Climate Change, Development and Security in the Central Sahel

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Executive Summary

This report sheds light on the possible effects of climate change on development and security in the Central Sahel, namely in Burkina Faso, Mali and Niger. It examines the interactions between climatic stresses, food security, and conflict risk, by highlighting the region's key socio-economic and political conditions, and how these could shape future vulnerability to the effects of global warming. It further discusses existing measures and policies and how these could be improved to increase the region's resilience to climate- related challenges. Climate variability is a key issue in the Central Sahel, owing to a heavy reliance on rainfed agriculture, pastoralism and other climate-sensitive livelihoods. Yet, its effects need to be understood in a wider social and political context.

The European Union (EU) and its member states are heavily invested in the region through their foreign, security, and development policies. In order to be successful, and to contribute to transnational cooperation with African partners in a meaningful way, they need to consider the challenges and opportunities related to climate change and politically- and context-sensitive climate change adaptation, which are discussed in this report.

This report uses a mixed methods approach, combining qualitative literature review, quantitative data analysis, future climate impact projections, semi-structured interviews, a survey with more than 200 regional experts, as well as a participatory scenario planning exercise. It provides a multifaceted overview of climate-related challenges and vulnerabilities in the region, combined with the perspectives of local experts and stakeholders. These would help overcome preconceived ideas, while also considering alternative political pathways in the wake of climate change.

The main findings of the study are the following:

- Climate change is and will be an important factor for the future of the Central Sahel. Both its current and future impacts, however, are intrinsically linked to social and political factors that must be emphasised when addressing climate-related challenges in the region.
- Climate change will likely have significant impacts on the region, including more rainfall variability, more extreme events like droughts and floods, and higher temperatures over time that will rise faster than the global average. Some parts of the Central Sahel will experience more rainfall, while other parts will receive less.
- These effects of climate change can potentially trigger cascading risks for local livelihoods (especially agriculture and pastoralism), food security, communal and state-citizen relations, and could lead to more displacement. In other words, climate change could aggravate the region's existing challenges.
- Extreme weather events could disrupt agricultural and pastoral production, and harm vulnerable rural communities, particularly women and marginalised groups who generally have greater difficulties to cope. Food insecurity could increase as a result.

- Mobility is an important economic diversification and coping strategy in the region. Adverse climatic change and its impacts on local communities could lead to further displacement, rural-urban migration, and even intensify regional migration and displacement across borders. Yet, even in the wake of climate change, migration to other African countries will likely by far exceed migration to Europe. Moreover, some populations will remain trapped due to a lack of means to relocate.
- Climate change could also affect inter-communal tensions through its effects on rainfall and transhumance patterns. Conflicts could escalate, if systems of resource and conflict management fail. Deep-seated grievances and the historical marginalisation of pastoralist communities are underpinning this risk.
- Our research suggests that climate change is not a prominent direct cause of the proliferation of armed groups in the Central Sahel. Other factors like foreign military interventions, religious claims, and the marginalisation of pastoralist communities are deemed more important by local experts. However, climate-induced economic losses and food insecurity, communal tensions, as well as public discontent with poor conflict prevention mechanisms could all indirectly benefit armed groups by facilitating recruitment and opening avenues for exploiting grievances and winning over marginalised communities.
- The likelihood and severity of climate impacts on livelihoods, food security, mobility and conflicts in the Central Sahel will largely depend on the future evolution of the region's socio-economic and political conditions, which shape its vulnerability and resilience to adverse climatic change. Agricultural productivity, infrastructure, trade, social safety nets, effective and inclusive institutions, and systems of resource and conflict management are critical factors to consider in this regard, as are economic opportunities and social relations more broadly. All of them are affected by the policies and geostrategic interests of the EU and other global players.
- The evolution of these factors is uncertain, but scenarios co-developed with local experts can help project them into the future and prepare for the possible challenges and opportunities they will create. For the purpose of this report, we identify three distinct and plausible scenarios, each characterised by different levels of resilience and vulnerability to the effects of climate change on livelihoods, food security, mobility, and conflict risk: One assuming the success of conventional approaches to development and security in the region; another one describing stagnant development, insecurity, and increased vulnerability to the effects of climate change; and a third scenario describing an alternative development path focusing more strongly on social inclusion and environmental sustainability.
- National policies are increasingly taking into account risks linked to climate change. However, actions to promote resilience and adaptation are constrained by the limited resources available, the fragmentation among disparate initiatives, and a lack of clarity on the leadership for climate action. Regional cooperation, supported by a number of well-established regional organisations, including ECOWAS, is a crucial factor in how well Sahelian countries can respond to the impacts of climate change.

- → Migration containment policies appear as disruptive measures that compound climate-related challenges for the region's vulnerable communities: by trapping people in exposed areas, increasing pressures on services, reinforcing national identity and exclusionary discourses, hindering livelihoods - such as transhumance - and, in the end, aggravating tensions and conflicts. Therefore, for the sake of more coherent European security and development policies, the migration brake must be eased.
- → Peacebuilding and security strategies in the region have been marred by an overly securitised approach, with often overlapping and incoherent initiatives focused on stabilisation rather than human security, development and resilience. This is coupled with growing signs of fatigue and weariness on the part of European and Sahelian societies vis-a-vis foreing military interventions. In fact, a large number of surveyed local experts call for reduced EU military involvement in order to increase climate resilience in the Central Sahel.

Based on these insights we propose the following recommendations:

1. Capitalise on the complementarity between agriculture and pastoralism

Agriculture: The priority should be to increase soil productivity (ratio of production to usable land). To this end, small-scale irrigation methods should be pursued for their economic and environmental benefits. In this context, drip irrigation can be a useful tool and should be linked to traditional land conservation and restoration techniques, which are useful for restoring soil fertility and ensuring the biological balance of soils. In addition, the use of climate-adapted improved seeds should be promoted. There have been great investments in research in recent years, but there is a lack of support for the dissemination of knowledge on resistant seeds among farmers.

Pastoralism: Political commitments made to the promotion of pastoralist livelihoods need to be translated into concrete actions. This means improving water points and access to water, strengthening veterinary services, access to credit for decentralised cooperatives, and strengthening value chains for animal products. In addition, transhumance corridors must be better defined and rigorously enforced, but still allow for flexible adjustments to future climatic impacts and addressing the historical exclusion of pastoralist communities. It is also necessary to improve information and early warning systems, and to facilitate the dissemination of climate information to pastoralist communities.

2. Promote small-scale adaptation initiatives and review existing ones to address their potential negative impacts

Large mitigation and adaptation initiatives such as the Great Green Wall need to be analysed in terms of their potential counterproductive effects. The project seems to take advantage of the complementarity of different livelihoods in the region (pastoralism and agriculture) but is too focused on the latter. It should also be open to other possible effects of climate change beyond desertification, and it should rethink the role of actors involved in environmental protection, such as forestry services, which have been repeatedly accused of corruption and abuse by local populations.

Climate-Smart Agriculture (CSA) can be an interesting model to improve climate change adaptation, as it combines traditional and modern techniques to increase agricultural productivity, although it should try to avoid relegating pastoralism to a secondary role.

3. Relax migration control measures and promote mobility as a coping strategy

Restricting migration in the Sahel risks hindering effective climate change adaptation, especially among households and communities that rely on mobility to cope with erratic weather conditions. Policy initiatives in the region must respect mobility as a way of life and as an essential coping strategy. The EU should continue to support the implementation of existing protocols on free movement, but without prioritising bilateral agreements aimed at migration containment, as this weakens regional approaches promoted by ECOWAS.

European policy-makers must therefore heed the evidence provided by much of the academic world on the importance of greater internal and external border flexibility. They must use it to refute xenophobic and racist discourses in Europe that legitimise counterproductive containment strategies in the Sahel. They must do so by appealing not only to respect for human rights, free movement or even the need for labour, but also for the sake of a more coherent and effective foreign policy. In other words, if the EU really wants to enhance the resilience of Sahelian communities, it must ease the brake on migration, which is inconsistent with other policy objectives in the region. All this must be done by incorporating new narratives that focus on the fact that migration will mostly remain within Africa - as the IOM has already done in its latest reports (IOM, 2020) - and considering the links between climate change and (in)mobility.

4. Redefine peacebuilding and security strategies by prioritizing bottom-up approaches, human rights, and principles of coherence, effectiveness and accountability

The track record of efforts and past strategies for the region by the EU and international community is at best mixed. Increased attention to governance - informed by a more politically sensitive approach to local dispute resolution mechanisms, including for natural resource management - seems appropriate.

This will require a greater involvement and inclusion of the plurality of conflict resolution mechanisms, from traditional, religious, local, national, regional and/or international perspective, which would also help avoid legal pluralism that allows for exclusion of certain groups. To this end, the current decentralisation processes in the three countries are crucial processes to take into account and support, while considering some of the shortcomings in these processes.

A recalibration of peacebuilding and security strategies in the region would not mean a rapid withdrawal of military missions without an alternative plan, but requires a necessary improvement in the plans designed from now on. This would also call for a re-orientation of funds towards sustainable development, away from restrictive migration control and militarised security. To this end, objectives and strategies must be harmonised, with full recognition not only of state and regional actors in the Sahel, but also of local civil society. Military activities deployed in the region must be improved, based on a human rights approach, and a better understanding of climate risks.

Ultimately, this inevitably implies prioritising not only human rights, but also the principles of effectiveness and accountability applicable to both local and international actors. The new European Integrated Strategy for the Sahel offers an opportunity to rethink what has been done so far, and to commit to new scenarios that minimise the area's vulnerabilities from a socio-economic, political and climatic point of view.

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1. Introduction

This report sheds light on the possible effects of climate change on development and security in the Central Sahel, namely in Niger, Mali and Burkina Faso. It examines the complex interaction between climatic stresses, food security, and conflict risk, highlighting key socio-political conditions in the region and how they could shape future vulnerability and resilience to the effects of global warming. In doing so, the study also delves into the conditions that underpin the region's current situation of fragility (Pye, 2021), namely the proliferation of armed groups, inter- and intra-community conflicts, governance challenges, and high rates of food insecurity.

Our research challenges reductionist perspectives of climate change and competition over resources (reference) as main causes of conflicts in the region. Such approaches often entail a securitised and paternalistic view of society that evokes the well-known "tragedy of the commons", without taking into account the range and complexity of conflict dynamics operating at the local, regional and international levels (Verhoeven, 2014). Climate variability is an important issue in the region, owing to a heavy reliance on rainfed agriculture, pastoralism and other climate-sensitive livelihoods. Yet, its effects need to be understood in a wider socio-political context. Our study therefore considers climate change not only as a physical phenomenon, but also as a process that reveals existing social challenges and inequalities. It also highlights possible adaptation measures that enhance the resilience of local communities.

Beyond reviewing existing literature and analysing publicly available data, this report presents the results of original research involving individual interviews, a survey, and a scenario planning exercise with regional experts and stakeholders. The purpose was to gain a multifaceted understanding of climate-related challenges and vulnerabilities in the region, including the role of unequal power relations operating at different levels. Key elements guiding our research are humility and intellectual honesty, as well as avoiding Eurocentrism as much as possible - being aware that biases are always present, but recognising them when they occur.

This study builds on a theoretical framework of cascading climate risks, which has been developed by the CASCADES research team.[1] This framework focuses on climate triggers (CT) from a biophysical, meteorological and hydrological point of view. It covers their knock- on effects on agricultural production, livelihoods and social relations along so-called impacts transmission systems (ITS), possibly leading to risks that spread beyond borders and sectors (Hilden et al. 2020). Importantly, the study also considers key scope conditions that shape exposure, vulnerability, and resilience to impacts along the impact transmission chain. The Central Sahel case study contributes to the CASCADES project by diagnosing risks and vulnerabilities in that region and by discussing possible risk reduction measures.

The report is divided into three main sections: a situation analysis of past and present challenges and the conditions for vulnerability and resilience in the Central Sahel; an analysis of impact transmission mechanisms and potential future risks in the context of different socio-economic and political scenarios; and finally, an overview and discussion of opportunities for risk reduction, including possible improvements to existing measures and initiatives.

[1] See: https://www.cascades.eu/

1.1 Methodology

This report uses a mixed methods approach, combining qualitative literature review, quantitative analysis of historical data and future climate impact projections, semi-structured interviews, an online survey, as well as a participatory scenario planning exercise. **Desk research** included academic papers, grey literature, technical reports and policy briefs in order to prepare semi-structured interviews with relevant experts and stakeholders. A total of 38 online **expert interviews** were conducted between July 2020 and February 2021 with representatives of national, regional and international organisations; civil society and farmers and herders organisations; experts in development, security and climatic issues.

The **online survey** was conducted among experts and stakeholders in the Central Sahel; mainly in Niger and Mali.[2] It gathered experts' perceptions of environmental vulnerabilities linked to food (in)security, conflicts and migratory phenomena. This methodology was chosen as an alternative to the representative face-to-face survey initially planned, which was impossible to carry out due to COVID-19 restrictions. Online surveys face challenges in the Sahel, where internet penetration is still limited, although exponentially growing mainly through access via mobile phones. However, the implementation of the survey has proved to be a success and provides interesting results and research leads for the future. It offers interesting insights into participants' preferences with regard to adaptation and resilience measures in the region.

From the 850 people we invited via email, a total of 216 participated in the survey (82% male and 18% female).[3] This response rate of 25% is satisfactory in the current context. The sample has certain limitations and biases (see Annex D), especially a large share of experts living in urban areas and an underrepresentation of rural perspectives. However, a great effort has been made to reach experts with diverse profiles, in terms of country and areas of expertise and professional background. The majority of respondents, 82.4%, identified themselves as experts on Niger, followed by 53% for Mali and 45.4% for Burkina Faso. In terms of professional background, 52% work in the public sector and 43% in the private sector. In terms of expertise, efforts have been made to involve people from the fields of peace and security, development and food security, as well as climate change adaptation and resilience.[4]

The survey provides an overview of perceptions of climate change among professionals and experts working on a daily basis on the effects of global warming and climate change adaptation. It addresses three key issues. First, it examines experts' perceptions of the Sahel's vulnerability to climate change and its impacts. Secondly, it investigates the climate change-security-migration nexus and, finally, it asks about the potential for improving EU- supported climate resilience and adaptation measures in the Central Sahel.

[2] In addition, roughly a third of the survey subjects involved Burkinabé participants and participants from neighbouring West African countries, as well as a few European participants with relevant regional expertise. Some of the survey focussed on cross-border issues and on the region as a whole, others more specifically on Mali and Niger; the countries we expect to be more directly and severely affected by the effects of climate change on security. This choice was made in view of the limited resources for the survey. However, a certain bias towards perspectives from those two countries needs to be acknowledged when interpreting the survey's results.

[3] For more information about sampling, recruitment methods and questionnaire design, see Technical report (Annex D).

[4] For more information, see the raw data published. Bourekba. M. & Puig. O. (2021). *CASCADES Survey on the effects of Climate Change in the Sahel region* (2020). [Data set.]. Zenodo. http://doi.org/10.5281/zenodo.4727021

The **scenario planning exercise** had the objective of projecting possible climate risks and vulnerabilities into the future and deriving recommendations for climate adaptation, security, and development policy. The exercise, initially also planned as a three-day on-site workshop in Ouagadougou, Burkina Faso, was finally implemented in the form of five virtual sessions over a period of four weeks: a first inaugural session to discuss the topic of our research and identify major risks and vulnerabilities in the region; followed by three breakout sessions with subsets of the participants to develop three scenarios for the future development of the region's vulnerability and resilience to climate-related risks; and finally another plenary session to discuss risk reduction and adaptation options with the whole groups. Great care was taken to recruit participants from the three countries and from diverse professional backgrounds (e.g. academics, policymakers and advocates, as well as development and security sector practitioners, while also ensuring gender balance, to the extent possible).

The exercise resulted in the development of three scenarios for the region: One following a business-as-usual development path in line with currently dominant paradigms (Scenario 1); another one describing a stagnant development, insecurity, and increased vulnerability to the effects of climate change (Scenario 2); and a third scenario describing an alternative development path focusing on social inclusion and environmental sustainability (Scenario 3). The three scenarios are not exhaustive but are rather meant to offer insights into different plausible futures and inform policies and adaptation strategies; our methodology is discussed in more detail in a forthcoming paper (Van Ackern & Detges, forthcoming). Possible impacts of climate change in the context of the three scenarios are discussed in section 3 of this report.

Lastly, our quantitative analysis involved exploratory data analysis[5] and regression analysis. We studied historical data on climate trends, climate impacts, and trends in food security and conflict (including data on communal violence and violence perpetrated by armed groups and terrorists, as well as on sensitive political attitudes). In particular, we used these data to study the effects of droughts and floods on food insecurity and conflict risk at the level of provinces, *cercles*[6] and *departments* in the study area, as well as at the individual level, using data from the ACLED[7] and Afrobarometer projects.[8] Moreover, we studied climate impact model ensembles from the ISIMIP[9] project in an effort to identify future risks and inform our scenario planning exercise. The results of this work are mainly discussed in section 3 of this report.

[5] Through maps, figures, and descriptive statistics that are partly shown in this report.

[6] A cercle is the second-level administrative unit in Mali. Mali is divided into eight regions and one capital district (Bamako); the *régions* are subdivided into 49 *cercles*.

[7] The Armed Conflict Location & Event Data Project. To see more: https://acleddata.com

[8] See Annex A for more details on utilised data and results.

[9] The Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) "offers a framework for consistently projecting the impacts of climate change across affected sectors and spatial scales. An international network of climate-impact modellers contribute to a comprehensive and consistent picture of the world under different climate-change scenarios" (https://www.isimip.org/).

2. Current challenges to human security and sustainable development

This section presents the main socio-economic and political challenges in the Central Sahel, which, for the purpose of this report, includes Mali, Niger, and Burkina Faso. This section presents the different livelihoods in the region and their relative importance. It highlights the incompatibility between current agricultural expansion, extensive pastoralism, and sustainable (and inclusive) land use: while production has increased, this has come at the expense of grazing areas and soil health, and strained communal relations. As a result, patterns of transhumance[10] have become longer and more dispersed, which is also partly due to the ineffective implementation of grazing regulations.

2.1 Livelihoods

Agriculture, livestock rearing and fishing are the main livelihoods in the Central Sahel. The agricultural sector employs more than 70% of the population in Mali and Niger (National Statistics Institute, 2018) and more than four-fifths of the population in Burkina Faso (FAO, 2014), while the industrial sector engages between 15 and 25 % of the population, mainly in the mining industry, as well as other industries such as textile and emerging food industries. Regional cross-border trade of livestock and derived products (meat and dairy) contributes between 12 and 19% of the GDP of countries analysed (Steenhuijsen Piters et al., 2021). Informal trade is also widespread (Bouët et al., 2020).

Key insights:

- Rainfed agriculture, pastoralism, fishing, and trade are the main livelihoods in the Central Sahel.
- Agriculture in the region is expanding due to rapidly growing demand, often at the expense of grazing areas; however, despite this loss in grazing areas, ruminant production in the region is still growing.
- In the past, pastoralism has often been discredited as supposedly unproductive and conflict-prone, along with a historical political bias towards sedentary agriculture. There have been recent efforts to address this via different initiatives.

[10] Transhumance is the seasonal movement of herds supervised by herders. In Sahelian countries, transhumance is an adaptation strategy aimed at optimising livestock access to water and pasture of sufficient quality (FAO, 2012).

Agriculture

Agriculture in the Sahel is mainly based on rain-fed cereals such as sorghum, millet and maize - and increasingly rice - as well as on cash crops including cowpea, cotton, sugarcane and onion. The main discourses around Sahelian agriculture emphasise its subsistence mode of production, its lack of modern techniques and skills, and above all its low productivity (FAO, 2013). In turn, different factors, including rapid population growth rates (the highest in the world),[11] unsustainable land management, overgrazing, urban growth, and land grabbing shape the factors that drive soil degradation and the expansion of agricultural land (IOM, 2019).

Nevertheless, agricultural production has increased substantially in recent decades in the Sahel. For example, in Mopti, central Mali, cereal production has tripled over the last 15 years, despite high levels of conflict and violence (ICG, 2020).[12] This increase has been mainly due to the expansion of agricultural land, which in turn can contribute to desertification and potential disputes between communities. According to FAOSTAT data, areas under cultivation have grown from 2009 to 2018, albeit at different rates: 6.4% annual average in Mali, 2.7% in Burkina Faso, and 2.3% in Niger. However, in Niger, where uncultivated arable land is scarce, agricultural expansion has significantly slowed to a growth rate that is only half of that during the period of 1989-2008 (FAOSTAT, 2019).

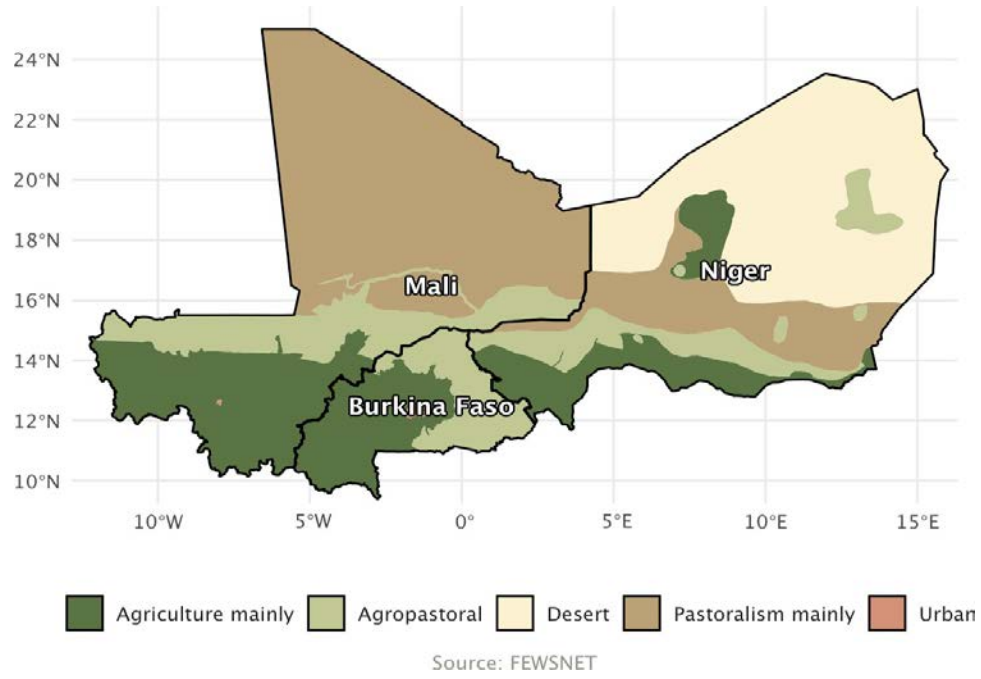

Figure 1: Main livelihood zones in the study area[13]

[11] The growth rate in Niger is 3,8%, the highest in the world. In Mali, it is 3% and in Burkina Faso, 2,9% (World Bank, 2021).

[12] Total cereal production was 420,000 tonnes in 1999-2000, and 1.21 million tonnes in 2018 (Annuaire Statistique du Mali, 2018).

[13] Map adapted from FEWSNET livelihood zone maps: https://fews.net/fews-data/335

Agricultural production has steadily grown in Mali since 2012; in Niger, production has been unstable but with an upward trend in recent years (FAOSTAT, 2019). In Burkina Faso, agricultural production grew by 5.4% annually between 2008 and 2010; and by 6.2% annually between 2011 and 2013, on average (for cereals, the growth rates over these two periods are 10.4% and 4.8%, respectively). More recently, crop production growth in Burkina Faso declined to 3% between 2014 and 2019. The overall share of irrigated agricultural land is very low in the region, mainly due to a lack of appropriate technology and of adequate investment to make use of available water. In Burkina Faso, the land area equipped for irrigation was just 1.7% of all arable land in 2013 (FAO, 2014). Agricultural yields have mostly increased in the study area, but remain lower than the sub-Saharan average. In Niger, yields have been stagnant (FAOSTAT, 2019).

The increase in production has also been related to population growth, different forms of human mobility (i.e.rural-urban, urban-urban, and to different surrounding countries), and urbanisation. Although dietary habits, especially in rural areas, have remained limited to basic grains, the accelerated processes of urbanisation have led to changes in consumption patterns, with a greater intake of wheat, rice, vegetables, poultry, milk and fish (Staatz and Hollinger, 2016). Most of these food items are imported, but the region has significantly increased domestic rice production (Steenhuijsen Piters et al., 2021). Overall, agriculture can be seen as expanding at the expense of grazing areas; however, despite this loss in grazing areas, ruminant production is still growing. Currently, the important challenge for local, national, regional and international institutions is to increase agricultural productivity in a sustainable way that minimises the impact on other activities such as extensive grazing, in order to reduce the potential risk of conflict.

