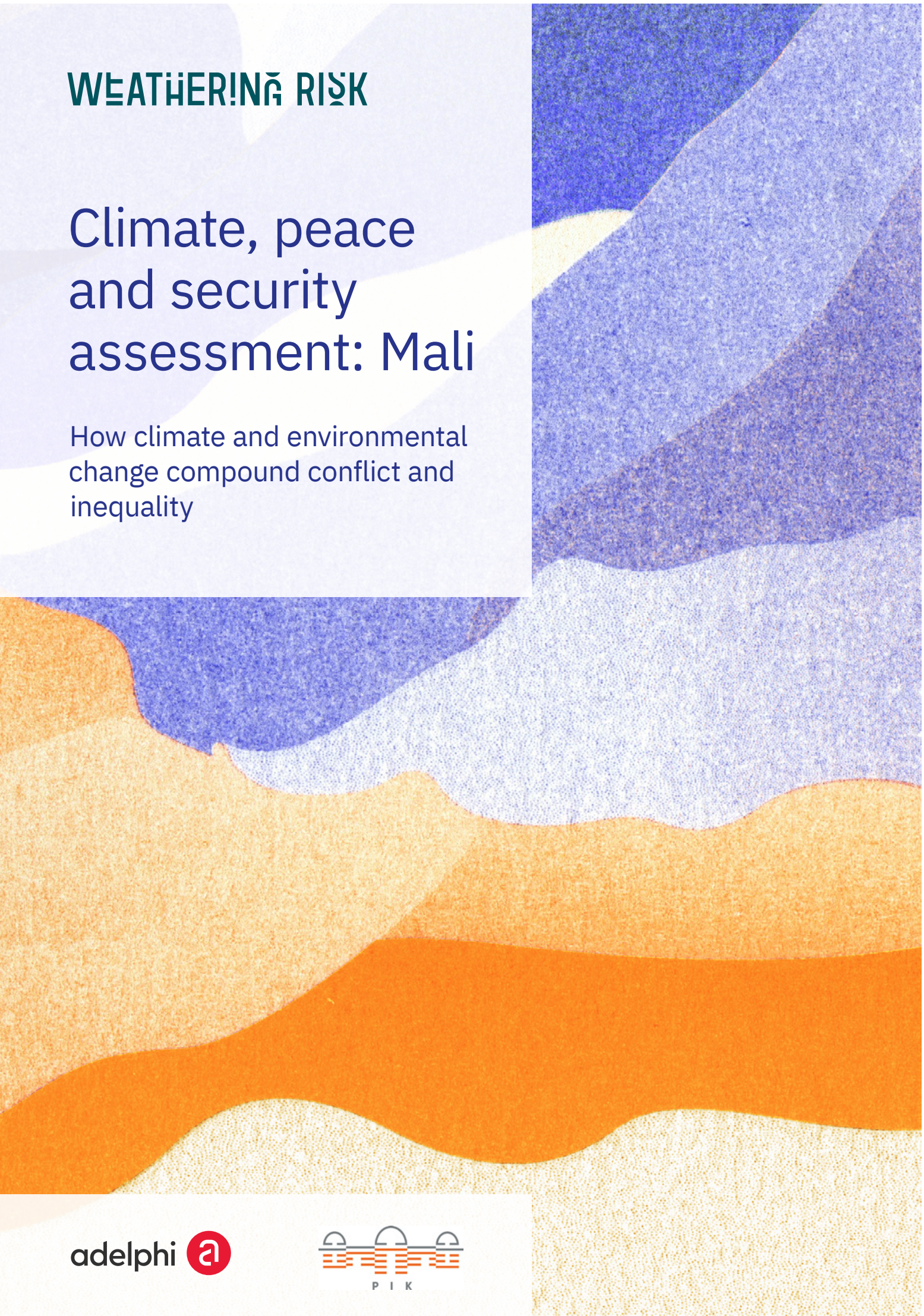
WEATHERING RISK

Climate, peace and security assessment: Mali

How climate and environmental change compound conflict and inequality



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Executive Summary

Mali is experiencing both rising insecurity and significant climate variability. Violent conflicts take place especially in Gao, Kidal, Tombouctou, Mopti, Segou, and, increasingly, in southern and western regions. Over the past decades, the country has been exposed to substantial inter-annual and decadal rainfall variability as well as increasing frequency and intensity of extreme weather events. In the future, climate change impacts will put significant additional pressure on natural resource-based livelihoods, gradually limiting people's ability to adapt.

Outside Mali, attention has tended to focus on political and security developments in the wake of the military coup of August 2020, the announced withdrawal in 2022 of French troops from the Operation Barkhane counter-terrorism mission, and – most recently – alleged massacres of suspected jihadis by the Malian military and foreign mercenaries.

However, the country also experiences wider political, economic, and social challenges. Among a complex set of drivers of conflict dynamics in Mali, poor governance and structural socio-economic exclusion and marginalisation play important roles. Weak governance is both a cause and consequence of conflict: people often experience the state as corrupt, exploitative, predatory, and rent seeking; insecurity reduces state presence and service provision even further.

