracts, projects, and so on), and the use of public resources for public legitimation. Finally, governments’ responses to disasters are also heavily shaped by clientelism (Pelling and Dill, 2006). In his review of factors driving conflicts in the Sahel, Raleigh concludes that government failures to regulate contested livelihoods should not be downplayed in understanding the drivers of conflict in the Sahel.

Hence, in the Sahel, the risk of conflicts related to climate change is inextricable from pre-existing economic, political, and physical vulnerabilities in the communities in question, where the politics of resources and risk distribution affect instability (Wisner, Blaikie, and Cannon, 2004; Eriksen, Brown, and Kelly, 2005). In their study of the Mopti region, Benjaminsen et al. (2012) point to restricted mobility for pastoralists, political negligence, corruption, and rent-seeking as important alternative drivers of conflict in Mali. Benjaminsen (2008) further contends that dysfunctional and corrupt institutions, more than droughts, are the main factors behind the Tuareg uprisings in Mali—and recent gun proliferation is only exasperating these trends.

# VI. Climate change, institutions, and conflict in the Sahel: Lessons from Mali

Mali offers an excellent illustration of the complex nexus between climate change, livelihoods, and conflict in the Sahel. Since the beginning of the 2000s, this country which has been greatly impacted by climate change, has also experienced several types of violence—including riots in main cities, communal violence, Jihadist insurgency, and military coups. Understanding the current situation in Mali will provide significant insights in how institutional failure combined with economic scarcity brought about by climate change, all play out to generate increased instability and violence in Mali.

Mali is a landlocked, low-income country located in the Sahel with a poverty rate estimated at 47.2 percent (Instat, 2015). Only an estimated 27 percent of Malians have access to drinking water, the country's infant mortality rate is 102 per 1,000 births, and life expectancy at birth is 53 years. Like most Sahelian economies, the Malian economy is largely concentrated in the informal sector, which contributes 55 percent to overall GDP, as much as 98 percent of the added value of the primary sector, and 66 percent of that of the tertiary sector (Instat, 2015). Since 2012, Mali has been beset by violence and political instability; while these issues have been primarily concentrated in the North, the entire country has faced significant economic repercussions as a result.

The North and South are two major territories in Mali. The North (the Sahara) is almost entirely uninhabited and is comprised of the regions of Timbuktu, Gao, and Kidal. These regions represent two-thirds of the national territory but account for just 10 percent of the country's population (Coulibaly and Lima, 2013). The South (the Sahel) is more populated and home to a fairly vibrant agricultural sector. The region of Mopti is located between these two areas and represents the border between the jihadist-occupied north and the government-controlled south. In 2012, Ansar Dine and the Movement for Unity and Jihad in West Africa (MUJAO) seized control of the entire northern part of Mali (Barbelet and Goita, 2015). These groups, which began moving south toward the capital, Bamako, reached the town of Kona in the Mopti region in January 2013. At that point, the Malian government declared a state of emergency and asked for the assistance of France, which then stopped the jihadists' progress and forced them to retreat further north as part of "Operation Serval."

The Niger River Delta in Mali is an excellent illustration of how climate change and institutions interact to shape conflicts and disputes. Farmers, herders, and fishermen are all dependent on the delta for their livelihoods. Farmers and pastoralists have long coexisted in the Sahel and local institutions have historically mediated conflicts between them. Since independence, the Malian government has favored farmers over herders: For example,

Benjaminsen and Berge (2004) show how President Modimo Keita repeatedly disrespected pastoralism, preferring to promote industry and agriculture to advance his socialist development agenda. His successor, Moussa Traoré, did little to ease the frustration of nomadic peoples. Benjaminsen et al. (2012) looked at land dispute cases (between farmers, farmers and herders, and farmers and fishermen) heard by the Mopti court of appeals in Sévaré and found that court settlements in Mali are usually costly due to the prevalence of judge bribery. The authors' interviewees tended to see institutional weakness in dealing with conflicts as the main cause of violence in Mali.

In Mali, sources of livelihoods are tied to ethnicity. The Muslim Fulani and Tuareg tend to be pastoralists, while the animist Songhai and Bambara tend to be agriculturalists. The patterns of communal conflicts in Mali discussed below illustrate how ethnic and religious factors, along with government failure, interact with climate change to drive disputes.

The Niger River supports intense agricultural activity on the part of both farmers and herders. While the farmers cultivate rice, the herders grow burgu, which is a fodder crop for cattle used to feed herds during the dry season. Burgu grows on deeper water than rice, and during dry periods—which are increasingly frequent due to climate change—rice farmers often encroach on burgu fields, leading to communal conflicts between pastoralists and farmers. Since the 1950s, a quarter of burgu fields have been converted to rice fields (Kouyaté, 2006) due to the decrease in rainfall in the area.

In recent years, the Fulani and the Tuareg have been increasingly joining the jihadist insurrection in northern Mali. This is the result of two intertwined factors: alleged government discrimination against the ethnic groups and conflicts over water resources that have been exacerbated by climate change. Ahmadou Koufa, the head of the MUJAO, is Fulani, while Iyad Ag Ghali, the head of Ansar Dine, is Tuareg. In this context, Jihadist attacks lead to retaliation from the Bambara and Songhai agriculturalists, setting off a vicious cycle of intolerance and violence.

As illustrated above, the case of Mali shows the complex nexus between climate change, livelihoods, and conflicts in the Sahel. Specifically, climate change and institutional weaknesses interact to shape conflicts and disputes, exacerbating pre-existing conditions and factors for conflicts which could have been otherwise mitigated.

# VII. Conclusion

The relationship between climate change and conflict is the source of a great deal of controversy in the literature. While some authors see climate-induced scarcity as leading to fighting over resources, a growing body of empirical evidence points to the role of institutional failures in conflict. In this paper, we have used the Sahel as a case study showing that conflict has many interconnected factors, including state failure, demographics, and rent-seeking behaviors. By generating increased scarcity, climate change is further compounding these factors, in a context where there are little alternative options to mitigate food insecurity and support livelihoods besides natural resources. Therefore, adaptation to climate change should be central to any policy that seeks to mitigate conflict in the Sahel. Unless the effects of climate change on livelihoods are mitigated, the spread of poverty will push increasingly desperate people into the hands of opportunistic groups, such as Jihadists.

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