Pastoralism

Livestock production (mostly cattle, but also sheep and goats) in the Sahel is primarily extensive – transhumant or nomad - or intensive and (semi-) sedentary. Although agriculture is progressively combined with livestock rearing (agro-pastoralism), and ranching is growing in peri-urban areas, transhumant pastoralism remains an important cattle husbandry practice in the Sahel, with 70-90% of herds being moved in line with the seasonal availability of grazing land and water (FAO, 2012). Over the last three decades, transhumant patterns have become longer and more dispersed, especially southward (UNEP, 2011). This trend can be explained by an increase in herd sizes, aridification, and the expansion of agricultural areas into formerly pastoral areas, which force herders to find alternative transhumance routes (Ayantunde et al., 2014). Routing decisions are influenced by the quantity and quality of available pasture land, the location of water points, and access to livestock markets. Other influential factors include the presence of defence and security forces, as well as the levels of security in pastoral areas, marked by the presence of non-state armed groups and self-defence groups.

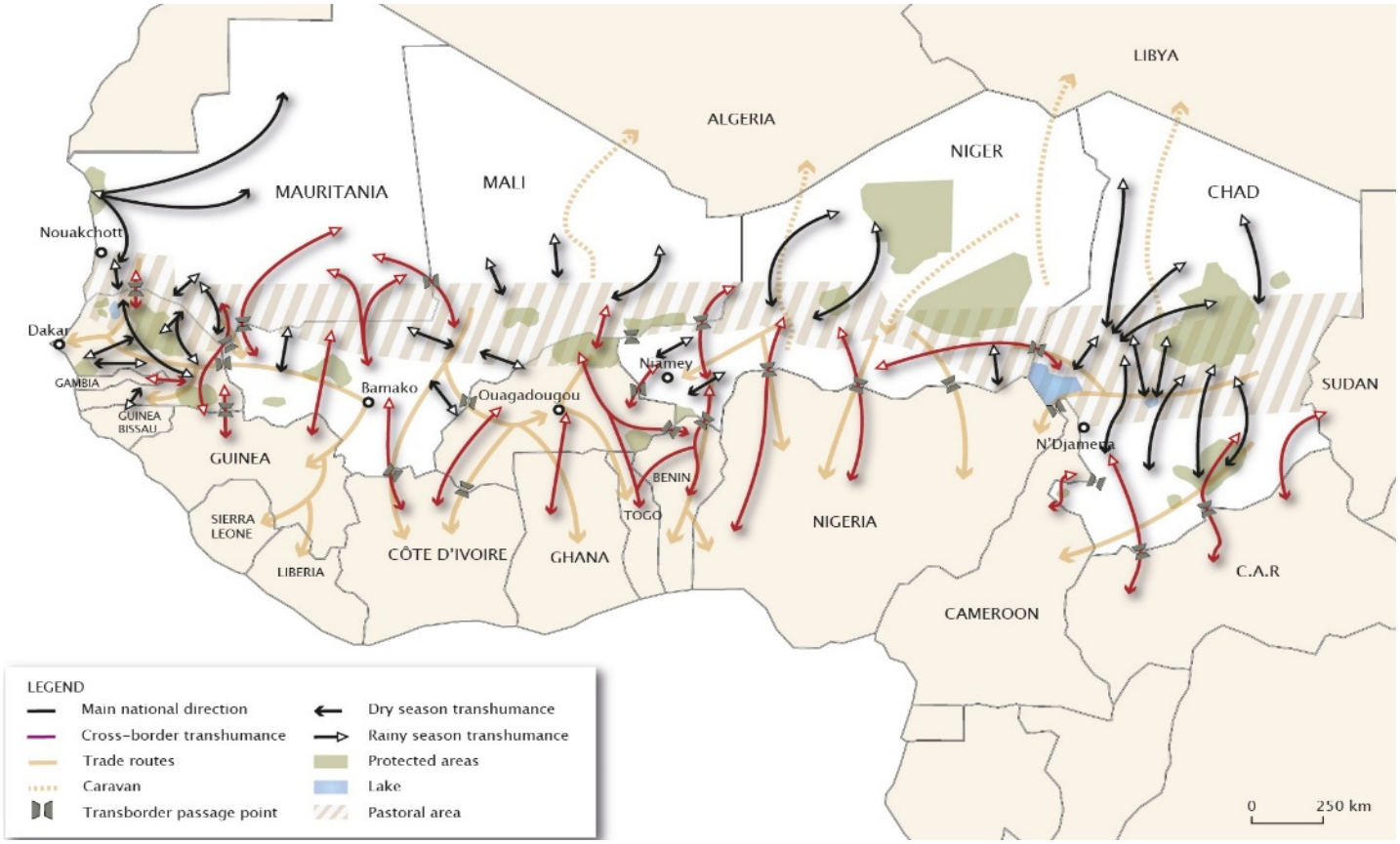

Figure 2: Overview of cross-border herd movements and commercial cattle trade channels[14]

National and regional protocols regulate livestock corridors in order to guarantee access to grazing resources (McPeak & Turner, 2012). At the regional level, livestock mobility is regulated by the 1998 Protocol on Transhumance of the Economic Community of West African States (ECOWAS). Mali has had a pastoral charter since 2001, while Burkina Faso and Niger approved their pastoral codes in 2002 and 2010, respectively (FAO, 2012). These regulations, however, remain difficult to apply due to rapid herd growth, land degradation, changing fodder availability, and conflicts - resulting partly from a poor implementation of regulations (Brottem & McDonnell, 2020).

In the past, transhumance has often been discredited as supposedly unproductive and conflict-prone, along with a historical bias towards sedentary agriculture in development policies and narratives (Benjaminsen et al., 2012; Bisson et al., 2021). There have been efforts to address this situation through the African Union's Policy Framework for Pastoralism in Africa (2001), the first political initiative on the continent aiming to ensure, protect, and improve the livelihoods and rights of African pastoralists (Hesse & Thébaud, 2006). Likewise, the Nouakchott Declaration (2013) values pastoralism as a productive activity and way of life to be protected and promoted. Meanwhile, the Global Alliance for Resilience Initiative for the Sahel and West Africa (AGIR), implemented by the European Union between 2014-2020, places the promotion of pastoralism among its main priorities for the long-term development of

[14] Source: FAO (2012)

the region. The overall impact of this initiative, which has received €1.5 million from the European Development Fund, has yet to be evaluated.

Other livelihoods

Fishing activities in the study area are carried out predominantly in the inner delta of the Niger River and Lake Chad, as well as along the Niger, Volta and Senegal rivers. There is evidence of increased production notably along the Senegal and Niger rivers. While estimates are rough, fisheries, processing and trade contribute importantly to local livelihoods (FAO, 2016). In the inland delta of the Niger river, there are as many as 35,000 households dependent on this activity, and fish production can exceed 100,000 tonnes in the best years, according to the World Fish Center (2010). In this area, fishermen develop agricultural diversification activities, mainly based on rice, or opt for seasonal mobility by moving to where the fish congregate. Although human mobility is common in floodplains that do not allow permanent settlements, it is also quite restricted, as it is marked by the migratory patterns of ancestors who previously negotiated and obtained rights to exploit certain spots. Growing population density in the area and, above all, conflicts over resource management create further obstacles to mobility (FAO, 2016).

Regarding Lake Chad, fishing is particularly important and accounts for 45% of household incomes in the region. There are two types of fish trade: local and cross-border, directed towards southern Nigeria (Ovie & Emma, 2011). Here too, the expansion of armed groups such as Boko Haram, the fluctuation of water flows according to rainfall, and the reinforcement of the border - or even the closure of historical spaces of movement - between Niger and Nigeria have contributed to undermine livelihoods (Kwarkye & Matongbada, 2021). In Burkina Faso, fishery resources are mainly based on small reservoirs built to collect water and spread throughout the country, which are particularly vulnerable to droughts and water evaporation (FAO, 2016).

Besides fisheries and fish trade, cross-border trade of other products is another relevant economic activity. Imports and exports of basic foodstuffs take place within the framework of the regional market under the Economic Community of West African States (ECOWAS) and West African Economic and Monetary Union (WAEMU). This trade, whether in dairy products or meat, which also involves livestock, contributes between 12 and 19% to the GDP of Burkina Faso, Mali and Niger (Steenhuijsen Piters et al., 2021). Restrictive national policies and informal customs procedures encourage the smuggling of different products, including tobacco, drugs, arms, etc. The size of some of these activities is difficult to measure, but surely exceeds the uranium profits in Niger, according to Grégoire (2011).

Finally, mining is also an important economic activity in all three countries analysed. The extraction of natural resources such as gold in Mali and Burkina Faso, as well as uranium in Niger, are important sources of revenue, but are exploited mainly by multinational companies. Hence, the economic contribution of mining often does not translate into tangible improvements in the macroeconomic situation of the countries. Niger, for example, is the fifth largest exporter of uranium in the world, mainly exploited by France through its international company Areva, now called Orano.[15] Niger also has considerable gold, iron, coal and oil reserves, with oil production began in 2011 through a Chinese company. In the case of Mali, gold is the second largest source of exports in terms of volume (being the third largest producer in Africa), after

[15] Orano has recently announced that the company will leave Niger due to depleting uranium reserves.

cotton, which historically has been the basis of Mali's export sector. In recent years, there has been an exponential growth of artisanal gold mines in Mali, which is also related to the increase in conflict activity and criminal networks in the region (Boas & Strazzari, 2020). In Burkina Faso, the mining sector is expanding: in addition to gold, the country has other significant resources such as zinc, copper, manganese, phosphate and limestone. There are also traces of diamonds, bauxite, nickel and vanadium in the country (EITI, 2021).

2.2 Food security

Around 14.4 million people were at risk of food insecurity in Burkina Faso (3.5 m), Mali (7.1m) and Niger (3.8 m) in 2020, a level that had not been reached since 2012 and two times more than the previous year, according to the Cadre Harmonisé's food security analysis (2020).[16] Gross cereal production and livestock production were quite satisfactory in Mali and Niger in 2020. However, ongoing conflicts in northern and central Mali, the expansion of extremist groups' activities, as well as COVID-19 restrictions (including border and market closures, and restrictions on personal mobility and transport) among others, deteriorated food access and security in recent years (FEWSNET, 2020). In spite of surpluses in recent harvesting periods, food insecurity during the lean season[17] has left between 3 and 4 million people in a critical food situation (Cadre Harmonisé, 2020). Historically, such acute food insecurity has been more prevalent along the border between Mali and Niger, as well as north of Lake Chad. These places have seen at least some level of acute food stress for most part of the last 10 years (see figure 3).

Key insights:

- Food insecurity in the Central Sahel is caused by multiple factors, including climatic shocks and episodic violent conflicts that displace people and disrupt production and market access in the short term, as well as by chronic factors, notably extreme poverty and social marginalisation.
- Even though food production systems in the region have the capacity to feed local populations, countries continue to import large quantities of basic foodstuffs, especially rice. This makes them vulnerable to international food price spikes and speculation.
- ECOWAS is promoting food security in the region via a number of initiatives and has developed some institutional capacity and political leadership in that domain, but remains dependent on international donors.

According to experts surveyed for this report, food insecurity in the Central Sahel is mainly related to climatic shocks and violent conflicts that displace people and disrupt production in the short term, as well as by more long-term processes such as population growth (Peng & Berry, 2018; FAO, 2019). Social inequalities (e.g. in the access to food and land tenure), and corruption also come to bear, as does poor access to markets - itself often the result of historical international dependence and subordination in relation to trade and official development assistance (ODA).

[16] This is an early warning tool developed at the request of actors in the region (states, IOs, Civil Society, NGOs) and their partners to support decision making and responses to food crises. Annual appeals to donors coordinated by UN agencies such as FAO are made on the basis of the results of each campaign.

[17] This is the period in which resources of the previous year are depleted, which can occur between the first months of the year and the next harvest (around September/October, after the rainy season). It is the most difficult time for rural households.

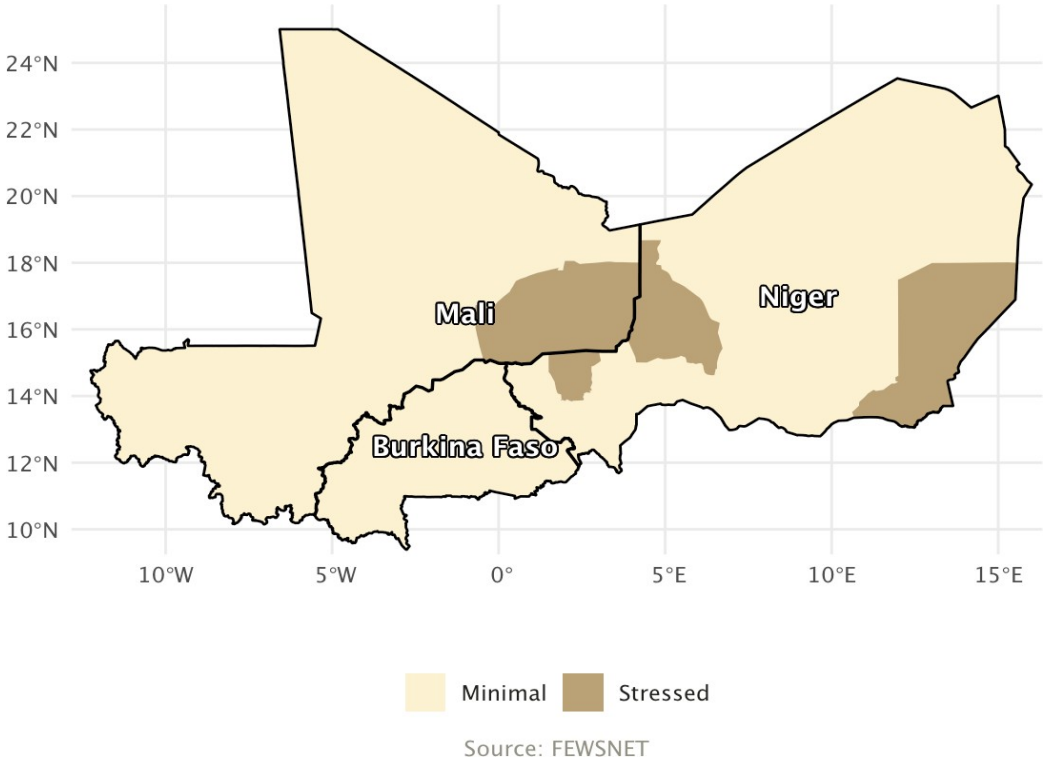

Figure 3: Average level of acute food insecurity in the study region over the past 10 years[18]

In particular, the 2008 global food crisis and the recent COVID-19 pandemic have highlighted the Sahel's dependence on world markets for cereals (e.g. rice, wheat), animal products (e.g. poultry - especially chicken), dairy products and fish, as well as agricultural inputs (Steenhuijsen Piters et al., 2021). Even though Central Sahelian food production systems have the capacity to feed local populations, they continue to import large quantities of basic foodstuffs, especially rice. This makes them vulnerable to international food price spikes and speculation, as witnessed during the 2005 famine in Niger (Olivier de Sardan, 2005).

Regional mechanisms and response to food crises

To promote agricultural and economic development, strengthen food security, and improve the prevention and management of food crises, ECOWAS adopted its own agricultural policy (ECOWAP) in 2005. Following the food price crises in 2008, its implementation process accelerated. However, this has not yet achieved significant productivity gains or brought about structural change in agriculture and the food economy. National agricultural investment programs did little to durably improve incentives for private investment in agricultural marketing and trade, as well as in food processing and distribution. This is despite the fact that the 2008 crisis - and subsequent crises in the early 2010s, due in part to climatic shocks - highlighted the insufficient resilience of markets and the high risk to vulnerable households of losing access to food markets (Bricas and Goïta, 2018). In recent years, more attention has

[18] The FEWSNET Food security classification scheme identifies 5 levels of acute food insecurity: “Minimal”, “Stressed”,” Crisis”, “Emergency”, and “Famine”. Acute food insecurity, as measured by FEWSNET, is also different from more latent or chronic forms of food insecurity that prevail in the region.

been given to the challenges of regional market and trade development, and the competitiveness of regional agrifood value chains.

ECOWAP also prioritises the development of the livestock sector. It has therefore adopted a common regulatory framework for the cross-border movement of livestock, especially for transhumance between Sahelian and coastal countries. The lack of a common perspective between the two regions on how to develop the sector has resulted in the poor coordination of national regulations on cross-border livestock movement and trade (Tondel, 2019). The Sahelian countries' approach to transhumance has been somewhat accommodating, with a historical tendency to let herds graze where grazing conditions are best, as long as tensions with local communities are limited. Coastal states have exercised increasingly strict control over livestock movements, due to increasing pressure on land resources. Thus, in practice, there has been little harmonisation in the regulation of livestock mobility among ECOWAS countries (APESS, 2015). On the contrary, they have often adopted ad hoc measures, sometimes contrary to regional agreements and regulations (Thébaud, 2017).

Against the backdrop of farmer-pastoralist conflicts, several initiatives have also been launched to promote a more harmonious and effective development of the livestock sector. In particular, the Regional Investment Program for Livestock Development in Coastal Countries (PRIDEC) aims to complement programs targeting Sahelian countries, and the local dairy offensive promotes investment in the dairy sector. Given the high level of food insecurity risks related to natural hazards, West African regional organisations play an important role in preventing and managing food crises. For this reason, ECOWAS has created the regional food security reserve as a tool to better respond to emergency food aid needs, complementing national and community stocks of staple foods. The regional reserve is composed of national staple food reserves pooled among member states (one-third) and a common financial reserve (two-thirds). In 2017, a first regional physical stock of over 11,000 tonnes of cereals (maize, millet, sorghum and rice) was pooled among four-member states (OECD, 2018). Since then, the stock has been expanded to about 30,000 tonnes. This stock was first used in 2017 to provide food assistance in northeastern Nigeria and again in 2018 in several countries.

The Sahelian countries also rely on the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), which has a mandate to combat food insecurity and desertification in the region.[19] CILSS coordinates the main regional mechanism for food crisis prevention and management (PREGEC). It also leads the Food Crisis Prevention Network (RPCA), an international platform for consultation and coordination, under the political supervision of the ECOWAS and WAEMU Commissions, with the support of the Sahel and West Africa Club Secretariat. PREGEC and RPCA promote the implementation of the Charter for the Prevention and Management of Food Crises, which aims to ensure the coherence, coordination and effectiveness of the interventions of the various regional and international actors.

In the face of recurrent food and nutrition crises, regional and international actors have committed to strengthening the resilience of vulnerable populations. These actors have made progress in linking emergency aid with livelihood recovery interventions and the promotion of socio-economic development. However, challenges remain in streamlining food security information and management mechanisms, and in involving

[19] The Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) was created on September 12, 1973, following the major droughts that hit the Sahel in the 1970s. It currently has 13 members, including: 8 coastal states (Benin, Côte d'Ivoire, Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal, and Togo); 4 landlocked states (Burkina Faso, Mali, Niger, and Chad); and 1 island state (Cape Verde).

economic actors in integrated risk management approaches. The ECOWAS Commission has developed some institutional capacity and political leadership to lead these processes and mobilise financial resources, but remains largely dependent on international donors, including for the regional reserve.

2.3 Human mobility

In the Sahel, seasonal and circular migration has been a way of life for generations as a means of economic diversification and to cope with erratic rainfall conditions; a phenomenon some have called "cultures of mobility" (Hahn and Klute, 2001). Different types of mobility are common in the Central Sahel: nomadism, transhumance, rural-urban migration and temporary migration to neighboring countries, known as exodus (Boyer, 2019). The region is also experiencing forced displacement, mainly due to conflict and violence, but also to climatic shocks. Estimates put the number of internally displaced persons (IDPs) in the region at more than 2 million, as well as 850,000 refugees in the area, mostly from Mali (UNHCR, 2021). The largest number of IDPS are currently in Burkina Faso, followed by Mali and Niger. Many of these IDPS are located in settlements within or close to urban areas (R4 Sahel, 2021; IOM, 2020).

Key insights:

- Mobility, in its different forms, is essential to livelihoods in the region as a way of diversifying sources of income and living with challenging economic and climatic conditions.
- Therefore, the countries of the Sahel have established protocols on free movement. Yet, these are contravened by restrictive policies under the aegis of European border reinforcement strategies.
- Mobility in the region is mainly internal and emigration is mostly to coastal West African countries. Only a small fraction of Sahelian migrants set out for Europe.
- The region is also experiencing forced displacement due to conflict and violence, but also to climatic shocks.

Mobility in the region is mainly internal and remains within Africa, historically reaching the Gulf of Guinea countries like Côte d'Ivoire, Nigeria and Ghana (Boyer, 2003); or North Africa, mainly Algeria and Libya (Molenaar, 2017; Puig, 2017). Only a small fraction of Sahelian migrants set out for Europe,[20] although current conflicts and political instability point to a slight increase of migrants heading north. This stands in stark contrast to the salience that migration through the Central Sahel has gained in EU policy circles during the last few years.

Not least since the so-called “refugee crisis” in Europe and the 2015 Valletta Summit, the EU has been keen on curbing transit flows through the region. It has put in place a strategy of border reinforcement and development cooperation, aiming at the sedentarisation of mobile communities in the region. This system is mainly supported by the EU Trust Fund for Africa, which is backed to 75% by the European Development Fund (EDF) and to 25% by contributions from the member states (Venturi, 2017; Puig,

[20] Historically, migrants from the Soninke group have been present in France due to a long tradition of travel within the community. Other nationals from Burkina Faso or Mali have migrated to EU countries such as Italy mostly as a result of increasing conflicts, although most migration remains intraregional (IOM, 2020).

2020). The EU has focused in particular on stemming flows through Niger,[21] a historical crossroads of African migrations to the north (Brachet, 2009), which in recent years has become an important part of the central Mediterranean migration route to Europe (Puig, 2019). In fact, it was established that 90% of the people arriving in Italy had previously passed through Niger, although this number is declining since the implementation of the EU's border externalisation strategy. This, however, is indirectly encouraging other, more clandestine routes, and exposes migrants to more human rights violations (Brachet, 2018; Pérez & Puig, 2019).

Mobility is essential to livelihoods in the region. The Sahelian countries have protocols on free movement of people, adopted by ECOWAS in 1979 and a specific protocol on transhumance in 1998 (Aduloju, 2015; Idrissa, 2019). Cross-border pastoral movements are increasing between Mauritania and Mali and between Niger and Benin, but herders face increasing challenges when crossing borders (FAO, 2012; IOM, 2019). Informal border crossings continue to prevail, but migration containment policies have led to more controls in the region and violations of regional protocols on free movement (Zanker et al., 2020).

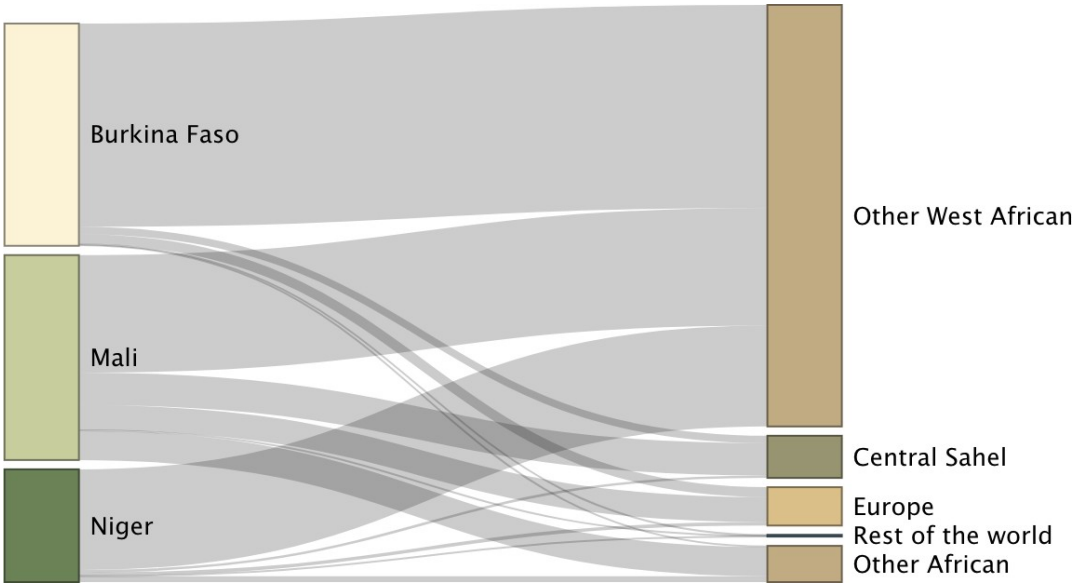

Figure 4: Emigration from our study area between 1990 and 2017 (UNDESA)[22]

Overall, migration patterns continue to be mainly towards coastal countries in the south, and not so much to the north (see also figure 4). Rural-urban migration especially makes up a large part of mobility in the region (Boyer, 2019). This migration may or may not be definitive, but it maintains the links between rural and urban communities through remittances and social ties (Mounkaila, 2002). Growing urbanisation in the region, although still minor compared to other regions,[23] also implies new challenges in terms of urban planning, access to and guarantee of basic services, and social cohesion.

[21] The strategy is also being implemented in Mali and increasingly in Burkina Faso.

[22] Estimated from migration stock data: https://www.un.org/en/development/desa/population/migration/data/estimates2/estimates19.asp

[23] The degree of urbanisation remains low. Only 16.4% of the population lives in cities (FAOSTAT, 2018).

2.3 Inter and intra-communal conflicts

Disputes between farmers and herders have been present in the region for centuries (Hussein et al., 1999; Turner, 2004). In most cases, peaceful coexistence and cooperation have prevailed, but over time there have also been tensions, which in some cases have turned violent, as in recent years (UNOWAS, 2018). The Central Sahel is home to a number of traditionally sedentary farmers (Bambara, Sonray, Malinké, and Fulani), pastoralists (Fulani, Tuareg, and Moor), and fishermen (Bozo), who compete and collaborate over natural resource management and access to land (Brottem & McDonnell, 2020). However, it should be said that farming or herding is not exclusive to specific ethnic groups: increasingly, a combination and hybridisation of activities is observed, which also induces collaboration and tension.

In some areas, such as the northern part of Burkina Faso, for example, income and agricultural activities are cross-cutting between different ethnic groups, especially the Fulani and Mossi. This is also observed in many other areas of Mali and Niger. Thus, income and livelihoods derived from one sector, say agriculture, are not always perceived as losses for another, say pastoralism. In other words, there is often a shared interest in cooperation, a fact that is frequently overlooked in conflict analyses (UNOWAS, 2018).

Key insights:

- Dispute resolution mechanisms to manage access and use of natural resources between communities are widespread across the region, but have come under pressure in recent years.
- The proliferation of weapons and involvement of political elites and armed groups have made communal conflicts more violent and deadly in recent years.
- Historical grievances and social inequalities, as well as incongruous or biased rules for governing the access to resources are important factors underpinning communal violence in the Central Sahel.

Since the destabilisation of Libya in 2011 and the consequent proliferation of weapons in northern Mali, inter-communal conflicts have become more violent, especially in the centre of Mali, in the inner delta region, and the border area between Mali and Burkina Faso (see figure 5). Interestingly, most of the communal violence has taken place in or close to agro- pastoral and border areas, especially in Mali (see figure 4). In most cases, these areas also overlap with historical trade routes, where currently much of the illicit trafficking is taking place (ICG, 2017).

Violence between the historically sedentary and agricultural Dogon and Bambara communities and the traditionally nomadic and semi-nomadic Fulani herders has escalated since 2015, and has led to several massacres (HRW, 2018). But conflict between communities can be traced back to longer-term historical grievances over the management of natural resources, as well as policies that have favoured agriculture over time, to the detriment of pastoralism (Benjaminsen, & Ba, 2018; Bisson et al., 2021).

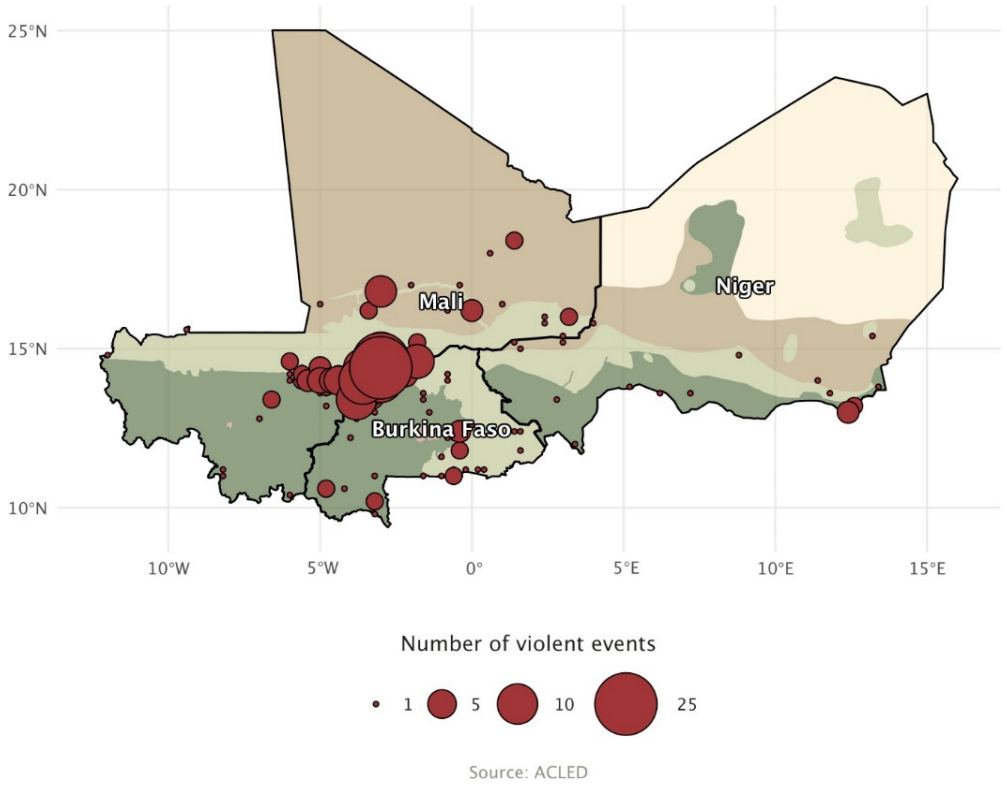

Figure 5: Communal violence in the study area over the past 10 years[24]

Currently, the lack of clear demarcation and non-compliance with protocols for the use of grazing and agricultural areas - by both pastoralists and farmers - have led to agricultural encroachment on pastoral lands, overgrazing, intensification of livestock production and lack of compensation for crop damage (Brottem & McDonnell, 2020). Other factors such as the increasing privatisation of land, exclusive agreements that contravene customary tenure relations, or the current ineffectiveness of conflict resolution mechanisms, including local and traditional ones, have also aggravated tensions (Chevallier et al., 2019).

Tensions occur within communities due to highly stratified social relationships that benefit a small feudal elite (Ba & Cold, 2021). The mismanagement of natural resources often lies at the heart of these conflicts, as do corruption and rent-seeking at multiple levels, from the local to the national level. This is visible in pastoralist communities, for example, whose leaders have historically charged fees for allowing grazing. Today, these Jowros, local Fulani leaders, stripped of their former powers and authority, continue to collect part of these fees and collaborate with state officials to do so (Benjaminsen et al., 2012). This is fuelling grievances among pastoralists, which are skilfully exploited by armed groups (Ba & Cold, 2021). Disputes over grazing areas have also been exacerbated by xenophobic attitudes towards herders of other nationalities in recent years (UNOWAS, 2018).

Local communal tensions and social inequalities are frequently exploited by political elites or armed groups with larger geopolitical ambitions. They are thus intertwined with dynamics that operate at the national level and beyond - for instance, in relation to the penetration of Wahhabi Islam into the region and armed groups adhering to this ideology. This has led to a loss of trust and legitimacy of formal and informal

[24] Armed Conflict Location & Event Data Project (ACLED); publicly available at www.acleddata.com

institutions, and a growing role for non- state actors, including armed groups (Théroux-Bénoni & Assanvo, 2016; UNOWAS, 2018).

2. 5 Violent extremism and armed opposition groups

Violent extremist and armed opposition groups (AOG) have proliferated across the Sahel, especially after the international intervention in Libya in 2011. Although they are active throughout the region, their main scope is currently limited to three areas: northern Mali, especially Tombuctu and Kidal; the Liptako-Gourma region (border between Mali, Niger and Burkina Faso), as well as the Lake Chad Basin (Boas & Strazzari, 2020). In these areas, they (loosely) operate under the umbrella of globalised terrorist groups such as Al Qaeda and the Islamic State.[25] Tensions between these groups are also growing and lead at times to open clashes between factions (Nsaibia & Weiss, 2020).

Key insights:

- Armed opposition groups (AOG), often under the umbrella of globalised terrorist groups, have proliferated across the Central Sahel by exploiting social vulnerabilities and the erosion of state-citizen relations in some areas.
- Foreign military interventions, far from defusing the violence, appear to have exacerbated the situation. Repressive military practices in the region and the arming of self-defence militias have led to many civilian deaths and serious human rights abuses.
- Armed groups have implanted themselves in pre-existing criminal networks and also intervened in natural resource management to curry favour with local communities.

The Islamic State in the Great Sahara (ISGS) with its various subgroups, and the regional Al Qaeda branch, Jama'at Nusrat al Islam wal Muslimin (JNIM), also known as the Group for the Support of Islam and Muslims (GSIM), are the most active groups in the area (see figure 6).[26] It should also be noted that other violent extremist groups are active in the region, for example Ansarul Islam in Northern and Eastern Burkina Faso. These groups are seen as elements of larger social movements, fuelled by social discontent, which challenge the social order (ICG, 2017). The expansion of violent extremist groups has led to a complex security situation, where these groups have implanted themselves in pre-existing criminal networks (Assanvo et al., 2019).

[25] This allegiance is mainly used for leadership, coordination and propaganda, rather than military support, but the submission of local groups to global organisations adds another layer of complexity to the local conflict dynamics in the region.

[26] ISGS was formed in 2015 as a result of different splits and mergers within the Al-Mourabitoun, MUJAO and El-Mouaguiine Biddam groups. This faction swore allegiance to the Islamic State. For its part, the JSIM or GNIM resulted in 2017 from the merger of Ansar Dine, Al Qaeda in the Islamic Maghreb (AQIM) in the Sahel, Katiba Macina and Katiba Al Murabitun, and is under the banner of Al-Qaeda. Its main supporters are the former Tuareg independence rebel, Iyad Ag Aghali, turned jihadist leader of Ansar Dine, and Amadou Kouffa, representing the Katiba Macina.

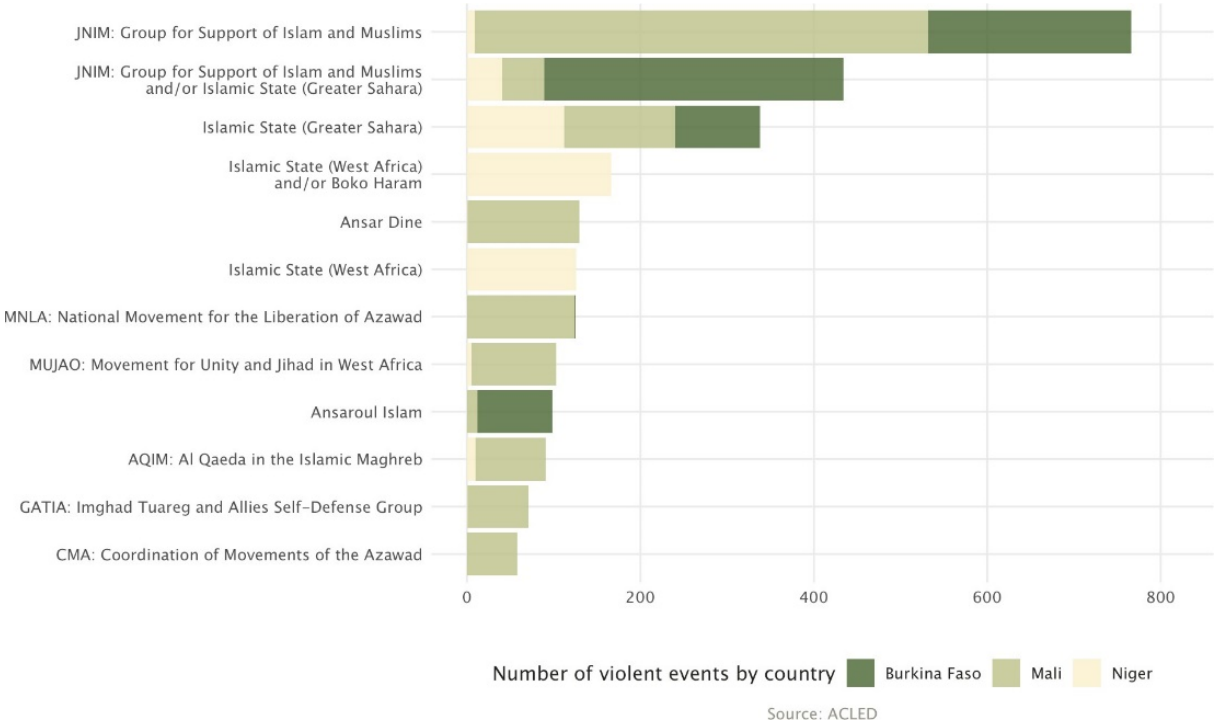

Figure 6: Most active AOG in the study area over the past 10 years

The EU, France and the United States have deployed extensive military missions to contain the proliferation of armed groups in the region. France intervened in Mali in 2013 following the occupation of the northern part of the country by Tuareg rebels and the 2012 coup d'état. It halted the jihadist advance southward by recapturing occupied areas in the north. Since then, the former colonial power has maintained several thousand troops fighting under the umbrella of Operation Barkhane, launched in 2014. In 2015, the Algiers peace accords were signed between Tuareg insurgent groups and Mali's central administration, providing for political decentralisation and redistribution of power, particularly towards the northern regions. However, five years after their signature, the impact of the agreements remains limited (ICG, 2021). Indeed, ACLED data reveal that violence involving AOGs, especially jihadists, has increased significantly in recent years (see Figure 7).

Regional security coalitions have launched several military operations under the umbrella of the Joint Force of the Group of Five for the Sahel (G5 Sahel, which includes Burkina Faso, Chad, Mali, Mauritania and Niger) and EU peacekeeping (MINUSMA) and military training and support missions (EUTM, EUCAP-Sahel). However, the proliferation of armed groups continues, reaching central Mali, as well as the Liptako-Gourma border area, as a consequence of the operations of the G5 Sahel (Boas & Strazzari, 2020).

Foreign military interventions have thus suffered a "relative failure", in the words of the new President of Niger, Mohamed Bazoum (Mohamed, 2021). The multiplicity of actors, plans and interests involved in foreign interventions is hampering their effective implementation (Venturi, 2019). In addition, repressive practices, extortion, abuses and even summary killings by local armies trained by European forces have been reported (HRW, 2020).

According to Luengo-Cabrera (2021),[27] Malian security forces have killed more civilians than jihadist groups.[28] Likewise, the EU has been perceived as remaining somewhat passive, for example, when local self-defense militias, supported by the governments of Mali and Burkina Faso[29] have committed grave human rights violations. Human rights violations are not new, in view of ineffective military structures in the region, but have been aggravated in a context of spiralling violence in recent years (Pérouse de Montclos, 2021).

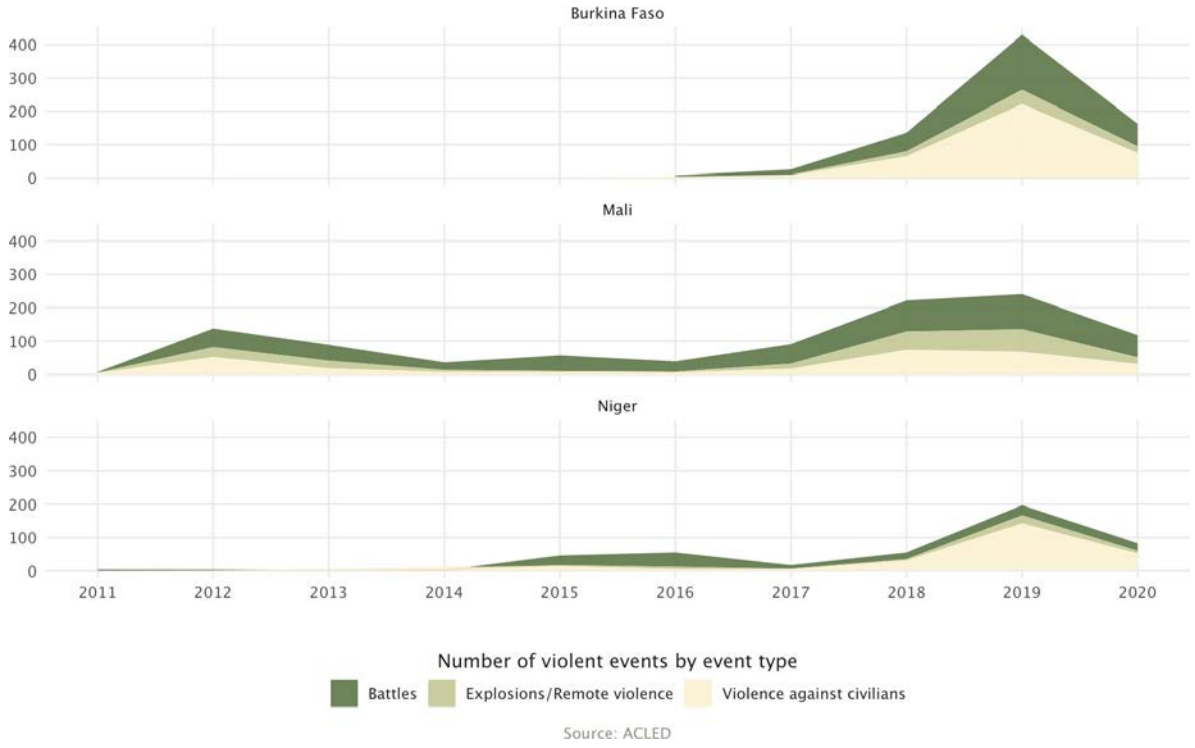

Figure 7: Violence involving AOG in the study area over the past 10 years

The proliferation of violent extremists and AOG takes place in a context of weak state-citizen relations, driven by poor access to essential services in remote areas, lack of trust in justice and arbitration mechanisms, corruption, and the opportunism of political elites (Benjaminsen & Ba, 2018). These groups capitalise on poor state governance and the lack of legitimacy and effectiveness of local and non-formal systems of resource management and conflict resolution (ICG, 2020; Raineri, 2020). Violent repression and human rights abuses committed by police and security forces in the pursuit of (alleged) jihadists further alienate local communities and damage already fragile state-citizen relations (Nagarajan, 2020).

[27] Data presented during the Seminar "Security in West Africa: lessons learned from the instability of the Sahel" (Casa África, 2020) based on ACLED data (2020) and also disseminated by the latest ISS report (2021). https://twitter.com/J_LuengoCabrera/status/1354116585796087808?s=20

[28] Data presented during the Seminar Security in West Africa: lessons learned from the instability of the Sahel (Casa África, 2020) based on ACLED data (2020) and also disseminated by the latest ISS report (2021).

[29] Recent development suggests that governments are encouraging the empowerment of militias. In 2020, the Burkinabe parliament passed a civil defence law in 2020 that allows for the arming and training of local militias to fight insurgent groups. This expands the network of civilian militias in the region and risks exacerbating violent conflicts (HWR, 2020).

The lack of economic opportunities, especially for young people, as well as the social status and prestige that come with taking up arms have also been identified as an important factor in the current conflict context and recruitment into violent groups. This is especially relevant for unmarried young men, and is interlinked with specific notions of masculinity (Brottem & McDonnell, 2020). Other factors influencing recruitment are a limiting gerontocracy, as well as the political and ideological radicalisation and stigmatisation of certain age and/or ethnic groups as alleged supporters or members of armed groups (Nagarajan, 2020). Members from both pastoralist and farmer communities are recruited by AOG, although AOG are more successful among historically disadvantaged groups, which are often pastoralists. However, it is necessary to avoid the dangerous stigmatisation of certain communities, as was the case when the Dan Na Ambassagou ethnic militia was created to fight communities that allegedly supported jihadist groups. This led to the perpetration of massacres against the Fulani, which in turn led to reprisals and an increase in inter-communal violence (UNOWAS, 2018).

A range of factors determine how these groups operate and relate to conflict dynamics in a particular area: their capacity (strength and resources), their objectives (desire to settle in the area, to expand their recruitment base, etc.), their members, and the particular social context of the conflict zone. This results in a range of positions, either being directly involved in the conflict, acting as “mediators”, or adopting a position of non-interference (Assanvo et al., 2019).

Research also points to the intricate linkages between illicit and organised crime and armed and violent extremist groups. This includes border areas such as the Liptako-Gourma area, spanning Burkina Faso, Mali and Niger, where many armed and violent extremist groups are currently active. Illicit activities have been found essential to the establishment, expansion and survival of extremist groups, including in the Liptako-Gourma region (Assanvo et al., 2019). These groups have implanted themselves in pre-existing illicit activities and trading routes, which include trafficking in weapons, drugs, motorcycles and fuel, but also cattle rustling, artisanal gold mining and poaching. Income from these activities has allowed these groups to not only purchase vital supplies (medicine, communication equipment, weapons, fuel, etc.), but also to implant themselves more strongly and permanently, and earn passive or active support from local communities. In some cases, for example, these groups have allowed unrestricted hunting, while providing protection for hunting communities (Assanvo et al., 2019).

Armed groups also intervene in natural resource management to curry favour with local communities. Extortion and (the threat of) violence are common practices to gain control of territory and expand their influence (Assanvo et al., 2019; Ba & Cold, 2021). However, in some instances, they have also provided a kind of “justice” for pastoralist communities, offering them protection and promoting grazing rights (Bagayoko et al., 2017; UNOWAS, 2018). In some areas of Mali, for example, armed groups have forced *Jowros* to significantly reduce the fees charged for access to grazing land (Raineri, 2018).

3. Climate change impact and risk analysis

This section discusses possible effects of and risks associated with climate change in the Central Sahel. This includes an assessment of biophysical impacts, as well as their possible socio-economic and political consequences. Based on the analysis of past trends and current patterns, we discuss possible effects of climate change on livelihoods and food security, human mobility, and conflict risk, and link them to different scenarios. Our argument is built on the basis of insights from expert interviews, our online survey, our quantitative analysis, as well as from our scenario planning exercise with regional experts.

3.1 Biophysical impacts

The Sahel is among the regions in the world most strongly affected by climate change (IPCC, 2019). Increased rainfall variability, increasing temperatures and extreme weather events, mainly droughts and floods, are the most acute effects of global warming in the area both in the present and in future projections (Tschakert et al. 2020). The whole region receives a low to very low amount of precipitation annually[30] and it is particularly sensitive to rainfall variability. It has a very long dry season and a short rainy season, the timing of which fluctuates from year to year (usually between May and October).

Key insights:

- Climate change will likely lead to more rainfall variability in the Central Sahel, and thereby also increase the frequency and severity of extreme events like droughts and heavy rains. According to surveyed experts, these effects will be stronger in ecoclimatic zones with lower rainfall, i.e. in the Saharan and Sahelian zones.
- Over time, climate change is also projected to increase temperatures in the region, in particular in the northern parts of Mali and Niger. Mean annual rainfall is projected to increase in Niger and on the Mali-Burkina Faso border and to decrease in the western part of Mali.
- Surveyed experts expect a greening effect of climate change on vegetation in the region, even though it could be countered by rapid population growth, overgrazing, and other non-climatic factors.

[30] The semi-arid region is divided into three main ecoclimatic zones: Saharan zone -mean annual precipitation around 100-200 mm, such as in Khartoum, Sudan-, a strict Sahelian zone, with mean annual precipitation between 200 and 700 mm, such as in Niamey, Niger, and a Sudanese zone, with mean annual precipitation between 700 and 1,200 mm, such as in Bamako, Mali.

This section focuses on the main biophysical impacts of climate change in the area, including gradual changes in temperature and precipitation, changes in the frequency of extreme weather effects, as well as possible impacts on water resources and desertification.

Long-term trends and gradual changes in temperature and precipitation

Climate projections for the Sahel are not conclusive and differ depending on climate models, periods and geographical zones (Hulme, 2000; Nicholson, 2013). Yet, there is some agreement regarding increased rainfall variability (in time and space); more frequent extreme events, such as droughts and floods; and warming temperatures, which are rising 1.5 times faster than the global average (IPCC, 2019).

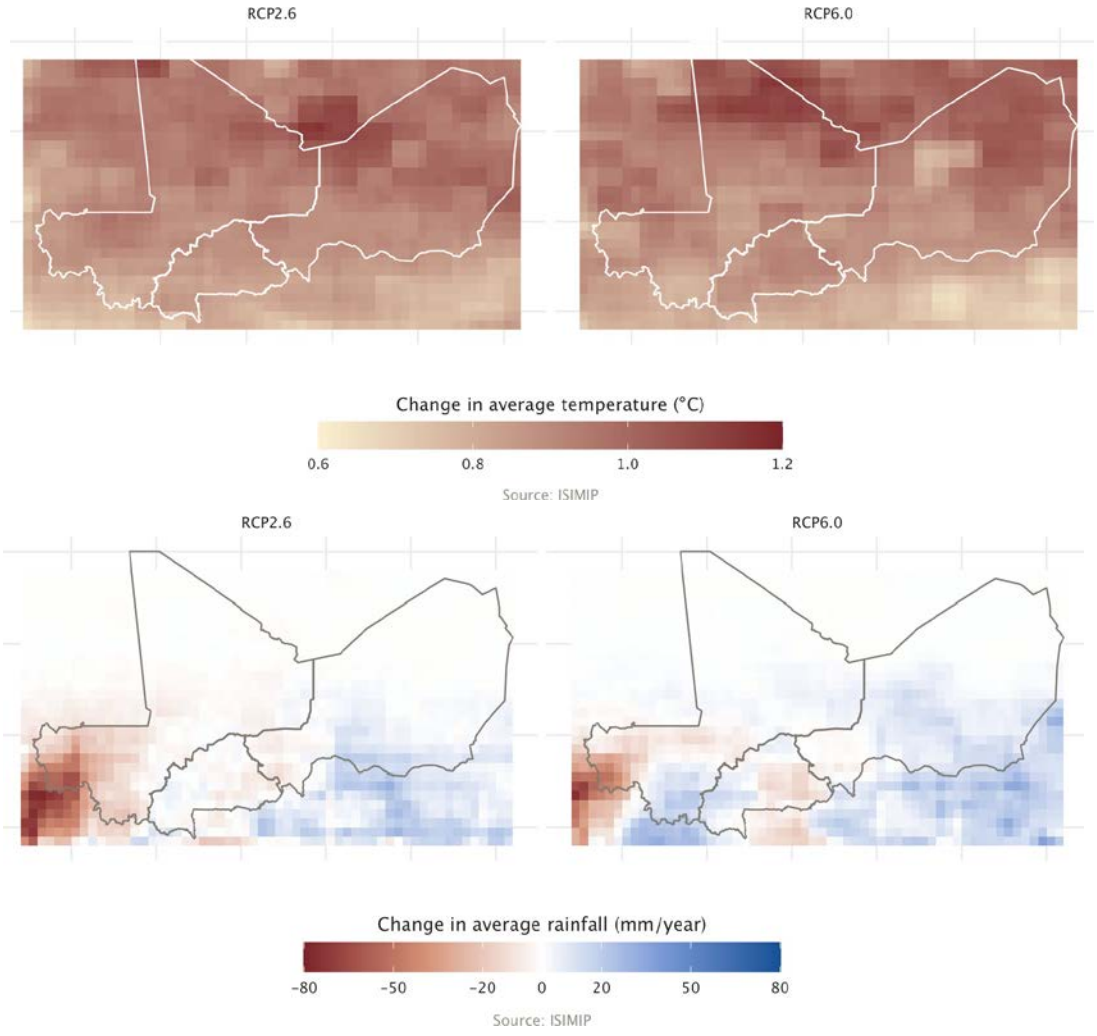

Figure 8: Projected changes in average temperatures and rainfall over the next 30 years

ISIMIP data predict an increase of roughly 1°C in average temperatures in most parts of northern Mali and Niger over the next 30 years. The southern part of our study area, which contains most crop and pastureland, is expected to see an increase in average

temperature of between 0.8 and 0.9°C (see upper panel, figure 8). Predictions are roughly consistent across RCP2.6 and RCP6.0 climate scenarios.[31]

For the most part, average annual rainfall is expected to increase in Niger and along the Malian-Burkinabe border over the next 30 years, albeit with slight variations between RCP2.6 and RCP6.0 scenarios. On the other hand, the western part of Mali is largely expected to see a decrease in average annual rainfall (see lower panel, figure 8). Such changes are not insignificant as 50 mm is more than 10% of the difference between the 600 and 200 isohyets that delimit the Sahel zone (Somé et al., 2013). Considering that water, rather than temperature, is the main limiting factor for agriculture[32] in the region, these changes are all the more relevant. Crops grown in Sahelian countries can withstand modest temperature increases, with yields slightly declining or rising, provided that water availability remains adequate. It should be noted, however, that higher temperatures also tend to increase evapotranspiration and heat stress in plants, which may also negate the beneficial effects of a slight overall increase in water availability.

Changes in rainfall variability and frequency of extreme events

Climate experts identify increasingly frequent and severe extreme events, such as droughts and heavy rains that can lead to devastating floods, as major climate change-related challenges in the Sahel (IPCC, 2019). This is corroborated by the findings of our survey. A large majority of interviewed local experts identify droughts (84%) and heavy rains (72%) as a very or extremely important consequence of climate change. This contrasts with somewhat lower levels of importance for other extreme events like heat waves and bush fires, although these are identified at less “important” consequences of climate change by a large number of interviewed experts (see figure 9).

According to local experts, most of these effects of climate change will be felt strongest in ecoclimatic zones with lower rainfall, i.e. the Saharan and Sahelian ecoclimatic zones in the northern part of our study area. In particular, these include the Gao and Kidal regions (Mali), as well as Tillabery, Agadez, and Diffa (Niger), and, in Burkina Faso, the regions of the Sahel, the North and the Centre-North.

Impact on water resources

In arid areas of the Sahel, river water resources, which depend chiefly on rainfall, are crucial. The main resources are provided by the Niger River (for Mali and Niger), the (Black) Volta River (for Burkina Faso) and the Lake Chad Basin (for Niger). For the Niger River, the most important water resources are found in the Inner Niger Delta region located in central Mali. For the inland delta, the effects of climate change are related to rainfall variability, although water flow quantities are more significantly affected by the construction of the Sélingué hydroelectric dam and the irrigation systems of the Office du Niger (Wetlands, 2010). In the Volta River basin, climate change is expected to lead to higher surface runoff and sediment yield, thus contributing to greater erosion (Op de Hipt, 2019).

[31] RCPs - short for Representative Concentration Pathway - are climate scenarios based on assumptions on future greenhouse gas concentrations used by the Intergovernmental Panel on Climate Change (IPCC). Different RCPs are named after the level of radiative forcing (a proxy measure for changes in the concentration of carbon dioxide in the atmosphere) in the year 2100 for the corresponding scenario. RCP2.6 is considered a scenario with relatively low levels of radiative forcing, whereas RCP6.0 is a scenario with intermediate to high levels of radiative forcing and hence assumes higher concentrations of greenhouse gases in the atmosphere (IPCC, 2021).

[32] Although increased water evaporation due to higher temperatures is obviously a potential risk.

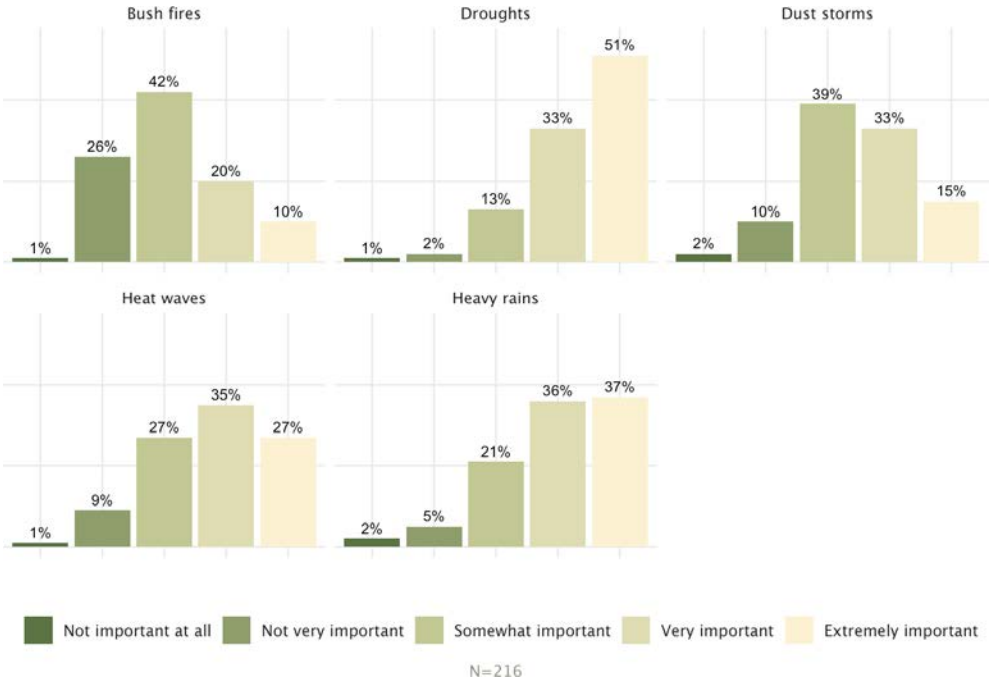

Figure 9: Importance attributed to possible effects of climate change by surveyed experts

Lake Chad, located on the border between Chad, Niger, Nigeria and Cameroon, is often put forward as an example of the adverse effects of climate change on water resources in the Sahel. Political discussions are dominated by the assumption of a shrinking lake. However, new scientific evidence seems to challenge this view. The lake did indeed shrink significantly during the 1970s and 1980s, but in recent decades its groundwater reserves, which account for 80% of its reserves, are increasing (Nagarajan et al., 2018). Moreover, its surface water reserves are in constant flux, depending on seasonal and yearly variations in rainfall. This accounts for variations in the size of the lake and can create the impression that the lake is shrinking when comparing satellite images between specific periods, although this is not entirely the case (Vivekananda et al., 2019).

Positive rainfall trends since the mid-1990s have also led to an increase in the reserves of the Niger and Volta rivers basins, the other main aquifers in the region (Carvalho et al., 2018; Helming et al., 2019). How to exploit these reserves sustainably is one of the main challenges to promote adaptation and resilience to climate change in the region (see also section 4).

Impacts on vegetation

Contrary to what is often assumed, purely climatic drivers would likely lead to a re-greening of the Sahel (Schewe & Levermann, 2017). A narrative of desertification has emerged in the region since the major droughts of the 1970s and 1980s, but there is no scientific consensus about it (Fensholt et al., 2017). Some experts even denounce a “desertification myth” (Thomas & Middleton, 1994), inspired by colonial-era development narratives (Davis, 2016). However, desertification is present in some pockets of Nigeria and Sudan, although the popular assumption of an overall advancing desert does not seem to be confirmed by empirical evidence (Dardel et al., 2014). Earth

Observation studies generally show a positive trend in rainfall and vegetation greenness over the last three decades in the Sahel (Brandt et al., 2015).

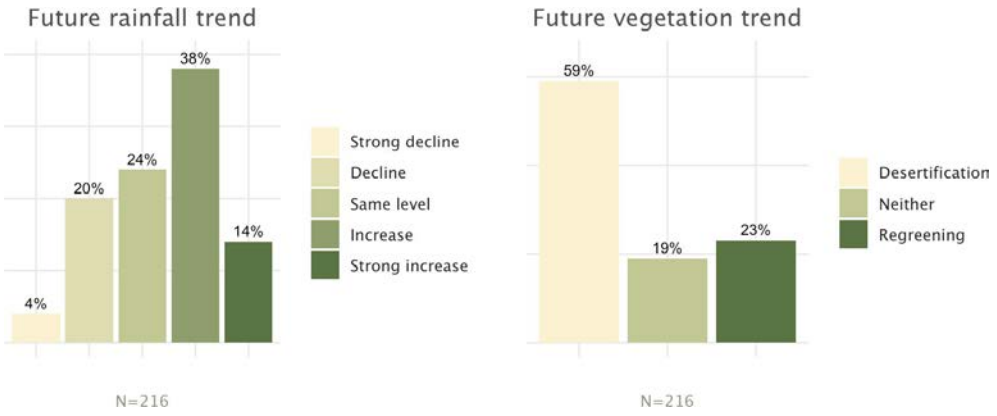

Figure 10: Expected future rainfall and vegetation trends in the Sahel (survey results)

In contrast, non-climatic factors like rapid population growth, overgrazing, and deforestation could counter or even reverse this trend (Hutchinson et al., 2005; Seaquist et al., 2009). Overall, most experts interviewed for this study (58%) expect increasing desertification in the study area compared to only 23% who expect a re-greening, even though most of them (52%) deem an overall increase in precipitation in the study area to be the most plausible scenario for the next 10 years (see figure 10).

3.2 Possible consequences for livelihoods and food security

Climate change impacts in the region are first adversely affecting livelihoods, mainly rainfed agriculture and pastoralism. According to our survey, these two activities, along with mixed agro-pastoralism, are the most severely affected by climate change in Niger and Mali, while other sectors such as trade are expected to be much less affected (see figure 11).

These climate-sensitive activities are likely to be adversely affected by an increased frequency and severity of extreme weather events (especially droughts, extreme rainfall, and floods), more erratic rainfall regimes, and rising temperatures. Over the next years, these could impact agricultural production, and thus threaten rural livelihoods and related commercial activities.

Key insights:

- Climate change is likely to affect livelihoods and compound food insecurity in the Central Sahel.
- The severity of climate impacts will largely depend on irrigation capacities and the presence or absence of safeguards like access to markets, credit, services, and social safety nets.
- Women, youths and other marginalised groups, for whom access to these safeguards is generally more difficult, will be more vulnerable to the effects of climate change.
- Furthermore, the effects of climate change will differ across staple food cropping systems: crops like millet and sorghum could see a decline in yields, while rice may benefit from modest temperature increases.

These effects will be more pronounced in areas with limited irrigation capacities and flood management infrastructure. Farmers with poor access to agricultural inputs (e.g. seeds, fertilisers) and services, or limited knowledge of climate-resilient production techniques - including traditional knowledge - will also be most severely impacted (Zougmoré et al., 2019). Similarly, livestock production could be impacted by increasingly volatile quantity and quality of available grazing resources (FAO, 2012; De Haan et al., 2016).

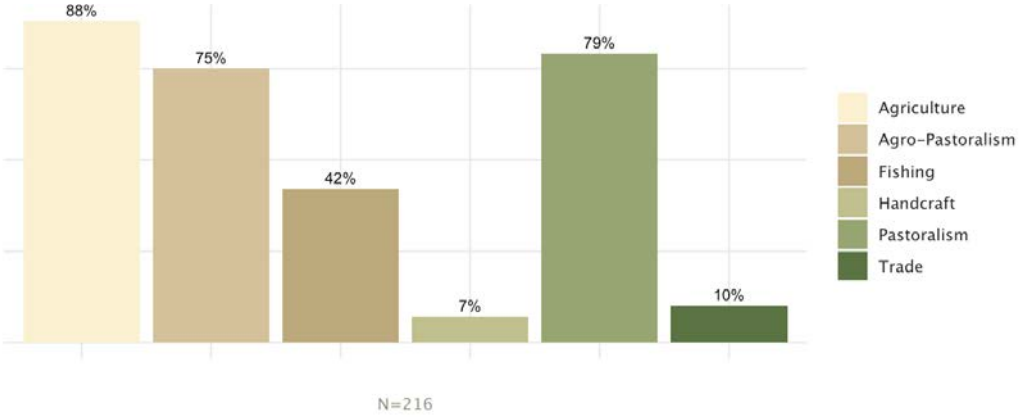

Figure 11: Sectors most affected by climate change in Mali and Niger (survey results)[33]

The effects on rural livelihoods could be severe, especially in the presence of weak social safety nets and limited access to services and other resources (e.g. household assets, savings, credit) that help cope with production shortfalls (Brottem & McDonnell, 2020). Pastoralists are likely to be severely affected if they struggle to access livestock markets and are compelled to sell weakened animals, which is again tied to the quality of infrastructure and level of (in)security in the region. Women, for whom access to land and credit is generally more difficult, will likely be in a more vulnerable situation than men (Görman & Chauzal, 2019).

Possible consequences on different cropping systems

Climate models consistently show that the effects of climate change on agriculture will differ across staple food cropping systems. For example, in the case of Burkina Faso, using four downscaled global climate models from the IPCC AR4, Somé et al. (2013) found that annual rainfall will either increase or decrease, depending on the model. All models, however, predict an increase in the daily average maximal temperature during the warmest month over the country. In Burkina Faso, water availability is a critical factor. Without irrigation, the likelihood that cereal yields will decrease is high, including in the southwestern part of Burkina Faso, which is one of the country's food baskets.

Studies conducted by CILSS's Agrhymet on Sahelian countries showed that average yields of millet and sorghum will fall by 15 to 25% in Burkina Faso and Niger by 2080. An increase in temperature of less than 2°C and small variations in rainfall (more or less 10%) would not cause significant yield losses (RPCA, 2015). Such crops grown in Sahelian countries can withstand modest temperature increases, with yields slightly declining or rising, provided that water availability remains adequate. Maize is particularly vulnerable to climate hazards - in Burkina Faso for example, maize output is highly variable from one year to another. For rice, average yields will go up for both rainfed (2 to 10%) and irrigated crops (10 to 25%). This is due to higher atmospheric concentrations of carbon dioxide, assuming that temperatures will increase modestly and water will be available in adequate quantities. Yet, an increase in interannual rainfall variability and frequency of extreme climatic events (floods and droughts) would negatively affect these yield trends and accentuate food insecurity risks.

[33] Respondents were asked to select as many options as they wanted.

Possible consequences on food security

Climate impacts risk compounding food insecurity in the region, as food availability, especially in rural areas, relies heavily on local subsistence production. Furthermore, poor road and storage infrastructures limit access to more distant markets. Depending on the amount of speculation in food markets and the volatility of (international) food prices, the situation could further worsen, even in urban areas which generally enjoy better access to food markets (Tomalka et al., 2020).

These concerns are also reflected in the results of our survey. A large majority of interviewed experts (72%) identify climate change as a main cause of food insecurity in Mali and Niger, even surpassing other factors like armed conflict (61%) or population growth (38%) (see figure 12).

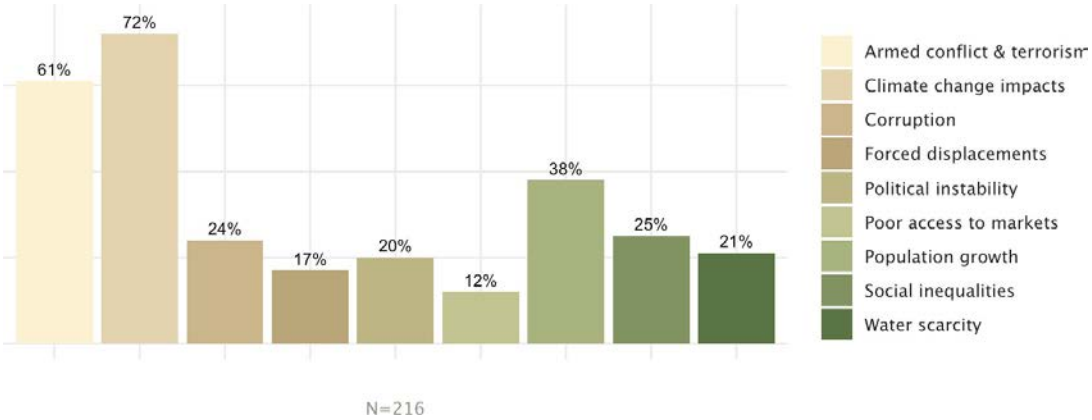

Figure 12: Principal drivers of food insecurity in Mali and Niger (survey results)[34]

The likely impact of future extreme weather events on food security is also corroborated by the results of our quantitative analysis. When looking at historical data for the Central Sahel, we find that areas that experienced a drought or heavy rains during the last growing season of major local crops systematically show higher levels of food insecurity (see Model 1, Annex B). The effect is rather small, however: a 0.05 point increase (on a scale from 1 to 5) for previous exposure to heavy rains and a 0.03 point increase for previous exposure to drought.[35] Interestingly, these effects are more pronounced in areas with lower levels of economic development - 0.08 for heavy rains and 0.06 for droughts - arguably because of lower coping capacities in those areas (see Model 2 & 3, Annex B).

Likewise, when overlaying Afrobarometer data[36] with historical climate information for the study area, we see that respondents living in localities recently affected by growing season drought are about 18% more likely to report greater difficulties in providing themselves with enough food (see Model 5, Annex C). Given that climate experts currently expect more frequent and severe extreme weather events in the region,

[34] Respondents were asked to identify up to three options.

[35] These effects might seem small overall, given that food insecurity is measured on a five-point scale in our data. Yet, it should be noted that we only estimate the effect of isolated extreme events. Repeated or prolonged events (e.g. multi-year drought) are likely to have a larger effect on food insecurity, even though this could not be reliably estimated in this study due to lack of sufficient data. It should be further noted that we only capture the direct effects of extreme events on food security, and that further indirect effects (e.g. through climate shock-induced displacements etc.) need to be taken into account, which we could not capture with our data.

[36] https://afrobarometer.org/

these effects are likely to add up in the future. The consequences for food security could be severe if not mitigated by appropriate adaptive measures.

3.3 Possible consequences for human mobility

Climate variability can influence all types of Sahelian mobility, from transhumance and rural- urban migration to cross-border circular migration to neighbouring countries. In particular, rainfall variability and changes in access to water and forage, as well as agricultural encroachment, can lead to unpredictable changes in herd movements that would conflict with established transhumance protocols, corridors and calendars (De Haan, 2016; Brottem & McDonnell, 2020). According to local experts interviewed for this report, herds coming from the north could travel further south in search of water points; this could take place later than usually expected, depending on possible delays in the arrival of the rainy season as a result of increasingly erratic climatic conditions.

Key insights:

- Climate change could lead to more mobility in the Central Sahel, via its effects on local resources, livelihoods, and conflicts.
- However, the most vulnerable households could remain trapped, as climate change affects their incomes and hence ability to move.
- Considering current patterns, most climate-related mobility is likely to remain within West Africa. Still, according to surveyed experts, part of this mobility will also be towards Europe.

Meteorological variability and environmental degradation can provoke loss of livelihoods both for farmers and pastoralists, which in turn can lead to rural-urban migration, depending on means to travel and economic opportunities in cities (Hampshire, 2002). In this sense, mobility is usually more prevalent among wealthier households than poorer families who lack the means for travelling, accommodation, and other travel expenditures. In any case, some people may be trapped (Black et al., 2011). Mobility works as a diversification of financial capacities rather than as a mere survival strategy in this context (van der Geest, 2011; McMichael, 2014). In general, men are more mobile than women. Yet the "Kantché phenomenon" in Niger[37] is an exception. It is a circular, seasonal mobility of women from rural areas of Niger to cities in Algeria, where women beg in city streets and send remittances back to their families. Sometimes they are exploited and forced into prostitution (Oumarou, 2016; Pérez & Puig, 2019). Women engaging in this type of mobility do so in order to respond to challenges in their communities, such as population growth, agricultural expansion, and extreme climatic events, as well as other cultural and social reasons, according to our research.

[37] Kantché is a department located about 70 km from Zinder, the former capital of Niger, and 60 km from the border with Nigeria. This singular phenomenon became known after the death of 92 women and children in the Sahara desert in 2013, but it began in 1975 when women, mostly of Hausa communities, undertook the route to the mines of Arlit, in the north of Niger, in search of domestic work. Afterwards, they continued their journey to Algeria, where they begged in city streets.

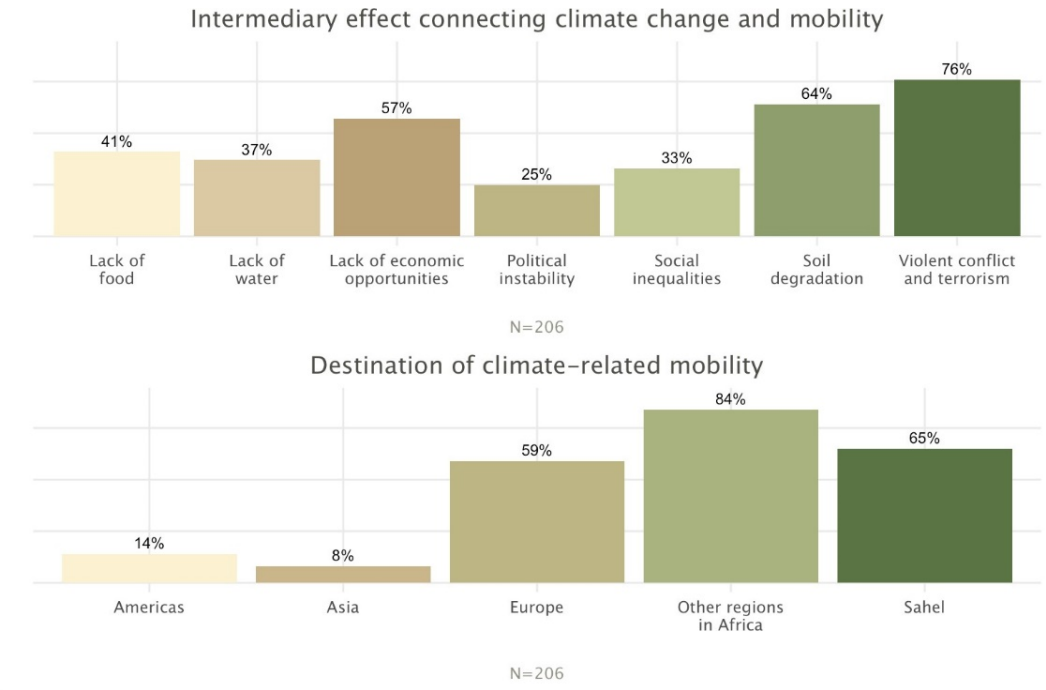

Figure 13: Expected effect of climate change on migration in the study area (survey results)[38]

The overwhelming majority of our surveyed experts (87%) expect more mobility in the Central Sahel in the wake of climate change (result not shown). Moreover, they identify different mechanisms that could connect climate change to increased mobility, including more violence in the wake of climate change (72%), soil degradation (61%), loss of livelihoods and economic opportunities (55%), or food insecurity (40%) (see figure 13, upper panel).

However, mobility is likely to remain mostly intra-regional, with a focus on movements towards coastal countries in West Africa, which would not represent a substantial change to current patterns (IOM, 2020). In fact, a number of experts are critical of the idea that climate change would lead to mass migrations towards Europe (see De Haas et al., 2020). This view is also somewhat reflected in the results of our survey. A large majority of respondents expect climate-related mobility to remain within Africa (84%) or the Sahel itself (65%) (see Figure 13, lower panel). Still, more than half of surveyed experts think that a part of climate- related movements could reach Europe (59%), while only a minority consider migration towards Asia or the Americas as likely (8% and 14% respectively).

[38] Respondents were asked to choose as many options as they wanted.

3.4 Possible consequences for inter- and intra-communal conflicts

Conflict scholars disagree over the specific role of climate change in communal tensions in the Sahel (Benjaminsen & Ba, 2018). A majority of studies find a complex and indirect link between both phenomena, intertwined with other socio-economic, political, and historical factors (Gleditsch, 2012; Kloos et al., 2013).

Key insights:

- Climate change is likely to add an additional challenge to relations among and within communities in the Central Sahel via its disruptive effects on livelihoods, population settlement, and patterns of transhumance.
- According to local experts, climate change is an important driver of communal violence in the region, alongside (and most likely in interaction with) poor resource management and the marginalisation of pastoralist communities.
- Moreover, our results suggest that climate change will aggravate latent tensions between communities rather than directly triggering violent confrontations.

Several mechanisms could potentially connect climate change to communal violence in the region. As seen in previous sections, the effects of climate change could, under certain conditions, affect local livelihoods and food security, or disrupt established patterns of transhumance and mobility. This in turn could, for instance, lead to more disputes over agricultural encroachment, crop damages, and access to water points, all of which could exacerbate conflicts between communal groups (Brottem & McDonnell, 2020).

According to our survey, climate change impacts are perceived to be among the main drivers of communal violence in Mali and Niger (selected by 47% of respondents), along with poor resource management (61%) and the marginalisation of pastoralist communities (44%) (see figure 14). The results are in line with previous work that deems resource management most important for the escalation of communal conflicts in the Sahel rather than resource scarcity per se, underlining the importance of considering environmental impacts in their wider societal context (Benjaminsen et al., 2012; ICG, 2020).

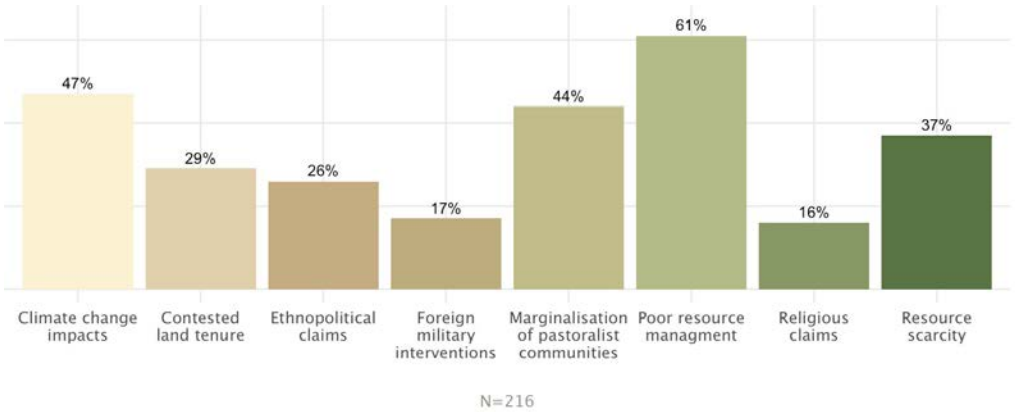

Figure 14: Principal drivers of communal conflict in Mali and Niger (survey results)[39]

Our historical analysis of Afrobarometer data and climate information for the Central Sahel indicates that people recently affected by growing season drought are about 14% more likely to have more negative attitudes towards members of another ethnic community (see Model 6, Annex C). On the other hand, our own quantitative analysis of historical rainfall and conflict data[40] for the last 20 years does not reveal any link between climatic extremes (in particular droughts and floods) and the frequency of violent events between ethnic groups in Burkina Faso, Mali and Niger.[41] Taken together, these results suggest a latent and indirect effect of extreme events, rather than a simple and direct link between climate change, its effects on extreme weather events, and violence.

[39] Each respondent was asked to identify up to three key drivers.

[40] Armed Conflict Location & Event Data Project (ACLED): https://acleddata.com

[41] Again, it should be noted that our analysis does not capture the effect of repeated or prolonged extreme events (e.g. multi-year) and that the results need to be interpreted in that light.

3.5 Possible consequences for violent extremism and armed groups

As explained in section 2.5, the proliferation of violent extremism and Armed Opposition Groups (AOG) is seriously challenging development and peace in the Central Sahel. Climate- induced losses of livelihoods or food insecurity could exacerbate this situation, for instance by creating opportunities for armed groups to more easily recruit destitute farmers and herders in search of food, money, or protection (Ba & Cold, 2021). It also highlights a lack of preparedness and overall failure of public authorities to effectively protect communities from the adverse effects of climate change, which subsequently exacerbates existing anti- state grievances (Ba & Cold, 2021).

Key insights:

- Climate change does not seem to be a direct cause of the proliferation of armed groups in the Sahel, although its disruptive effect on rural livelihoods, food security and discontent with public authorities could indirectly benefit armed groups.
- These effects can be expected to be more pronounced in structurally abandoned and peripheral areas.
- Yet, when it comes to identifying the drivers of terrorism in the region, surveyed experts deemed foreign military interventions and religious factors to be more important than climate change and resource scarcity.

The results of our research suggest that climate change is not a prominent direct cause of the proliferation of armed groups in the Central Sahel. This corroborates earlier findings that describe climate change as an indirect cause of conflict in the region at most (Benjaminsen & Ba, 2018; McCullough et al., 2019).

In our quantitative analysis, we do not find a direct link between either heavy rains or drought and the frequency of violent events involving AOG in the Central Sahel (see Model 4, Annex B). On the other hand, we find evidence for an indirect link, whereby heavy rains or drought lead to an increase of 5% and 7%, respectively, in the frequency of violence involving AOG in the following months, via their effect on local food security. In areas with poor infrastructure and low economic activity, the effect is even larger, nearing 22% for both types of extreme events. These results not only underline that the effects of climate change on AOG violence are more likely to be indirect than direct, but also suggest that they will strongly depend on contextual socio-economic or political factors, which corroborates with previous assessments (Brown, 2019; Nagarajan, 2020).

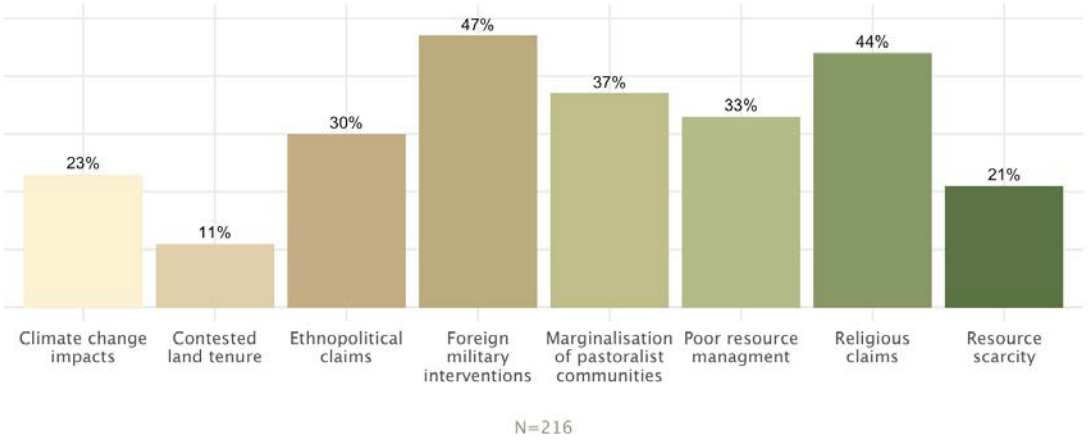

Figure 15: Principal drivers of terrorism in Mali and Niger (survey results)[42]

When it comes to identifying the drivers of terrorism in the region, the results of our expert survey suggest that climate change plays a secondary role. Only 23% of respondents identify climate change impacts as key drivers of violent extremism and terrorism in Mali and Niger. A larger number of experts rather attribute the proliferation of armed groups to foreign military interventions (47%), religious claims (44%) and the marginalisation of pastoralist communities (37%) (see figure 15).

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The different knock-on effect of climate change discussed in section 3 are summarised in Figure 16 below: key biophysical impacts discussed in section 3.1 (in green), potentially lead to downstream effects on livelihoods, food security, mobility and human security (in brown). Yet, these relations are not deterministic but shaped to a large extent by socioeconomic and political factors that determine the region's vulnerability or resilience to climatic and climate-related stresses (in grey). The following section discusses these factors in more detail and presents scenarios for their possible future evolution.

[42] Each respondent was asked to identify up to three key drivers.

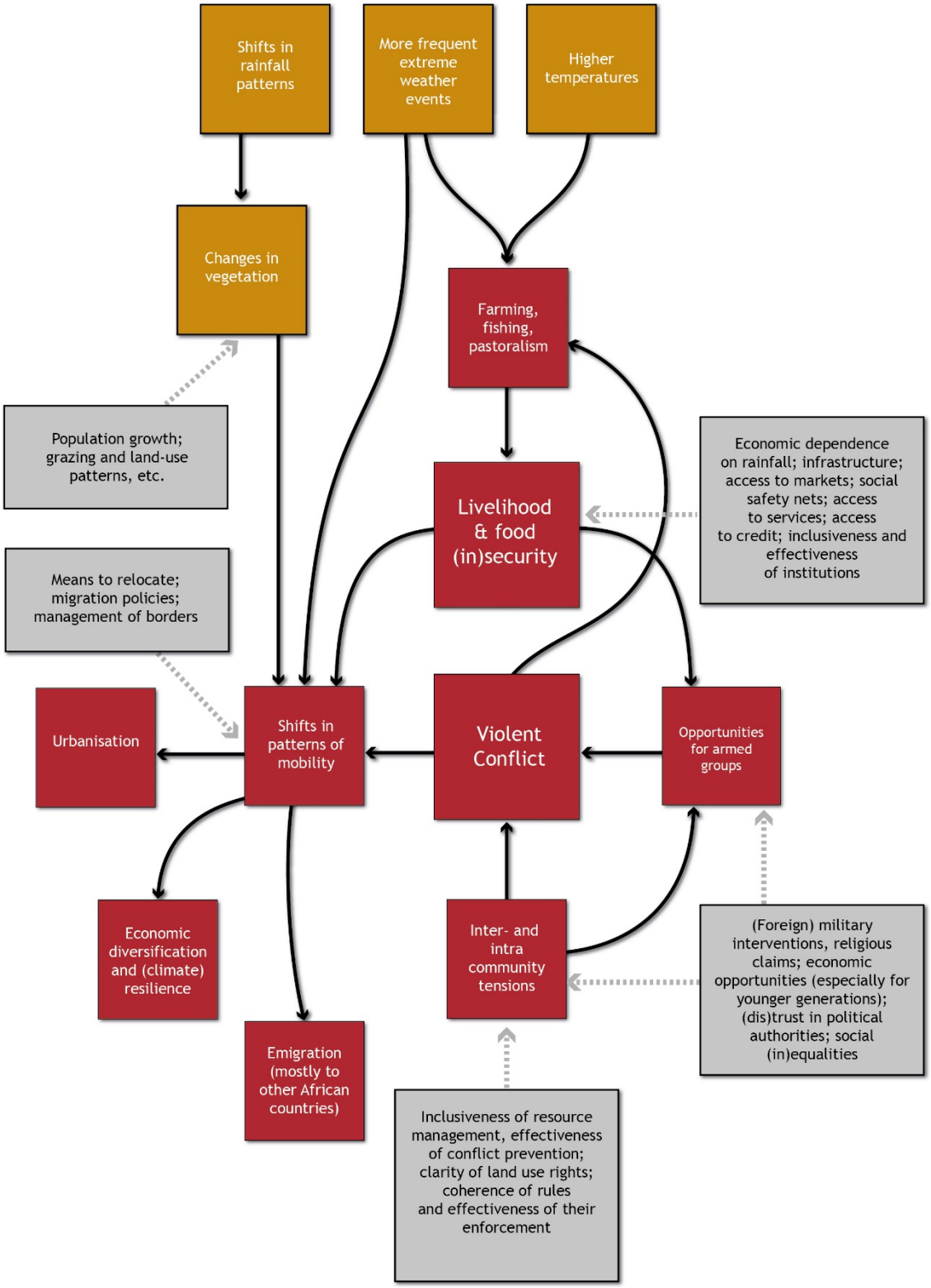

Figure 16: Summary of potential impacts of climate change in cascades

3.6 Socio-economic and political context and future scenarios

All future impacts and consequences discussed so far remain somewhat hypothetical. Whether or not they will materialise will largely depend on the future evolution of socio- economic and political conditions in the Central Sahel and their influence on the region's vulnerability and resilience to climatic change.

According to experts consulted during our scenario planning exercise, the effect of climate change on livelihoods and food security in the Central Sahel will depend on the ability to maintain local agricultural and pastoral productivity in the wake of adverse shocks and pressures. This involves access to land, water, and other production inputs (e.g. seeds, fertilisers), as well as access to relevant services (e.g. agricultural extension services, veterinary services) and production technologies (including traditional knowledge). It also involves access to credit, insurance, and other resources that help bridge climate-induced production losses. Likewise, the state of local infrastructures (including roads, irrigation and flood management infrastructure) and markets for livestock and food will play a key role for people's ability to cope with such shocks, which is also closely tied to the openness of borders and opportunities for cross-border transhumance and trade. Moreover, the structure of local economies, in particular their dependence on rainfall, as well as economic opportunities in non-agricultural sectors are among the most important factors to consider.

Key insights:

- Future climate impacts on livelihoods, food security, mobility and conflicts in the Central Sahel will also depend on the evolution of the region's socio-economic and political conditions that determine its vulnerability or resilience.
- Economic opportunities, inclusive development, and coherent rules, among other factors, will play a key role.
- We envision three different scenarios for the future development of these factors in the region. These are not exhaustive, but rather meant to inform policies and adaptation strategies.

Likewise, social safety nets and access to services (such as health and education) are essential in order to cope with adverse climate change and seek out more climate-resilient livelihoods. This is especially important for women and minority groups, who are often not only more vulnerable to climatic shocks but also less likely to benefit from such services. Access to social services and inclusive institutions will also more generally influence state- citizen relations, trust in public authorities, and ultimately opportunities for armed groups to win over those who have lost their livelihoods to droughts and other extreme events.

People who need to be mobile in order to cope with the effects of climate change will only be able to do so if they have the necessary financial means, social networks, and knowledge of economic opportunities elsewhere. Climate-induced mobility - when it takes place - will also have different economic and social effects, depending on the

quality of urban planning (in the case of rural-urban migration) and on general attitudes towards migrants in receiving communities.

Possible effect of climate change	**Factors influencing the likelihood of this effect**[43]
Climate-induced productionshortfalls, loss of livelihoods and food insecurity	• Economic dependence on rainfall • Ability to maintain agricultural productivity • Infrastructures (roads, irrigation, flood management) • Access to markets (food, livestock, agricultural inputs) • Management of borders • Social safety nets and access to services • Inclusive and effective institutions
Mobility as a coping and economic diversification strategy	• Means to travel and relocate • Social networks • (Knowledge of) economic opportunities elsewhere • Migration policies and management of borders • Urban planning • Attitudes towards migrants among host communities • Inclusive and effective institutions
Increased risk of inter- andintra-communal conflicts	• Inclusiveness of institutions • Effectiveness of the enforcement of rules • Effectiveness of conflict resolution • Coherence of resource governance • Clarity of land use rights
Increased proliferation of armed opposition groups	• Economic opportunities, especially for youngergenerations • Inclusiveness and effectiveness of institutions • Trust in political authorities • Social (in)equalities

Furthermore, the likelihood of communal violence in connection with climate change will depend on the evolution of institutions, conflict and resource management practices, as well as social relations overall. The downside of legal pluralism, in particular the coexistence of sometimes inconsistent rules (formal vs informal, or inconsistencies across levels of governance), will be a major challenge to address in order to prevent further conflicts - climate-related or otherwise. Moreover, a lot will depend on the ability to define and agree on clear land use rights and delimitations of transhumance corridors and schedules. This also includes effective enforcement of rules and compensation mechanisms in case of violations. Similarly, economic opportunities, especially for younger generations, as well as the level of (in)equality between communities, age groups, and genders, will affect recruiting opportunities for armed groups.

As the future evolution of these factors is mostly uncertain, we can envision different scenarios, characterised by different levels of vulnerability or resilience to the impacts described in previous sections.

[43] Identified through expert interviews and a literature review and refined by local experts consulted during our scenario planning exercise.

Scenario 1: "Success of conventional approaches to development"

In this scenario, the resilience of farming and livestock rearing activities is supported by the promotion of large-scale irrigation systems and investment in infrastructure, mechanisation and new production technologies. This potentially leads to an increase in rice yields in Burkina Faso, the southern part of Mali, and the Tillabery area of Niger. This scenario reflects a commitment to the prevailing development paradigms, and relies on improved access to regional and international markets, as well as an increase in national production capacity. However, the strong demand for food, especially in the rapidly expanding cities, is only satisfied by imports, which intensifies dependence on international markets and puts some pressure on the most vulnerable and excluded groups. Overall, Sahelian economies become more resilient to the effects of climate change. However, some groups remain on the sidelines of this development, especially pastoralists and women, as well as people in structurally neglected rural areas.

Cities are rapidly growing in this scenario and migrants are accepted to the extent that they contribute to the economy, which means that mobility is a viable coping strategy for some; but again, those with fewer means remain behind.

Public institutions work efficiently and are strongly oriented towards the benefit of the economy and economic growth. The economic boom - thanks to the strong agricultural sector - has had a positive impact on the governance structure of the region. Corruption has decreased. The pluralistic legal system has been reformed and standardised. Effective institutions largely improve the management of resources and conflicts. Although much is privatised and owned by large companies in this scenario, tenure rights are clearly defined, even for groups that were often marginalised in the past. Although there have been setbacks from time to time and pastoralist communities still have to fight for their rights, the management of agricultural land and grazing and transhumance corridors is mostly effective. This increases the resilience of rural communities and helps prevent tensions in the wake of climatic shocks.

Although some social inequalities persist, the living conditions for a large part of the population in the region have improved. Equality between generations, genders, and ethnic groups has increased to a certain extent, but there is little contact and exchange between the different groups. They rather live separately and independently from each other. In general, economic opportunities and political institutions encourage non-violence, therefore armed groups have limited room to proliferate.

Scenario 2: "Everyone for themselves"

We can also envision a different future in which institutions are struggling with limited resources and corruption, and in which societies are not inclusive.

The benefits of agricultural reforms and investments in irrigation and other infrastructure benefit a few large producers and leave smallholders and especially minority groups behind. These groups are thus more vulnerable to climate-induced production shocks, loss of livelihoods and food insecurity. The agricultural sector neglects traditional knowledge and misses out on opportunities to organise production in a more sustainable way. Over time, the continuous degradation of land and water resources also compounds the region's vulnerability to rising temperatures and more frequent extreme weather events.

Strong demand for imported food in bulging cities implies growing dependence on international markets, and thus also greater vulnerability to speculation and food price spikes, with limited social safeguards to protect the most vulnerable. There is a lot of precarious housing on the outskirts of cities - making residents vulnerable to extreme

weather events. In addition, competition and xenophobia persist between certain communities. Migrants are often stigmatised. The uncertain legal status of migrants both in cities and rural areas makes them vulnerable to expropriation and exploitation, especially in relation to unclear land tenure arrangements.

Ineffective institutions make resource management and conflict resolution difficult. The role of traditional and local authorities has been devalued, and there is a dissonance between customary and formal norms. Corruption and forum shopping are prevalent. An anti- pastoralist bias is present in land tenure policies, further cementing the marginalisation of pastoralist communities. A clear demarcation of grazing areas is largely missing. Competition for resource access is fuelling disputes, which are aggravated by climatic pressures and shocks.

Corruption, ineffective resource management and conflict resolution, as well as growing social inequality have led to a social divide. Confidence in the justice system and mechanisms for resolving conflicts between communities is lacking. Those who are not beneficiaries in this system are susceptible to radicalisation and recruitment by armed opposition groups that offer them an alternative. This scenario sees the influence of armed groups and illicit activities increase, partly also as a result of climate impacts on rural livelihoods.

Scenario 3: “A new direction”

Lastly, we can envision a different future in which societies and economies in the Central Sahel depart from the previously dominant development paradigms, and embark on an alternative path focusing on social inclusion and environmental sustainability.

Production is organised in a decentralised way with a strong focus on sustainable and inclusive practices. Improved resource governance reduces conflicts and allows a more efficient coordination of agricultural, pastoral, and fishing activities. The effective inclusion of traditional knowledge into the technology mix allows productivity to increase somewhat, even though levels remain lower than in the first scenario. The levelling of social inequalities and a strong focus on inclusive governance and services imply lower levels of vulnerability to climate change for large parts of the population. Formally marginalised groups have easier access to credit; however, the banking system is only moderately developed. In addition, this scenario implies less investment in large-scale irrigation schemes and transport corridors, but greater development of managed lowlands (small-scale irrigation) and connectivity between rural and urban areas. It also involves an increased reliance on local production and markets, which increases vulnerability to droughts and floods and other effects of climate change.

Regional integration and partnerships are strengthened and cross-border cooperation contributes to regional trade networks. Cities are not growing as much as in other scenarios. There are good urban planning systems, although drainage systems and urban water infrastructures are average due to lack of financial resources for their maintenance and improvement. Migrants are generally well accepted and integrated into the host communities. These factors facilitate human mobility and make it a viable strategy to cope with climate change.

Resource and conflict management works well, especially at the local level, and land rights are clearly defined. Community committees play an important role for conflict prevention and resolution and deal effectively with conflicts between farmers, fisherfolk and herders. Communities work hard to reconcile and victims of past conflicts are compensated. Women and youth take on an important role in peace-

building. Another key element in this scenario is the promotion of cross-border regional peace programmes.

Thanks to far-sighted and prudent management and support from the diaspora, inclusive and effective institutions have been built. The health and education sectors, in particular, function very reliably. There is an extensive network of rural schools and a system of virtual education through the internet, radio and mobile phones. The state has a strong role, but under public scrutiny as participatory democratic structures ensure accountability. Levels of corruption have decreased substantially. The legal pluralism in the region is appreciated and well regulated. Legal structures are decentralised and respond to local needs. Public grievances are not very pronounced and fewer armed opposition groups are present in the region. In some cases, the loss of livelihoods due to climatic effects makes communities turn to illicit activities, such as livestock theft and trafficking, to make ends meet.

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That said, the three scenarios presented here are not exhaustive. They are rather meant to offer insights into different possible futures and inform policies and adaptation strategies. Considering climate-related challenges and vulnerabilities in the scenarios, a number of opportunities exist to reduce future risks and increase resilience in the Central Sahel.

4. Challenges and opportunities for risk reduction

This section discusses possible options to reduce risks and vulnerabilities presented in section 3, and to promote resilient livelihoods and far-sighted policies in the Central Sahel. We formulate policy recommendations along three broad strands: (1) Promoting resilient livelihoods and food systems; (2) Enabling mobility as an essential coping strategy; and (3) Redefining peacebuilding and security strategies. This section draws on the suggestions and ideas of regional experts and stakeholders consulted during interviews, our survey, and our scenario planning exercise. It is partly based on an assessment of existing measures, of their potentials and shortcomings, as well as of potential implementation challenges. This section also addresses how the EU and its member states could support adaptation and resilience in the Central Sahel.

4.1 Promoting resilient livelihoods and food security

The main livelihoods in the Central Sahel are inextricably linked to one another. Therefore, climate change adaptation measures must be holistic, seeking to maintain a balance between ecosystems and livelihoods, as well as between livelihoods themselves, thus taking advantage of their complementarity.

Key insights:

- Climate change adaptation involves improving agricultural productivity and promoting pastoralism. Experts also call for more engagement on agriculture, more development aid from the EU, and a stronger promotion of intra-regional trade. They are also in favour of reducing the EU's efforts to manage migration flows in the region.
- Agriculture will benefit from the promotion of sustainable small-scale irrigation systems, better-adapted seeds, and the use of traditional soil conservation techniques. Access to markets, weather services, and established transhumance corridors should be improved to make pastoral livelihoods more resilient.
- Strategies such as the Great Green Wall or Climate-Smart Agriculture have room for improvement in their implementation and appropriation by local populations. They should also consider a possible greening effect of climate change and better include extensive pastoralism.

According to surveyed experts, climate change adaptation in Mali and Niger should particularly focus on agriculture: almost 90% of the respondents think that this sector should be prioritised. Furthermore, agriculture has also been prioritised in Burkina Faso's adaptation policy. Prioritising agriculture is closely followed by (intensive)

livestock rearing (82%). Other activities such as (extensive) pastoralism receive less support (44%), and migration, which is an important economic diversification and coping strategy in the region, receives the least support (12%) (see figure 17).

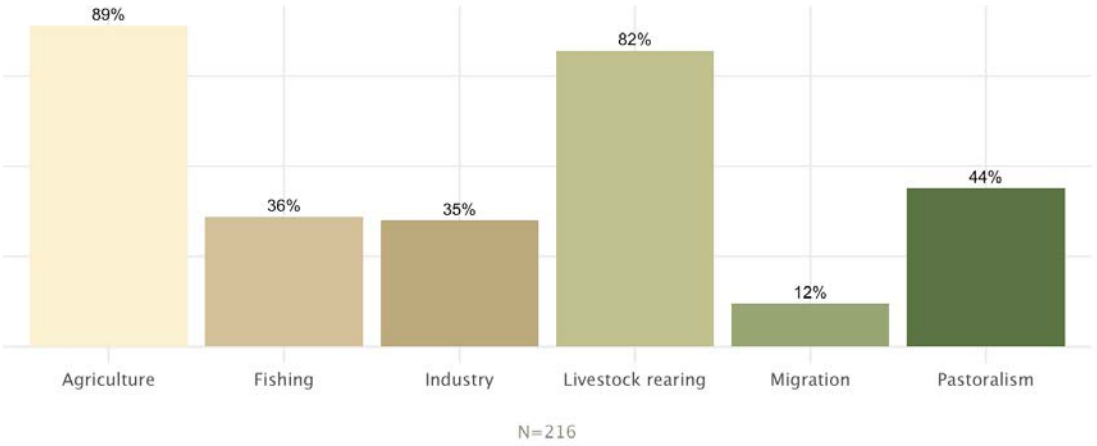

Figure 17: Activities to promote adaptation in Mali and Niger (survey results)[44]

In order to support these activities, most experts suggest improving irrigation systems (72%) and dryland farming techniques (50%), as well as promoting improved seeds (48%) - these are among the top three measures identified by the experts. Other measures such as better access to meteorological information or subsidies are less frequently identified as top priority for adaptation (see figure 18).

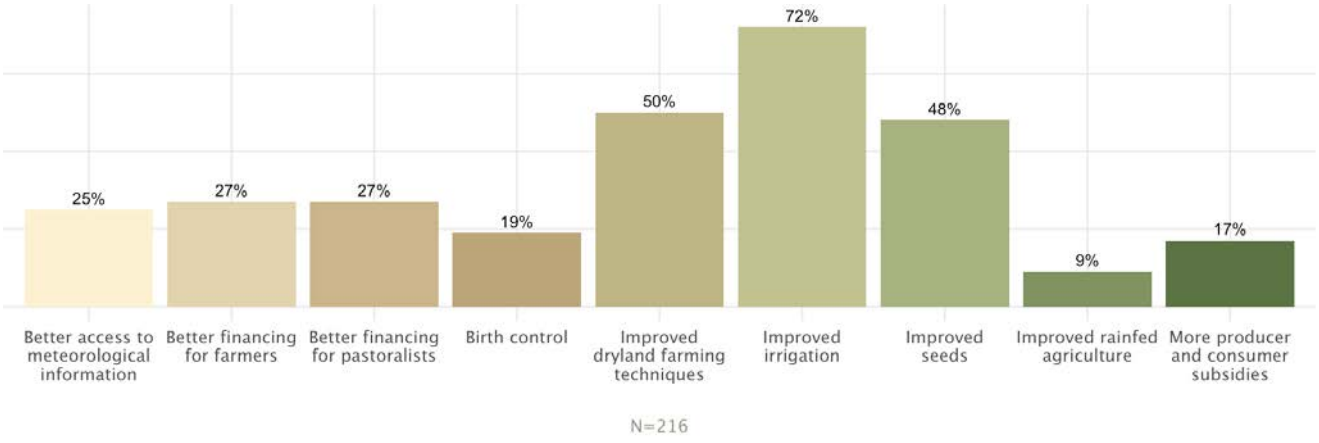

Figure 18: Preferred climate change adaptation measures - Mali and Niger (survey results)[45]

[44] Respondents were asked to identify as many options as they wanted.

[45] Respondents were asked to identify as many options as they wanted.

Accordingly, most surveyed experts (85%) think that **EU efforts towards promoting adaptation in the agricultural sector should be increased**. About half of the respondents are in favour of additional ODA (58%) and further promoting intra-regional trade (46%). On the other hand, a sizable portion of the respondents (62%) think that reducing the military involvement of the EU and its member states in the region would be beneficial for climate change adaptation, as would be reducing the EU's involvement in migration management (44%) (see figure 19).

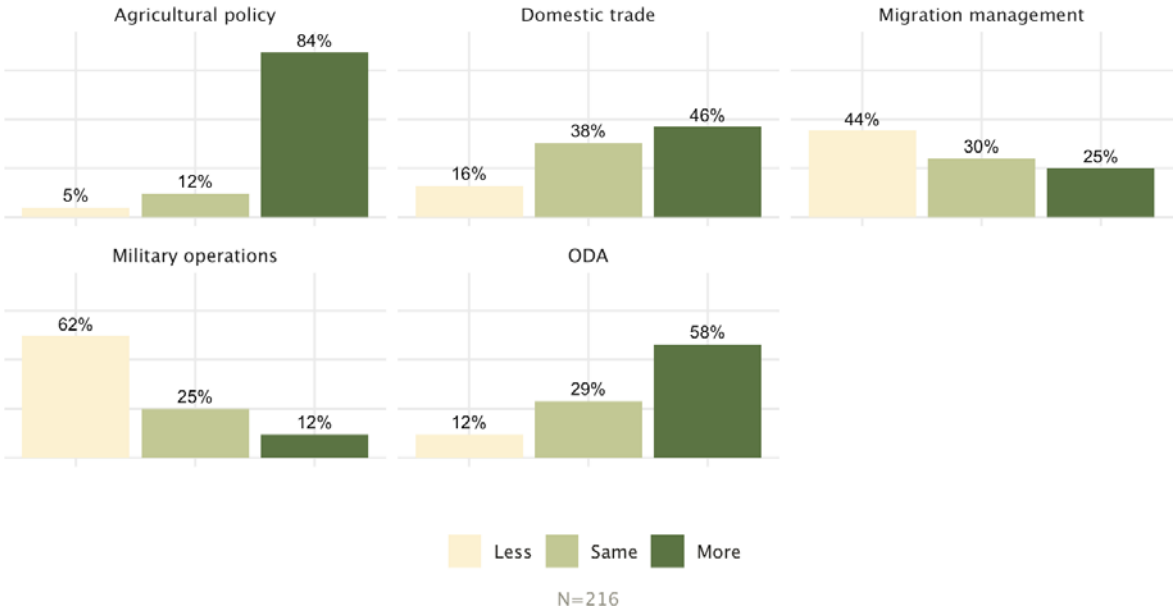

Figure 19: Need for EU support in different sectors in Mali and Niger (survey results)

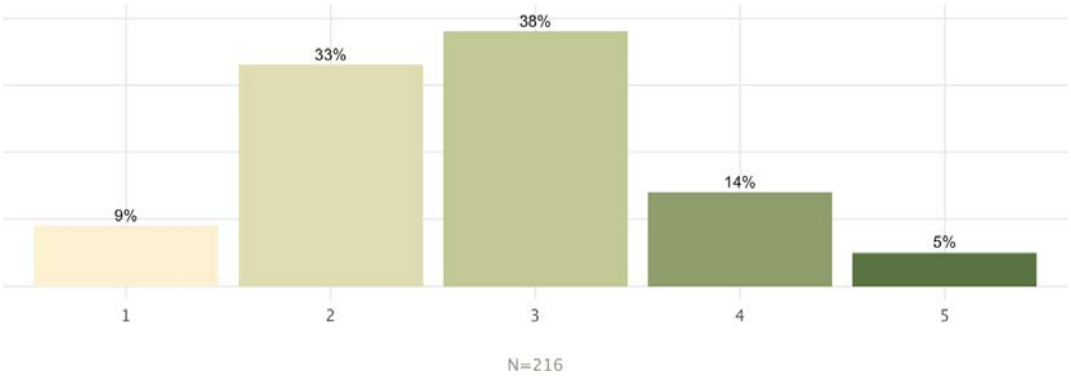

Figure 20: Helpfulness of EU policies for resilience in Mali and Niger[46]

Overall, the surveyed experts are not very satisfied with the impact of EU policies on adaptation and resilience in the region, with a majority of respondents considering current EU policies as rather "unhelpful" than "helpful" in that regard (see figure 20).

[46] Score attributed by survey participants: 1="Not at all", 5="Extremely"

Improving the resilience of agricultural systems

The main agricultural objective for the Central Sahel should be to improve agricultural yields, i.e., to increase production without the need to expand the use of cultivated land. This would require **tapping the region's irrigation potential**. In Burkina Faso, for example, only 0.5% of the total national cropland is irrigated - this represents only 27% of the potentially irrigable land area of 233,500 ha. In Niger, the situation is similar to that of Burkina Faso, while Mali's largest irrigation potential of approximately 566,000 ha is also under-exploited (Helming et al., 2019). Irrigation facilities remain limited and often not exploited in a sustainable way. Development models in recent decades have prioritised large-scale, costlier and less profitable irrigation techniques.

However, priorities seem to be changing. Recent studies highlight the environmental and economic benefits of investing in small-scale irrigation systems. In particular, the installation of motor pumps (which could be a possible option) can mitigate production risks, intensify production, and promote agricultural entrepreneurship (Xie et al., 2014). The type of irrigation systems has an effect on the cost-benefit ratio of farming activities in the region. Manual methods are widespread in the Sahel, but some experts point to drip irrigation as a viable and feasible technique to promote higher profitability and lower environmental impact (Partey et al., 2018). To this end, the technique could be solar- powered.

This form of irrigation could be coupled with a number of **dryland farming techniques**, such as soil conservation and restoration, through fallow rotation mechanisms, use of less aggressive tillage techniques, and prioritisation of mulch or cover crops (Zougmoré et al., 2019). The FAO calls this set of techniques "Conservation Agriculture". This approach has shown benefits in terms of yields (maize, sorghum, and millet crops), soil improvement and crop diversification. These methods involve the use of local and traditional techniques such as zaï (tassa), half-moon, erosion, ditching, subsoiling or sodding, which are highly valued for restoring soil fertility and ensuring its biological balance (Sanou et al., 2016; Boureima et al., 2017). These techniques are still common in many smallholder communities in the countries analysed, and remain successful in terms of yield. They also integrate organic manure for cultivation. However, they require a large number of workers (Jalloh et al., 2013). Despite the high labour costs, overall positive economic effects on the production chain can be expected. In addition, these techniques seem to contribute less to greenhouse gas emissions and more to soil conservation and water harvesting (Schuler et al., 2016).

On the other hand, there have been remarkable advances in recent years with regards to the use of **drought-resistant seeds**. This was (partly) made possible by the research carried out by local centres such as Agrhymet or the Sahel Institute, funded by international organisations. The problem, however, lies in the lack of ownership by local farmers, as our interviews with local experts tends to indicate. This is why local experts are calling for more support, funding and efforts in disseminating their knowledge. They also consider that investments in improved seeds should be linked to the valorisation of rainfed crops. Moreover, they call for using crops that need less water instead of prioritising products such as rice which, despite its nutritional benefits, is not adapted to the regional environment and cultures.[47] Even though the potential for irrigation in the region is great, investments should be made in the intensification of both irrigated and rainfed crops. In fact, rainfed crops have the greatest development potential in light of potential costs and benefits (Helming et al., 2019).

[47] According to agriculture analysts focusing in the area interviewed for this report.

The lack of funding for **infrastructure** in a broader sense, not only for irrigation, but also for transport, storage, processing and energy, is another key issue to consider. Addressing funding gaps in this domain will greatly improve agri-food systems in the Central Sahel, according to interviewed experts. Likewise, improved access to **meteorological information** is important. Increased rainfall variability due to climate change requires better information on the distribution, intensity, and frequency of extreme events that may affect crops. Early warning systems in this domain should be based on modern technology, as well as local knowledge and observations.

Intra-regional trade has been playing an important role in providing market-based economic opportunities for smallholder farmers and livestock producers, despite various barriers to moving agricultural and pastoral products across borders. It has also helped mitigate local production shortfalls when major droughts and floods hit Sahelian countries over the past two decades. **Further efforts to develop regional agri-food markets are needed** to make Sahelian countries even more resilient to shocks, and to ensure the participation of vulnerable producers and households. However, these countries still heavily rely on the import of internationally traded staple food commodities to satisfy their consumption needs (Tondel and Ouédraogo, 2018). In the face of global climate change, which is likely to bring about more volatility in world markets, **monitoring of international market risks** should also be a critical component of Sahelian countries' food security strategies.

Improving the resilience of pastoralist systems

With regards to pastoralism, the most pressing issue is to translate into concrete action the commitments made in the **Nouakchott Declaration**: improving production services; improving the competitiveness of the livestock sector and market access for pastoralists; strengthening the security of assets, rights and lifestyles of pastoralists; improving access to basic services, and promoting political inclusion. This includes strengthening veterinary services, promoting research to support the sustainable management of pastoral resources, facilitating access to credit for decentralised cooperatives, and investing in pastoral water points. This also includes strengthening value chains to take advantage of the increase in demand for animal products, which involves strengthening cooperation between producer organisations of all kinds, and investing in infrastructure, especially transport. It also implies improving market information as well as enabling and monitoring cross-border trade. Furthermore, efforts are needed to improve meteorological information and early warning services, promote income diversification for pastoral communities, ensure access to basic public services, and promote land rights and pastoral mobility approaches. This declaration has already set out the foundations for strengthening pastoralist livelihoods. Now, practical application has to follow.

Our survey proposes several options directly or indirectly related to pastoralism. Increasing funding for pastoral communities ranks relatively high among experts' priorities, and would include several specific measures. The most salient is the consistent application of regional and national protocols regarding transhumance corridors. This implies identifying and adjusting the current transhumance routes: i.e., updating and adjusting the vocation of land, mapping livestock corridors, and defining entry and exit calendars that are flexible enough to accommodate unexpected changes in weather conditions. For this to be effective, there is a need to **improve early warning and information services** and, above all, to make them available to pastoral communities. Various regional and national projects are already moving in this direction, according to interviews conducted with local organisations, but they need to

be supported further, i.e., by promoting greater literacy among pastoralist communities on useful meteorological indicators.

In addition, it is essential to try to **address structural inequalities** between communities, but also within communities in relation to land use and ownership, access to water, as well as access to legal protection (Boas, 2019; Bisson et al., 2021). For example, according to some regional herders' organisations interviewed for this report,[48] conflicts between farmers and pastoralists tend to be resolved in favour of the former, as farmers are often better represented politically and have a better knowledge of legal processes. Farmers also have a greater influence over local authorities. This fuels grievances and distrust of institutions and public authorities among pastoralist communities, which eventually increases the risk of violent conflicts.

In general terms, initiatives aimed at pastoralism as a form of climate change adaptation should: (1) valorise its social, economic and cultural role; (2) guarantee access to resources through mobility; and (3) promote its economic potential in consonance and complementarity with agriculture, thus encouraging the effective implementation of national and regional policies for the promotion of pastoralism.

Existing strategies to improve agricultural and pastoral resilience

Most of the above-mentioned propositions are already integrated into concrete initiatives that are currently being developed. The Great Green Wall (GGW) initiative and the Climate- Smart Agriculture (CSA) model are amongst the most important ones. The first one is a regional initiative to combat desertification. The second is an integrative and comprehensive model that proposes a paradigm shift in agricultural practices and diversification.

Great Green Wall initiative

Inspired by the UN and led by the African Union (AU), the Great Green Wall (GGW) is Africa's flagship initiative to combat desertification. The project plans to replant thousands of trees on a 15 km-wide strip that spans 7,000 km across the Sahel belt, from Senegal to Djibouti. It foresees interventions in different sectors ranging from agriculture, pastoralism, forestry, and fisheries to education, health, and renewable energies.[49] The initiative, revived in 2002, was an old proposal by a European explorer. In 2007, the AU committed itself to the project and has been running it since 2010 within the framework of the Sustainable Development Goals and the 2030 Agenda. The Paris Agreement supported it with pledges of $4 billion, plus $100 million from the World Bank and additional support from France. More recently, during the One Planet Summit in January 2021, an additional $14 billion was pledged to the initiative, mostly by the World Bank, the African Development Bank, the EU, and the Food and Agriculture Organisation of the UN (FAO) (UNCCD, 2021). Although Sahelian governments have been committed from the outset, they have hitherto failed to make the expected progress. According to estimates, only 15% of the implementations have been realised, mainly in Senegal. Despite the project’s ambition, the persistent lack of funding, implementation difficulties, and conflicts in several participating countries have slowed progress.

[48] Such as the Réseau Billital Maroobé (RBM), the Association pour la Promotion de l'Elevage au Sahel et en Savane (APESS), and, at the national level, the Association pour la Redynamisation de l'Elevage au Niger (AREN).

[49] For more information: https://www.greatgreenwall.org/about-great-green-wall

In Niger, Mali and Burkina Faso, public administrations have taken ownership of the initiative, creating national structures for its implementation, and aligning the initiative with their strategies and policies. Objectives are specific and adapted to the challenges of each country, although most of them are shared: conservation and enhancement of particular ecosystems and biodiversity; restoration or conservation of degraded soils for the improvement of agricultural, pastoral, forestry and fisheries production; diversification of farming systems; satisfaction of domestic needs (in wood and/or non-wood products); and the creation of infrastructure to improve basic socio-economic conditions. The initiative promotes adaptation measures and techniques in a holistic manner for different livelihoods, by drawing on local and traditional knowledge as well as modern science. From this point of view, it relies on restoration and reforestation methods such as the Farmer-Managed Natural Regeneration (FMNR), which has successfully been applied in the region's countries in recent years.[50] It also advocates for limiting agricultural expansion and regulating pastoral activities.

The GGW pays particular attention to the promotion of agro-silvo-pastoral sectors to benefit from complementarity between activities and improve resilience and food security overall. This overcomes the simplistic dichotomy between agricultural and pastoralist communities, since "in fact, in one way or another we are all livestock keepers", according to an expert's statement collected for this study. The GGW takes into account the rapid increase in agro- pastoralism in recent years as a consequence of climate variability and the implementation of development and sedentarisation policies (Benjaminsen, 2012). As a new form of diversification, pastoralist communities see farming as a way to increase their income. Vice versa, traditionally agricultural groups have adopted intensive livestock rearing in the face of crop failures (Snorek et al., 2014). The GGW is committed to intensive rather than extensive development of agropastoral activities as a promising avenue. Agro-pastoralism is and will probably be the main activity in the future, as a consequence of climate change and its impacts on natural resources. Public policies are needed to support these hybrid activities by promoting a balance between crop and livestock production and addressing potential land use conflicts (ICG, 2020).

Climate-Smart Agriculture

Climate-Smart Agriculture (CSA) is an innovative and integrated model initially promoted by FAO (2013), which seeks to introduce a set of agricultural tools and policies valuing indigenous practices as well as modern technologies. This model aims to provide a framework for increasing agricultural and livestock productivity, as well as sustainability and equity, by promoting climate change adaptation and mitigation measures. The model is not as innovative in its content as in its approach, which is based on participatory research and the integration of different existing knowledge and techniques. Since 2011, it has been implemented in different villages in Sahelian countries through the Climate Change Agriculture and Food Security (CCFR) initiative. It is currently being implemented only in some specific areas of the three countries analysed (Zougmoré et al., 2019). The aim is to integrate it into national plans, strategies and projects in the short-term, such as the 3N (Nigeriens feed Nigeriens)[51] initiative.

[50] This technique adopted in countries like Niger, especially in Maradi region, has had high rates of success, with the planting of about 200 million trees with soil fertility benefits, providing substantial amount of biomass for household energy, and contributing to food security for about 2.25 million people, according to Tougiani et al. (2009).

[51] The flagship project of former President Mahamadou Issoufou has made some progress in terms of irrigation in areas such as Dosso, but has not achieved its ultimate goal of food sovereignty.

The CSA endorses the solar-powered drip irrigation systems referred to above, climate information systems, and high-yield and drought-resistant crops. It privileges organic fertilisers and takes advantage of complementarities between livestock and crop production (e.g. using manure as compost). It tries to bring together different activities such as agriculture, agroforestry and livestock rearing on the same plot of land, thus improving soil yields (FAO, 2018). It employs local knowledge of soil and water conservation, such as zaï and half-moon, as well as climate prediction and decision-making systems (Partey et al., 2018). Consequently, it promotes natural regeneration or fallow systems, which can also support forest development (Sendzimir et al., 2011). Although the practice of leaving fields fallow has been substantially reduced in recent times, due to population growth and other constraints such as land grabbing or conflicts, it is an integral part of traditional techniques (Nyong et al., 2007).

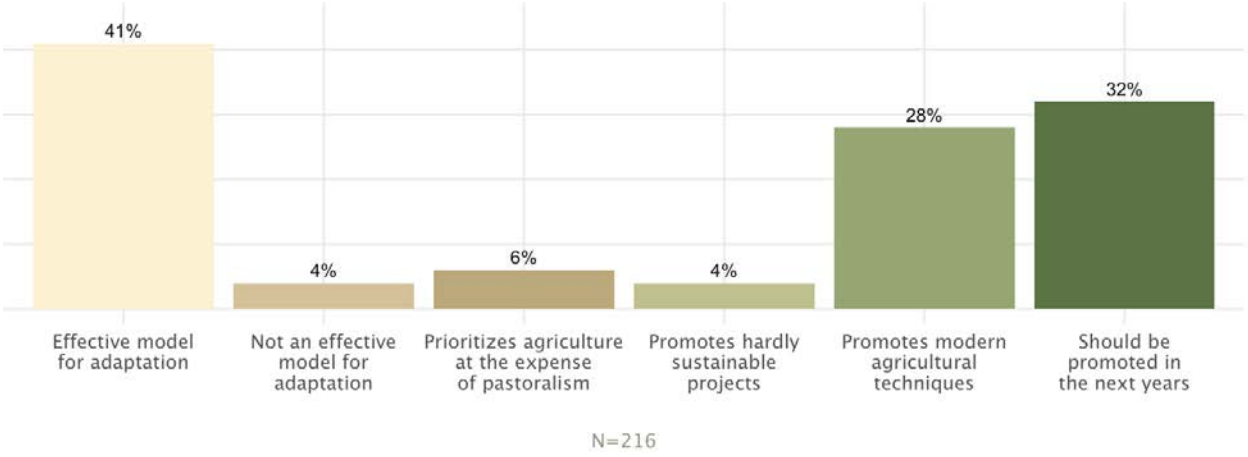

Figure 21: Expert opinions on the Climate Smart Agriculture model (survey results)[52]

Although this model is in an incipient phase of continuous improvement, more than half of the surveyed experts (58%) seem to be familiar with it. Among them, 41% consider it to be an effective strategy for improving climate change adaptation, compared to only 4% who do not; 32% even consider that it should be further promoted in the coming years, and 28% highlight its benefits for the integration of modern agricultural techniques. Only a small minority considers that this model prioritises agriculture to the detriment of pastoralism (6%) or that it promotes unsustainable practices (4%) (see figure 21).

Towards a broader perspective and more inclusive approach

Both the GGW and the CSA can be useful tools, although they have some shortcomings. The GGW's biggest challenge lies in funding and implementation, which has been problematic in certain cases. While the initiative represents hope for the region for international organisations, including the AU and the states involved, for other experts, this “gigantic project” is seen as part of a self-serving desertification narrative of regional and international actors (Davis, 2016; Behnke & Mortimore, 2016; Benjaminsen, 2017).

[52] Respondents could select as many options as they wanted.

In particular, the GGW must consider the possibility of a climate change-induced greening of the Sahel, and thereby adapt some of its measures to this scenario (Dardel et al., 2014; Fensholt et al., 2017). If that is the case, the GGW initiative, which involves a dozen countries and a wide range of projects, would have to **soften some of its discourse on desertification**, of which it has been the main proponent. It should also adapt the scope of its activities to benefit from a possible regeneration of vegetation.

Furthermore, implementation challenges need to be addressed. Building a green wall in the middle of the desert is a discourse easily accepted and defended by local and global public opinion. However, it is important to put in place an appropriate governance that allows for the **participation of diverse actors** besides public authorities involved in the conservation of natural resources. For instance, the Forest Services in Mali have been repeatedly accused of extortion and abuses against the most vulnerable rural communities in Mali (Nagarajan, 2020; Raineri, 2020). Their poor reputation challenges the effectiveness of vegetation rehabilitation initiatives, while intensifying vulnerabilities and potentially contributing to increased conflict.

It is essential to address these issues and avoid negative consequences on people's livelihoods and their ability to cope with adverse climate change. This implies a reconceptualisation of political strategies for the conservation of natural resources in response to human needs and, above all, a review of the responsibility of the authorities in charge of conservation and rehabilitation projects. Hence, preventing abuses of power by responsible authorities and **ceasing paternalistic and heavy-handed approaches to environmental protection** should be a priority (Nagarajan, 2020; Raineri, 2020).

Both our survey and interviews suggest that CSA can be an effective model to achieve sustainable agricultural and livestock development based on intensivity rather than extensivity. However, according to some experts interviewed, far from being an innovative model, it is merely a new name for the already existing, albeit declining cooperation between different livelihoods. Appropriation of this local model by political authorities and donors may thus lead to a **lack of ownership by local communities**. Moreover, although the model includes certain forms of livestock rearing, it relegates pastoralism to a secondary role. Projects continue to focus on sedentary livestock rearing, which is understandable because they are easier to monitor and evaluate. Therefore, transhumance seems to have a place only as an adjunct to agriculture, which does not help in reducing prevalent biases and the marginalisation of some pastoralist communities. These challenges need to be addressed if development policies in the Central Sahel are to truly benefit from synergies between agriculture and pastoralism.

4.2 Enabling mobility as an essential coping strategy

For many communities in the Central Sahel, free movement is essential to cope with challenging climatic conditions. Mobility in the region should therefore be enabled in light of possible climate impacts as discussed in previous sections.

Yet, migration policies in the region are bent on curbing migration flows to the EU rather than responding to the needs of mobile local communities (Brachet, 2018; Boas, 2020). Restrictive migration policies promoted by EU and Sahelian countries hinder effective climate change adaptation in the region (Gemenne & Blocher, 2017; Zanker et al., 2020). Increasing border control penalise vulnerable rural communities who either have limited access to identity documents or are unfamiliar with administrative procedures (Zanker et al., 2020). They also lead to violations of ECOWAS protocols on free movement. For instance, Niger's law 036/2015 against human trafficking has been used to intercept persons in Agadez, more than 800 km from the regional borders in Algeria and Libya, which is in violation of ECOWAS protocols on free movement (Puig, 2019; Zanker & Jegen, 2020).

Key insights:

- Regional mobility in its different forms is a key strategy for adaptation and resilience to climate variability and the long-term effects of climate change. It should therefore be respected and enabled.
- EU-backed migration restrictions and border enforcement policies create obstacles to regional mobility and aggravate existing challenges (climate vulnerability, tensions between communities, strain on public services, etc.).
- The promotion of climate change adaptation in the region must go hand in hand with the respect and promotion of regional protocols on free movement and cross- border transhumance.
- Adaptation and migration measures must also consider the immobility of certain populations due to a lack of means.

According to experts, restrictive migration policies produce more clandestine migration, which exposes migrants to more human rights violations (Andersson, 2016; Molenaar, 2017; Raineri et al., 2019; Brachet, 2018; Puig, 2020). Likewise, they create a number of additional problems in local economies, affecting social cohesion and West African integration (Idrissa, 2019). They reinforce national sentiment and tensions between groups from different countries (Snorek et al., 2014), and trap thousands of people in cities such as Agadez, Niamey or Bamako, which strains local administrations and services and dampens sentiment in host communities and among migrants (Okunade & Ogunnubi, 2018). Moreover, EU funds dedicated to control migration perpetuate and increase predatory and clientelistic structures and policies (Brachet, 2018; Boas, 2020). This could increase suspicions among communities, for example, between northern and southern communities in Niger over the hoarding of funds (Pérez & Puig, 2019).

Importantly, EU migration control policies are inconsistent with EU goals in other policy domains. Control measures contradict several EU-backed multilateral projects on free movement, such as Free Movement of People and Migration in West Africa (FMM) and the related Migration Dialogue for West Africa (MIDWA) project, launched in 2001. Addressing these issues and inconsistencies is key if migration policies are to support climate change adaptation in the Central Sahel, which is also in the EU's interest. Our survey results indicate that EU migration control policies in the region are seen with some scepticism. 44% of the surveyed respondents are even in favour of reducing the EU's involvement in this domain (see figure 19). More coherent policies that are also in line with local needs for mobility could help the EU regain the trust of stakeholders in the region, and would thereby benefit its development and security interests.

Rural-urban migration will remain a challenge in the region, and it calls for continued efforts to improve basic services in rural and urban areas, especially health and education. The main priority should be to **reduce inequalities at the local level, but also between urban and rural areas**, which is sometimes so pronounced that rural-urban migration is seen as the only possible form of social mobility. The conditions for a dignified life in rural areas must be created, by respecting and promoting the economic and social links that mobility makes possible between rural and urban spaces, especially through remittances. To avoid confinement of rural migrants in peripheral urban areas, efforts must be made **to improve urban planning in light of strong urban growth**. This also means avoiding the damage caused by gentrification processes resulting from speculation in central urban areas. A case in point is Niamey Nyala, the modernisation project launched by the Issoufou administration, which has promoted urban development under a discourse of combating informality, but which has displaced disadvantaged social groups to the periphery of the city. Priority should therefore be given to more inclusive and sustainable urban development.

Regarding transhumance, measures should **respect and implement national and regional protocols for free movement across borders** rather than hinder them, as we have seen (UNOWAS, 2018). Regional approaches should be supported, instead of bilateral agreements that may exacerbate the nationalisation of transhumance and aggravate xenophobic sentiments. Migrant status may preclude land ownership in some places, potentially marginalising or excluding certain communities, leading to grievances and tensions. On the other hand, people on the move may be seen as wealthy, which can also stir resentment. In this context, mobility management must be improved, in order to enable mobility as a resilience strategy (Gemenne & Blocher, 2017).

It should be kept in mind that climate change can lead to immobility, and that climate change adaptation strategies must also address the needs of "trapped" populations. In this sense, mobility management, rather than mobility per se, may entail problems that should not be ignored. Neither should mobility-related challenges be used as an excuse to legitimise sedentarisation (Nagarajan, 2020).

Challenges to the implementation of mobility-enabling policies

Enabling mobility in the Central Sahel should, in principle, be straightforward, as ECOWAS already has protocols in place to ensure freedom of movement. Yet, their implementation collides with some obstacles. In particular, the economic interests of organisations and elites that are involved in border control are not negligible. These involve huge profits for European companies and large sums of European funds to local elites (Akkerman, 2018). Furthermore, human trafficking networks proliferate due to the clandestinisation of routes resulting from stricter border restrictions (Andersson,

2016; Brachet, 2018). This set of rents, which are derived from the externalisation of borders, together with the incentive for Sahelian countries to keep the region at the forefront of European external action and development policy, may hinder the relaxation of migration control.

Xenophobia towards migrants is another major obstacle. It can result from grudges against mobile populations that are perceived as wealthier. It can also result from closed-border policies that encourage nationalist claims to natural and economic resources (e.g. pasture, and access to services). National and local elites can remedy this in different ways. On the one hand, they could promote the rights of migrants and facilitate access to land for them. On the other hand, they could strive to better integrate them into governance processes, and provide for the wellbeing of both migrants and host communities in order to reduce tensions and suspicions. Yet, this seems to run counter to current trends, whereby concepts of ethnicity, religion or nationality are used to create imagined walls. The reinforcement of borders in the region is aggravating this and hence not conducive to welcoming people on the move.

Regarding transhumance, conflicts are an important obstacle to the implementation of free movement, as herders cannot stick to established corridors due to insecurity. Similarly, the co-optation of funds by cities at the expense of rural areas, as well as by rural elites at the expense of rural populations, is a challenge, which is only aggravated by chronic dependence on external funds. The limitation of national budgets, and their prioritisation towards defense and migratory control, are further obstacles to the promotion of sustainable development, especially in rural areas.

4.3 Redefining peacebuilding and security strategies

Better access to and more equal distribution of natural resources, especially land and water, were seen by surveyed experts as critical to curbing different forms of violent conflicts. As mentioned in previous sections, local natural resource management mechanisms have increasingly broken down, including local and traditional ones, or have increasingly allowed for rent-seeking and corruption by powerful groups. Resulting grievances have been exploited by armed groups (Ba & Cold, 2021) and have fuelled discontent with the status- quo (ICG, 2017). In this context, the management of pastoralist activities will form a key element, as the unlevel playing field for natural resource management is often disadvantageous for pastoralists (Benjaminsen & Ba, 2008; Benjaminsen et al., 2012; Bisson et al., 2021). At the same time, strategies against violent extremism need to **consider the relationship between armed groups and local communities**, and their role as mediators of local conflicts in some cases (Assanvo et al., 2019).

Key insights:

- Supporting local-owned (peace) processes not only requires (re)-establishing and sustaining peaceful relations between communities, but also facilitating peaceful management of resources. In addition, this would require efforts to review land tenure systems and address legal pluralism.
- These support measures need to avoid a purely technical approach. Rather, they need to consider underlying political factors, and address governance issues.
- Efforts to avoid incoherence of (external) peace and security strategies should be continued, combined with support for a more human security-centred approach to peace and security in the Sahel, as well as reductions to the heavy European military footprint in the region.

Improving and **keeping the delimitation of pastoral corridors up to date** and limiting the expansion of agricultural land are urgent measures to reverse these trends, but they are not the only ones. There is also a need to review the land tenure system and to address the current legal pluralism (Ursu, 2018; Boas, 2019). Different forms of rights need to be clearly defined without harming the most disadvantaged, and by ensuring positive discrimination - or at least not blatant marginalisation - in official frameworks for historically relegated groups. The current coexistence of different rights can certainly create dysfunctions and perpetuate inequalities. While the application of customary law has often resulted in peaceful resolution of local conflicts, legal pluralism can lead to political manipulation or forum shopping between different competing centres of authority.

National actors should focus on decreasing the gaps between national laws, customary practices on land use, and local implementation, for example, of pastoralist rights. This could be supported by better including pastoralist communities in political decision-making processes, both at the national and local levels. In this vein, policy makers should **adopt approaches to natural resource management that validate local and**

traditional conflict resolution mechanisms, but avoid legal ambiguity that leaves room for abuse, rent- seeking, and marginalisation of disadvantaged groups.

Furthermore, it is important to address gender, social, cultural and ethnic inequalities through **bottom-up approaches**, taking into account the problems and needs of local populations without prejudice, and respecting the diversity of actors and motivations (Castillejo, 2015). Disciplines like sociology, anthropology and history, among others, can contribute to this and inform peace-building and natural resource management. This will also help **overcome overly militarised approaches** to security in the region and facilitate conflict prevention through a more sensible human security lens (Pérouse de Montclos, 2021). This means moving towards considering a wider range of relevant factors (e.g. climate variability, environmental degradation, secure livelihoods) and solutions (e.g. education and governance).

National, regional and international actors are currently involved in a range of initiatives that address peace- and security-related challenges, in line with natural resource management, national reconciliation and decentralisation processes. The Algiers peace accord in Mali is at the centre of efforts to ensure national reconciliation, although the recent coup and current transition period put a considerable strain on this process (Baudais & Chazal, 2020). In Burkina Faso, recently re-elected president Kaboré has appointed a Minister for National Reconciliation to address the country's ethnic and political conflicts (Wilkins, 2021). But experts also note considerable challenges to the implementation of current policies and laws, including with regards to pastoralism and agriculture in Burkina Faso. They also fail to address structural marginalisation and grievances among pastoralist communities (Bisson et al., 2021). Furthermore, decentralisation processes have been in place in all three countries for several decades. They have received considerable resources by international partners, but have not been able to improve local governance and participation, due to poor institutional capacity, elite capture and political conflict (Bisson, 2020).

At the regional level, a range of policies have been adopted to address insecurity in the region, for example, the N'djamena Declaration on pastoralism, security and development (2013), and the G5 Sahel Development and Security Strategy (2016). This comes in addition to security and military operations launched by regional and international actors (discussed in section 2). The AU also recognises and discusses climate-related security risks explicitly within its peace and security architecture, for example, through discussion at the AU Peace and Security Council, and the adoption of dedicated declarations such as the Bamako Declaration on Access to Natural Resources and Conflicts between Communities in November 2019. While the AU is seen as aiming to improve collaboration and coordination in this field, experts have noted a lack of tangible policy operationalisation, financial unpreparedness, and limited member state accountability as constraints to the AU's climate-security work (Aminga && Krampe, 2020).

The EU and its member states have also been intensively engaged in the region. For example, the EU's Sahel strategy and regional action plan (2015-2020), which was recently updated in 2021, includes country specific objectives to support food security and sustainable agriculture and sustainable use of natural resources (notably in Burkina Faso). To implement this strategy, the EU is deploying a wide range of instruments and programmes, together with EU member states and international and regional partners like the G5 Sahel. One example is the Programme régional de Prévention de l'Extrémisme Violent en Afrique de l'Ouest et dans le Bassin du Lac Tchad (PPREV-UE), funded through the EU's Instrument contributing to Stability and Peace. But this has also included, for example, funding for the West Africa Police Information System (WAPIS) Programme, support for ECOWAS' peace and security mandate, and funding

for the AGIR-Sahel, i.e. i.e. the Global Alliance for Resilience Initiative on food security (EU, 2015). Other initiatives to support development and security responses in the Sahel include the Sahel Alliance, launched in 2017 by France, Germany and the EU to coordinate donors and the G5 Sahel countries (EPRS, 2020). In 2019, France and Germany also launched the Partnership for Security and Stability in the Sahel (P3S), with the aim to broaden the scope of interventions against cross-border terrorism beyond the G5 Sahel countries. In 2020, French President Emmanuel Macron, together with the G5 Sahel countries' heads of state, launched the Coalition for the Sahel[53] (Pichon, 2020).

Experts have been **critical about the priorities of the EU** (Pérez & Puig, 2019; Schmauder et al., 2020). In practice, the majority of EU funds have been geared towards migration control, counterterrorism and stabilisation efforts (Boas, 2020). Governance issues have been addressed in parallel, predominantly via technical assistance, but not in concert with other European interventions in the region (Schmauder et al., 2020). Issues related to governance reforms are also addressed through political dialogue between the EU and partner countries in the region. According to experts, there has been a tendency to design security, development and humanitarian aid (including support that will include climate change adaptation objectives) in a technical manner, without being informed by systematic political or conflict analysis, and without sufficiently taking into account potential political consequences (Goxho, 2021). In some cases, this approach has led to negative effects which have fuelled conflicts and violence (Boas, 2019; Goxho, 2021; Pérouse de Montclos, 2021).

Towards more coherent and politically sensitive approaches

In this context, it will be crucial to promote a politically sensitive approach to development and security in the region and link it to ongoing decentralisation and reform processes. In areas where conflicts over resources are currently taking place, strategies and aid programmes should be implemented in a conflict-sensitive manner, buttressed by efforts to strengthen inter-communal trust, and social cohesion. Likewise, support for climate change adaptation, including the management of disputes over access to natural resources, can be flanked with support for judicial reforms, such as the implementation of land tenure laws.

There are promising initiatives in the region which can be harnessed and taken as key examples to draw lessons from. One such example is the Inter Collectivité du Sourou Mali. This initiative has brought together 29 territorial entities into one body in the Sourou Valley, bordering Mali and Burkina Faso. To address years of neglect of the river basin, the Inter Collectivité developed not only a Strategic Environmental Assessment (SEA), as was required by Malian law, but also an Integrated Sustainable Development Programme (ISDP). By doing so, the Inter Collectivité was able to ask local municipalities about their development needs and embed those into a framework of sustainable development (von Lossow et al., 2021). This has generated **ownership and participation from the local population**, while also contributing to effective decentralisation. The Inter Collectivité's local governance structure oversees the different projects in the region and has been given approval by central government and ministries to work directly with donors (Molenaar, 2020). This development has taken place, despite the worsening security situation in the region.

[53] https://www.coalition-sahel.org/en/

Yet, the mixed track record of development and security efforts in the Sahel call for a recalibration of strategies towards more coherence among trade, development, security, migration, and climate change adaptation policies. Despite the variety of initiatives in the region, EU activities and funding have mainly focused on stabilising, countering and preventing violent extremism, often from a heavily securitised perspective. While the EU has increased its climate change objectives in the region, this has not been accompanied by the necessary funding nor a conflict-sensitive approach. The adoption of **the EU Green Deal offers an opportunity to promote a more coherent approach** jointly supporting climate change adaptation and security, although the challenges of the past and the side-effects of some implemented policies will have to be taken into account.

Through its multiple actors, plans and interests, the EU's strategy has proven ineffective, with a high economic and human cost. Moreover, it has witnessed the perpetration of a series of human rights violations and crimes (Guichaoua, 2020; Moderan et al., 2021; Pérouse de Montclos, 2021). As we have already seen in section 3.5, this includes abuses, rapes and extrajudicial killings perpetrated by Malian and regional armed forces trained by Europe. For this reason, the majority of our survey respondents (62%) are in favour of a **reduced European security effort in the Sahel**. This is in line with public sentiment in some European countries such as France, where 51% of French citizens no longer support military intervention, according to the French Institute of Public Opinion (IFOP) (Moderan & Hoinathy, 2021). In this context, France raised a possible military withdrawal at the last G5 Sahel meeting, which ultimately did not take place.[54]

France is aware of the growing discontent among local populations towards its security strategy,[55] which is why it wants to involve other European and regional countries in military efforts through Operation Takuba.[56] This mission will be led by the EU, which will remain involved in the region through its recently adopted strategy for the coming years. This recognises the need to give greater emphasis to human rights and development (EU, 2021). Likewise, the EU has developed a roadmap to **address climate risk in defense operations** and activities. Among other things, it calls for training and awareness-raising on the potential negative impact of military missions on the environment and natural resources (EU, 2020). These efforts are welcome, as the objective should be to minimise negative effects in terms of restrictions on mobility or destruction of ecosystems, which have been formulated through short-sighted actions based on military logic.

[54] The French President, Emmanuel Macron, proposed a gradual withdrawal, but in the end maintained his commitment to the continuation of the Barkhane operation. To see the resulting press release: https://www.auswaertiges-amt.de/blob/2442494/45ab58515024cfc8a07d11f2679ca290/2021-02-16-commmunique-de-n-djamena---version-valid%25C3%25A9e-par-les-chefs-d-et data.pdf.

[55] While the 2013 Operation Serval was initially welcomed, especially in southern Mali, the prolonged military presence, its lack of transparency in the management of Kidal and its perceived lack of effectiveness in combating violence have increased animosity towards the former colonial power (Pérouse de Montclos, 2020).

[56] It will involve elite troops from several European countries, including France, Belgium, Sweden, the Czech Republic or Estonia. The force will be fully operational in 2021 with an initial mandate of three years. In addition, the G5 Sahel will maintain its troops, focusing on the Liptako-Gourma border areas. France will remain in command, with the help of other states, including a major one such as Spain, which leads the EUTM mission in Mali with 278 troops on the ground - and a promise to double the number of forces to 550 by 2021.

5. Summary and recommendations

Climate change is and will be an important factor for the future of the Central Sahel. Both its current and future impact, however, are intrinsically linked to social and political factors that must be emphasised when addressing climate-related challenges in the region. To do otherwise would assume the depoliticisation of hunger and conflict and enable policymakers to evade responsibility (ICG, 2020).

That said, climate change will likely have significant impacts on the region, including more rainfall variability, more extreme events like droughts and floods, and higher temperatures over time that will rise faster than the global average. This is supported by the results of our survey of more than 200 experts in the region. Climate models differ on future predictions, yet, using an ensemble of models from the ISIMIP project, we identify:

- An increase of about 1°C in average temperatures over most of northern Mali and Niger over the next 30 years.
- An increase in average temperature of between 0.8 and 0.9°C in the southern part of our study area, where most cropland and pastureland are located.
- Increased mean annual rainfall in Niger and on the Mali-Burkina Faso border, and decreased mean annual rainfall in the western part of Mali.

According to surveyed experts, the effects of climate change in the region will be felt most severely in ecoclimatic zones with lower rainfall, i.e. in the Saharan and Sahelian zones. In particular, these include the northern part of Mali (Gao and Kidal), as well as the Tillabery, Agadez, and Diffa regions in Niger, and, in Burkina Faso, the regions of the Sahel, the North and the Centre-North.

Climate change impacts in the region have the potential to trigger cascading risks for local livelihoods (especially agriculture and pastoralism), food security, as well as communal and state-citizen relations, and could lead to more displacement. In that sense, climate change could aggravate the region's existing challenges. In particular, extreme weather events could thwart the upward trend in agricultural production and harm rural **livelihoods**, which are more vulnerable due to challenges in accessing services and markets. Pastoralists would also be more severely affected by shifts and shocks in the quantity and quality of available grazing resources. The precarious situation of women and marginalised groups, who generally have greater difficulties in accessing credit and land, would likely worsen. Past trends indicate that extreme weather events negatively affect **food security** in the region, as shown in our quantitative analysis.

Such impacts on livelihoods, as a ripple effect, could further influence **mobility** in the Central Sahel. Mobility has been rooted in the region for centuries as a way of life, a strategy of economic diversification, and an adaptation measure to weather variability. Adverse climatic change and the possible loss of livelihoods could lead to further displacement, rural-urban migration, and the intensification of regional migration and displacement across borders. Migration to other African countries will likely by far exceed migration to Europe (see also Puig, 2017; Boyer, 2019). Climate change impacts could also lead to an extension and dispersion of transhumance in search of more and

higher quality pasture and access to markets (FAO, 2012). Yet it should be taken into account that climate change effects can also induce immobility and aggravate the situation of people who lack the means to relocate.

Besides affecting local livelihoods, food security, and established transhumance patterns, climate change impacts can also have an effect on inter- and intra-community tensions and violence, albeit indirectly. **Communal conflicts** are the result of a range of problems, including poor natural resource management and the historical marginalisation of pastoralist communities, the latter being a result of policies prioritising agriculture and the consequent encroachment on pastoral lands. Our quantitative analysis reveals that extreme weather events can strain inter-communal relations. People recently affected by drought in our study area are less likely to have positive attitudes towards members of other ethnic groups. Yet, this would not automatically lead to more conflict. Indeed, we do not find evidence for a direct link between droughts or heavy rains and communal violence when looking at data for the past 20 years.

Lastly, climate-induced economic losses and food insecurity, communal tensions, as well as public discontent with poor conflict prevention mechanisms could all be exploited by **armed groups** to extend their influence. Our results suggest that climate change is not a prominent direct cause of the proliferation of AOG in the Central Sahel. Surveyed experts tend to blame other factors such as foreign military interventions, religious claims, or the marginalisation of pastoralist communities. However, indirect effects of climate change on the proliferation of armed groups via the impacts outlined above are plausible.

Socio-economic and political context and future scenarios

The likelihood and severity of climate change impacts on livelihoods, food security, mobility and conflicts in the Central Sahel will largely depend on the future evolution of the region's socio-economic and political conditions. Experts consulted during our scenario planning exercise identified the following critical factors to consider: agricultural and pastoral productivity; infrastructure (irrigation, roads, etc.); access to local and international markets; social safety nets; effective institutions (both formal and informal); systems of conflict and resource management; economic opportunities for youth; as well as state-citizen and social power relations more broadly.

In particular, large-scale investments in transport and irrigation infrastructure would reduce vulnerability to droughts and floods. Inclusive mechanisms that allow for the participation of women, youth and other marginalised groups would further strengthen regional peace initiatives. Greater resilience would also be achieved in scenarios in which pastoralists and farmers agree on land use and effectively manage emerging disputes. Likewise, it is harder for armed groups to win over people adversely affected by the effects of climate change in scenarios that involve inclusive development and reduced social inequalities.

On the other hand, climate change impacts on vulnerable and marginalised communities are aggravated in scenarios with dysfunctional institutions and corruption, where they fuel grievances and animosity among communities, and create a fertile ground for violent extremism. In such scenarios, climate change impacts also put severe strains on urban planning in rapidly growing cities, and create obstacles for highly mobile economic activities. This increases the climate vulnerability of pastoralists and merchants in particular, and weakens the region's economy in general.

Challenges and opportunities for promoting resilience

Agricultural and rural policies remain very much focused on farm production, while the risks posed by climate change require a more integrated approach. A better integration of the different forms of livestock production with agriculture is a notable challenge, especially as intensive and sedentary livestock breeding is developing largely in parallel with traditional extensive, transhumance-based pastoralism. Moreover, initiatives to foster rural **livelihoods** continue to offer inadequate space for genuine participation of local non-state actors to ensure that they respond to their needs, respect their rights and do not undermine their access to resources that are critical for their livelihoods.

Despite the ambition of projects like the Great Green Wall, insufficient funding, implementation difficulties, and conflicts in several participating countries remain key challenges. In light of the possibility of a climate change-induced greening of the Sahel, experts have noted the need for projects in the region to adapt their measures to this scenario. Some political elites also need to soften their discourse on desertification. Moreover, despite investments in research in recent years on drought-resistant seeds (for example, by local centres such as Agrhymet or the Sahel Institute), there is a lack of local ownership of climate change-adapted seeds among farmers.

A lot of information has recently been produced about the impacts of climate change on agriculture and **food security**, yet this has not led to a significant revision of policies and initiatives to adapt to long-term changes in climatic patterns, with some exceptions. Public agricultural expenditures should not only be maintained at adequate levels, but should also be redirected towards the promotion of sustainable agricultural intensification. At the same time, governments should consider the food system in its entirety and foster mutually reinforcing measures and interventions across ministries that deal with different aspects of food production, marketing and consumption, as well as health, natural resources and rural development.

The issue of resilience is progressively shaping mechanisms to prevent and respond to food crises, but the linkages between sectoral strategies and crisis management can be further strengthened. Many institutions and initiatives already exist at the local, national and regional levels, and are contributing to the promotion of resilience and adaptation. Support for these should be continued, provided that they also benefit from political ownership.

Regional **mobility** in its different forms is a key strategy for adaptation and resilience to climate variability and the long-term effects of climate change. ECOWAS has put in place regional protocols on free movement and cross-border transhumance to facilitate this, but they are not consistently implemented. Moreover, current EU policies are rather bent on reducing mobility in the region as part of an effort to curb migration to Europe. In this context, migration containment policies appear as disruptive measures that compound climate-related challenges for vulnerable communities in the region: trapping people in exposed areas, increasing pressures on services, reinforcing national identity and exclusionary discourses, hindering livelihoods - such as transhumance - and, in the end, aggravating tensions and conflicts.

National and regional actors have adopted policies to address the negative effects of climate change, including on **peace and security** and peaceful relations between pastoralist and farmer communities. This has also included military operations, in many instances with external (European) support. Yet, peacebuilding and security strategies in the region have been marred by an overly securitised approach, with often overlapping and incoherent initiatives focused on stabilisation rather than human security, development and resilience. This is coupled to growing signs of fatigue and weariness on the part of Sahelian and European societies vis-a-vis foreign military

interventions. Moreover, heavy-handed military approaches to security in the region have led to human rights abuses, and have increased the climate vulnerability of local communities. A large number of experts surveyed for this report are thus in favour of reducing EU military support and interventions.

Decentralisation processes have not been able to improve **local governance and participation**, due to poor institutional capacity, elite capture and political conflict - with some successful exceptions. Farmer communities have often been better represented politically in decision-making bodies, leading to a better knowledge of legal processes. In addition, local dispute mechanisms, including for natural resources, have increasingly broken down, and farmer-herder conflicts have become more deadly.

While the AU is seen as aiming to improve coordination and **policy coherence** in the field of climate and conflict, experts have noted a lack of tangible policy operationalisation, financial unpreparedness, and limited member state accountability. This constrains the AU's climate-security work. Similarly, EU funds have been geared towards migration control, counterterrorism and stabilisation efforts (Boas, 2020). Governance issues have been addressed in parallel, predominantly via technical assistance, but not in concert with other European interventions in the region. While the EU has increased its climate change objectives in the region, this has been insufficiently accompanied by the necessary funding or a conflict-sensitive and politically oriented approach.

Policy recommendations

In light of these challenges and opportunities, we suggest the following improvements:

1. Capitalise on the complementarity between agriculture and pastoralism

Agriculture: The priority should be to increase soil productivity (ratio of production to usable land). To this end, small-scale irrigation methods should be pursued for their economic and environmental benefits. In this context, drip irrigation can be a useful tool and should be linked to traditional land conservation and restoration techniques, which are useful for restoring soil fertility and ensuring the biological balance of soils. In addition, the use of drought-resistant seeds should be promoted. There have been great investments in research in recent years, but there is a lack of support for the dissemination of knowledge on resistant seeds among farmers.

Pastoralism: Political commitments made to the promotion of pastoralist livelihoods need to be translated into concrete actions. This means improving water points and access to water, strengthening veterinary services, expanding access to credit for decentralised cooperatives, and strengthening value chains for animal products. In addition, transhumance corridors must be better defined and rigorously enforced while still allowing for flexible adjustment to future climatic impacts and addressing the historical exclusion of pastoralist communities. It is also necessary to improve information and early warning systems and facilitate the dissemination of climate information to pastoralist communities.

2. Promote small-scale adaptation initiatives and review existing ones to address their potential negative impacts

Large mitigation and adaptation initiatives such as the Great Green Wall need to be analysed in terms of their potential counterproductive effects. The project seems to take advantage of the complementarity of different livelihoods in the region (pastoralism and agriculture), but is too focused on the latter. It should also be open to other possible effects of climate change beyond desertification, and should rethink the role of actors involved in environmental protection, such as forestry services, which have been repeatedly accused of corruption and abuse by local populations.

Climate-Smart Agriculture (CSA) can be an interesting model to improve adaptation to climate change as it combines traditional and modern techniques to increase agricultural productivity, although it should try to avoid relegating pastoralism to a secondary role. Regional organisations such as ECOWAS have appropriated the model with the help of international donors. However, it should be noted that regional climate action is also conditioned by national politics and the interests and incentives of actors in specific sectors (Vanheukelom et al., 2016). Therefore, policies and funding aimed at promoting regional cooperation to build resilience and mitigate the risks identified in this report need to take into account this traction, which varies across sectors and countries (Vanheukelom et al., 2016).

3. Relax migration control measures and promote mobility as a coping strategy

Restricting migration in the Sahel risks hindering effective climate change adaptation, especially among households and communities that rely on mobility to cope with erratic weather conditions. Policy initiatives in the region must respect mobility as a way of life and as an essential coping strategy. The EU should continue to support the implementation of existing protocols on free movement, but without prioritising bilateral agreements aimed at migration containment, as this weakens regional approaches promoted by ECOWAS.

European policymakers must therefore heed the evidence provided by much of the academic world on the importance of greater internal and external border flexibility. They must use it to refute xenophobic and racist discourses in Europe that legitimise counterproductive containment strategies in the Sahel. They must do so by appealing not only to respect for human rights, free movement or even the need for labour, but also for the sake of a more coherent and effective foreign policy. In other words, if the EU really wants to enhance the resilience of Sahelian communities it must ease the brake on migration, which is inconsistent with other policy objectives in the region. All this must be done by incorporating new narratives that focus on the fact that migration will mostly remain within Africa - as the IOM has already done in its latest reports (IOM, 2020) - and considering the links between climate change and (im)mobility.

4. Redefine peacebuilding and security strategies prioritising bottom-up approaches, human rights, and principles of coherence, effectiveness and accountability

The track record of efforts and past strategies for the region by the EU and its member states is at best mixed. Increased attention to governance - informed by a more politically and conflict-sensitive approach to local dispute resolution mechanisms, including for natural resource management - seems appropriate.

This will require a greater involvement and inclusion of the plurality of conflict resolution mechanisms, from traditional, religious, local, national, regional and/or international perspectives, which would also help avoid legal pluralism that allows for exclusion of certain groups. To this end, the current decentralisation processes in the three countries are crucial to take into account and support, while considering some of the shortcomings in these processes.

A recalibration of peacebuilding and security strategies in the region would not mean a rapid withdrawal of military missions without an alternative plan, but requires a necessary improvement in the plans designed from now on. This would also call for a re-orientation of funds towards sustainable development, away from restrictive migration control and militarised security. To this end, objectives and strategies must be harmonised, with full recognition not only of state and regional actors in the Sahel but also of local civil society. Military activities deployed in the region must be improved, based on a human rights approach, and a better understanding of climate risks.

Ultimately, this inevitably implies prioritising not only human rights but also the principles of effectiveness and accountability applicable to both local and international actors. The new European Integrated Strategy for the Sahel offers an opportunity to rethink what has been done so far, and to commit to new scenarios that minimise the area's vulnerabilities from a socio-economic, political and climatic point of view.

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7. Annexes

A. Main variables and data utilised in the regression analysis

Variable	Description	Source	URL
Drought (growing season)	At least 30% of cropland in area has experienced unusually low levels of rainfall during the last growing season of major local crops	Uses standard precipitation index based on rainfall data from the CHIRPS project. Spatial information on crops and crop calendars are from IFPRI and FAO.	Publicly available at: https://www.chc.ucsb.edu/data/chirps Publicly available at: https://www.mapspam.info http://www.fao.org/giews/country-analysis/country-briefs
Heavy rain (growing season)	At least 30% of cropland in area has experienced unusually high levels of rainfall during the last growing season of major local crops	Uses standard precipitation index based on rainfall data from the CHIRPS project. Spatial information on crops and crop calendars are from IFPRI and FAO.	Publicly available at: https://www.chc.ucsb.edu/data/chirps Publicly available at: https://www.mapspam.info http://www.fao.org/giews/country-analysis/country-briefs
Food insecurity	Average IPC Acute FoodInsecurity Phase in administrative area as defined by FEWSNET Reported difficulties in accessing enough food in the last 12 months	FEWS NET Afrobarometer Data, [Burkina Faso, Mali, Niger], [Round 1-6], [2001-2015].	Publicly available at: https://fews.net/fews-data/333 Publicly available at: http://afrobarometer.org/countries
Local economic development	Night light emissions and density of paved roads in area in comparison to rest of the country	NOAA	Publicly available at: https://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html
Violence involving AOG	Number of violent eventsinvolving armed opposition groups (AOG) in the area	Armed Conflict Location & Event Data Project (ACLED)	Publicly available at: https://acleddata.com
Communal tensions	Attitudes towards members of other ethnicgroups (5-point scale)	Afrobarometer Data, [Burkina Faso, Mali, Niger], [Round 1-6], [2001-2015].	Publicly available at: http://afrobarometer.org/countries

B. Results of local-level regression analysis (admin2 level)

	Model 1	Model 2	Model 3	Model 4
	DV=Food insecurity	DV=Food insecurity	DV=Food insecurity	DV=Nbr. of AOG events (IV)
Log. rainfall (last growing season)	-0.1733 (0.0192) **	-0.1727 (0.0192) **	-0.1712 (0.0192) **	
Heavy rain (last growing season)	0.0533 (0.0102) **	0.073 (0.0137) **	0.0554 (0.0102) **	
Heavy rain (last growing season) x Stronger local economy		-0.0341 (0.0163) *		
Drought (last growing season)	0.027 (0.0102) **	0.0281 (0.0102) **	0.0548 (0.0143) **	
Drought (last growing season) x Stronger local economy			-0.0479 (0.017) **	
Food insecurity fitted (Model 1)				3.5953 (0.8323) **
Stronger local economy		0.0393 (0.0156) *	0.0407 (0.0156) **	
N	10959	10959	10959	10959
R squared	0.52	0.52	0.52	
F statistic	79.23	78.78	78.83	

Model 1-3: OLS - Model 4: Instrumental Variable (IV) Negative Binomial Regression

Standard errors in parentheses. Significance: ** p<0.01, * p<0.05

All models contain admin2, year & month fixed effects. Results not shown for intercept & control variables: Log. local food prices; Violent event in last 6 months; Log. population density; Log. nightlight emissions per capita

C. Results of individual-level regression analysis

	Model 5	Model 6
	DV=Lack of food last 12months	DV=Sympathy for other ethnicgroups
Log. rainfall (last growingseason)	0.0912 (0.0852)	0.2066 (0.1148)
Drought (last growing season)	0.1619 (0.0658) *	-0.1563 (0.0773) *
AOG violence last 12 months	0.0064 (0.0021) **	
Communal violence last 3months		-0.0988 (0.0335) **
Lack of food last 12 months		-0.0635 (0.021) **
Lack of cash last 12 months	0.8718 (0.0256) **	
Ethnic group treated unfairly	0.2486 (0.0529) **	0.0787 (0.0634)
Trust in head of state		0.0543 (0.0232) *
Education	-0.3456 (0.0459) **	-0.02 (0.0417)
Active in religious group		0.0952 (0.0328) **
Works in agricultural sector	0.1734 (0.0535) **	0.1718 (0.054) **
Receives remittances	-0.2522 (0.1285) *	
Area has better roads	-0.3757 (0.1378) **	
Area has electricity grid	-0.204 (0.061) **	0.1979 (0.0676) **
Area has market		0.1846 (0.0575) **
Mali	-0.7673 (0.1646) **	0.7402 (0.2605) **
Niger	0.4373 (0.2138) *	0.0892 (0.2691)
N	8550	6396
Ordinal logistic regression. Standard errors in parentheses. Significance: ** p<0.01, * p<0.05 All models contain admin. unit & year random effects		

D. Survey methodology

Introduction and Background

This online survey seeks to measure experts' opinions on the effects of climate change in the Central Sahel, particularly Niger and Mali. The Barcelona Centre for International Affairs (CIDOB, www.cidb.org) has developed the survey with the assistance of the Research and Expertise Centre for Survey Methodology (RECSM, Pompeu Fabra University) at all stages: from questionnaire design to survey implementation and data analysis.

The main goal is to understand how climate, development and security experts and elite stakeholders perceive climate change effects on current food security and conflicts in the zone. The specific objectives are to measure perceptions of:

- the specific climate change effects in the Sahel zone
- the role of climatic effects in relation to food insecurity, conflict and migration
- the adaptation measures to promote
- the satisfaction with the EU adaptation and resilience policies in the area

This exploratory online survey was conducted as an alternative to face-to-face interviews due to COVID-19 restrictions.

Sampling

Target population and sampling design

The target populations of the survey were climate, development and security experts, as well as local, regional and international stakeholders focused on the central Sahel zone. The sample was limited to decision-makers, civil servants, leading academics, media professionals, as well as professionals working in NGOs, social society organisations and local economic actors. In terms of geographical origin, the majority came from Niger, France and Mali.

Since there is no sampling frame for the Central Sahel experts, the sample selection methods were non-probabilistic, with no quotas for socio-demographic or other variables.

With a view to making sure the survey was answered by the intended people, personal emails were sent to them and a follow-up was ensured. A significant number of respondents confirmed by email that they had answered the survey. An additional measure consisted of offering respondents to receive further information about the survey by letting them include their email (optional) at the end of the questionnaire. Several dozen respondents shared their emails. Finally, the platform was enabled to make sure the respondents could answer only once from any device (computer, tablet or phone). Although these techniques do not ensure total control over the respondents, they helped to restrict the survey as much as possible to the people for whom it was intended.

Recruitment methods and sampling frame

Respondents were recruited using their contact information from prior research in the region. This information was gathered with the support of CASCADES partners, the United Nations Office for the Coordination of Humanitarian Affairs' (OCHA) public list of humanitarian contacts, and the Federative Structure of Research Racines (*Structure Fédérative de Recherche Racines*)[57] public website.

The database is organised according to the professional sector (national authorities, academic experts, international and regional organisations and development agencies, civil society organisations, NGOs, think tanks and media-journalism actors) trying to cover development, climate and security sectors. A version of this database was used to ensure the follow up of the survey.

All respondents were invited to respond to the survey through two channels: with personalised (last name) invitations sent from CIDOB and with these same invitations resent by those who received them, using a snowball method. In the first case, the two CIDOB researchersin charge of carrying out the survey, Oriol Puig and Moussa Bourekba, sent personal invitations to each potential respondent (in October 2020). Four weeks after the first wave of emails, researchers made a list of those who either responded to the email of invitation or left their email address at the end of the online questionnaire. On this basis, another database was set up to send reminders to those who did not fit in the two aforementioned profiles. Reminders were sent between the 3rd and 6th of November 2020.

Regarding the snowball method, the personalised invitation encouraged the potential respondents to forward the questionnaire to anyone with experience in development, security and climate change in these areas of the Sahel. The aim of using the snowball method was to achieve a greater number of qualified responses. While such a method bears the risk of sharing the questionnaire with people who are not part of the target, we believe such a risk is relatively low given the size of the sample and the personal relation between the researchers and some respondents. While this represents a methodological limitation, an effort has been made to expand the sample without reducing its quality. Therefore, they have been contacted individually, which has meant an acceptable degree of response to both the form and the invitation mail itself.

Sample size and descriptive statistics

In total, 302 people opened the survey. Of those, 216 people answered the full survey and 40 people did not answer any question. Another 31 people only answered socio- demographic questions (i.e., dropped before answering Q12) and 17 more people broke off at other points during the survey. These people may have broken off because they realised they were not qualified to answer the questions that regarded expertise, had bad internet connections or simply a lack of interest, among other possible reasons. In order to ensure comparability across questions, the sample considered in the analyses is composed only of those 216 people who answered the full questionnaire up to the final compulsory question

[57] SFR Racines is a research organisation working in the field of climate change and ecology and the Sahel region. It belongs to Abdou Moumouni University, based in Niamey (Niger). Further information can be found at: http://racines-sahel.org

(Q351_SQ005; about EU contribution to military operations in Mali). Unless stated otherwise, every result in this report corresponds to this sample of people.

Table 1 displays the composition of the sample (N=216) in terms of key sociodemographic variables. The sample is mostly composed of men, people in a middle age (30-60) and with advanced university degrees (masters or higher). This is in consonance with the expectations of the characteristics of the target population.

Descriptive statistics of sociodemographic variables

Variable	Categories	Percentage
Gender	Men	82%
	Women	18%
Age	20-29	2%
	30-39	27%
	40-49	37%
	50-59	27%
	60-69	7%
	70-79	0%
Highest education level	University degree inferior to master's degree	10%
	Master's or equivalent	44%
	PhD or equivalent	45%

**Percentages do not necessarily add up to 100% because of rounding. Besides, not answering was allowed for education level (1% of the sample did not answer this question).*

Considering complete responses, the response rate was 25% as 850 people were initially invited by email.

Questionnaire design

The questionnaire was designed through a meticulous process with constant and continuous interactions between researchers from CIDOB and RECSM at different stages. The process began in May 2020 with the questionnaire design. The first draft converted the research objectives into concepts of interest. This task was done and supervised by three researchers at CIDOB. After several discussions and feedback, a second version (V2) was shared with RECSM in order to improve the formulation of questions and response options. Several other versions were drafted and discussed between July 2020 and September 2020.

In September 2020, a third version (V3) collected other researchers' opinions from partner organisations involved in CASCADES. In parallel, survey programming using Lime survey proceeded. The programming required certain adjustments in response options but did not affect the overall survey. The programmed questionnaire – considered as the fourth version (V4) – was pretested internally (CIDOB researchers) and externally (people belonging to the target group of the survey based in the Sahel region). On this basis, the final version of the questionnaire (V5) was validated by RECSM before initiating fieldwork on the 5th of October 2020.

The questionnaire is divided into three distinct sections: the first section is devoted to personal characteristics; the second section intends to measure the perception of the effects of climate change in the Sahel and their impact on conflict and mobility; and the third section is related to the opinion on adaptation strategies (already implemented or that should be implemented in the future).

Translation

The questionnaire was developed in English in order to finetune it jointly with RECSM. Once the final version (V5) was agreed between CIDOB and RECSM researchers, CIDOB proceeded with its translation into French. A native French researcher completed the first translation of the questionnaire from English into French. The translated version was shared with other native French researchers working in similar fields. The feedback collected helped to finalise the French version. It is worthy to highlight that some minor adjustments were done after the pre-test was carried out.

Pre-test

The pre-test sample wanted to emulate the survey sample. For this reason, we collected the opinions of two people from the Sahel area (one researcher and one person from civil society) to respond to the questionnaire while paying attention to content, the time spent responding to the questionnaire and possible technical issues. Countries such as Niger and Mali, among the poorest on the planet, have increasing rates of Internet mobile penetration, but still low – from 1.42% in 2012 to 23.22% in 2017 and especially restricted to urban areas, according to official data from the national regulatory authority.[58] In addition to that, most potential respondents are believed to use their smartphone. Therefore, it was imperative to carry out such a pre-test in the region in order to spot possible technical difficulties. Based on their suggestions, CIDOB proceeded with certain improvements in order to make the questionnaire fully available on smartphones. In addition to that, the questionnaire was shared with CIDOB researchers – including a researcher on migration and a researcher with a solid background in survey design – to collect additional feedback following the same criteria (content, duration and technical issues).

[58] Report from Telecommunications and Postal Regulatory Authority (ARTP, 2017).

Fieldwork

Despite the limits of Internet penetration in Niger and Mali, the online survey is well justified due to pandemic travel restrictions. Fieldwork has absolutely been affected by COVID-19 to the extent that it took place online instead of face-to-face interview. Moreover, a great number of people - especially working in the field of humanitarian assistance - were repeatedly out of the office due to the current special context. For this category, we have sent more than one reminder.

The survey was fielded online via LimeSurvey. Respondents could answer the survey at any time using any device with Internet connection. The survey was fielded in French. Table 2 shows the number of respondents by country of residence.

Number of respondents living in each country.

Country of Residence	Number of people (for eachcountry)
Niger	127
France	18
Mali	17
Espagne	10
Senegal	8
Burkina Faso	6
Côte d'Ivoire	5
United States of America	4
Germany, Benin, Italy, Switzerland, Chad	2 per country
Belgium, Cabo Verde, Cameroon, Canada, Japan, Norway, Netherlands, Portugal, Central African Republic, Sweden, Togo	1 per country

Survey flow and survey programming

Participants were shown a welcome screen. They knew the number of questions (44 questions) and had a progress-bar present. Backward navigation was not allowed. All survey questions were presented to respondents, but they could not answer a given question by moving on to the next question ("No Answer" options were hidden). In addition to that, not all questions were obligatory. Only the following questions were optional:

Q3: What is your nationality?

Q6: What is the highest level of education you have successfully completed?
Q111: What is or what was your professional sector?

Q17: Do you think that central Sahel will experience a re-greening or a desertification in the next decade?

Q271: There are international and national policies to curb African migration flows across the Sahel. On a scale from 1 to 5 where 1 means "Not at all" and 5 means "Extremely", how much do you think these policies will affect intraregional mobility?

Q29: With a view to addressing climate change, what type of measures should Sahel countries implement in priority?

Q30: Are you familiar with the Climate-Smart Agriculture model?

Q36: In your view, how could the EU and its member states contribute to enhance adaptation and resilience measures to climate change in Mali and Niger?

Q37: Would you like to receive information related to the results from this survey? If so, please write down your email herein below.

Survey period and duration

Official fieldwork started on 5th of October 2020 and finished on the 1st of December 2020. Actual answers were provided from the 6th of October of 2020 to the 27th of November 2020.

The average survey duration was 39 minutes. This suggests that some people left the survey and came back afterwards. Indeed, 19 people completed the survey more than one hour after opening it. Excluding people who took more than one-hour, average survey duration was 27 minutes and median duration was 26 minutes. This is somewhat longer than what would be expected based on the length of the questionnaire and may be due to several reasons such as: bad internet connection, distracting calls/messages in between, online multitasking or presence of other people who distracted respondents, among others. There were only 8 people for whom the survey took less than 10 minutes.

Confidentiality

The data protection policy was specifically detailed at the beginning of the survey through a drop-down menu. Respondents had to accept it before completing the survey. Both in the invitation mail and at the beginning of the survey it was reminded that the participation in the survey was voluntary and totally confidential, anonymous and protected at all times, according to the EU General Data Regulation (GDPR). In addition, we included an asterisk and small print with the exact explanation of what GDPR means. The information was addressed to secure procedure and data analysis. We informed respondents that the survey would be treated in aggregate and confidential form, ensuring that respondents could not be identified. Likewise, the data analysis and collection would be subjected to strict security measures and only the CIDOB team would have access to the responses. We also added information about the expected duration time of the survey (10 minutes) and the right of respondents to withdraw at any time if they wish to do so.

All data and information were included with and after the approval and suggestions from CIDOB's ethics committee.

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