At the same time, livelihoods are increasingly difficult to sustain due. The problem is caused by recession, inequality, insecurity, corruption, social exclusion and policies that erode rather than enable coping strategies. These dynamics enmesh with significant demographic changes in the form of population growth, urbanisation, a shift towards sedentarisation, and movement in search of economic opportunities.

Against this backdrop, there is growing attention to the ways climate and conflict interact in Mali. However, there has been a lack of contextual evidence of specific risks, while concerns have rightly been raised that climate-related security risks could be used to avoid tackling wider issues of governance, exclusion, and marginalisation.

This paper aims to address these needs, by presenting qualitative and quantitative data analyses of climate security risks in the country. Using the Weathering Risk methodology, this case study is based on interviews with 87 individuals (28 women and 59 men) in June 2021, as well as historical analysis and future projections of climate change impacts in Mali conducted at the Potsdam Institute for Climate Impact Research (PIK).

THE CENTRALITY OF GENDER RELATIONS

Gender relations are crucial to understanding political, economic, social, environmental and conflict dynamics, but are often underexamined, particularly when it comes to how certain norms of masculinities drive conflict or men's gendered vulnerabilities. Meanwhile, gender norms in Mali negatively affect women's access to, control over, and ownership of resources and decision-making, yet they are also crucial to family livelihoods and building peace. Concurrently, social stratification by livelihoods, power holders, and the cadets sociaux[1] embeds discrimination within society and is a key form of structural violence.

1 Those whose social characteristics such as age, community and/or gender limit social mobility, block access to economic networks, and exclude them from positions of power.

Environment and climate change in Mali

Variability in climate, both geographically and over time, is not new to Mali, but recent decades have seen a steep change. Since the beginning of the 20th century, average temperature has increased by approximately 0.96 °C, accompanied by a considerable increase in very hot nights, with higher maximum temperatures and larger temperature variations in the northern parts of the country. During the same period, monthly average precipitation level decreased by 1.98mm (5%), with the on average wetter southern regions (most strongly Kayes and Sikasso) and very dry regions of Tombouctou and Taoudenit being particularly affected.

Other extreme weather events have also increased in frequency. The average number of heavy precipitation days per year rose from approximately 2.9 in 1999–2003 to around 3.6 days in 2012–2016. After the droughts of the 1970s and 1980s, an increase in flooding events has been observed across the Niger River Basin, in a general return to wetter conditions. Nevertheless, droughts have remained a recurring phenomenon. Mali is further experiencing major environmental pressures from human activity such as land degradation, which consequently reduces vegetation cover and contributes to the loss of fertile land – most notably a 15% or 366,000 ha tree cover loss due to deforestation between 2000 and 2020. Simultaneously, after the severe drought in the beginning of 1980s, a trend of re-greening has been observed across parts of the Gourma region in northern Mali, and in the Sahel region as a whole. It is important to remember that Mali's environmental challenges come both from climate change and from resource management systems often directly affected by conflict.

Looking to the future, precipitation and water availability projections are highly uncertain, but considering projected population growth, overall per capita water availability will very likely strongly decline. Meanwhile, temperature is projected to very likely rise between 1.8 and 2.5 °C by 2030, and between 2.0 and 4.6 °C by 2080 compared to pre-industrial levels. This temperature rise will affect the whole country, with higher temperature increases in northern Mali. The annual number of very hot days (with daily maximum temperatures above 35 °C) is projected to increase with high certainty all over Mali and will be much stronger in the south. The population affected by at least one heatwave per year is projected to very likely increase from 2% in 2000 to between 3.6 and 9% until 2030, while heat-related mortality will almost double from 2.5 to 4.7 deaths per 100,000 people by 2030.

Climate security pathways

Our research revealed four broad ways in which climate change and conflict are linked in Mali.

1. Climate change and conflict, separately and together, impact livelihoods, block adaptation, and affect social cohesion
Climate change and conflict lead to significant livelihood changes and hinder adaptation. Populations have previously found ways to adapt to climate change and deal with conflicts, but their scale, coexistence, and interaction make doing so almost impossible for many. Moreover, strategies to adapt to climate change are diminishing social cohesion and worsening conflict dynamics.

2. Weak governance, rent seeking and corrupt behaviour negatively affect adaptation, conflict dynamics, and environmental degradation
Weak governance and rent seeking, corruption, and conflict-insensitive behaviour by government and community leadership constrain adaptation to climate change, feed grievances, and contribute to ineffective conflict resolution. As a result, they weaken trust and confidence between the population and the government and drive conflict dynamics further with armed opposition groups (AOGs) actively exploiting these grievances to strengthen their legitimacy and gain support.

3. Increasing competition over natural resources contributes to rising (intra- and inter-communal) tensions and violence
Climate change, through its negative impacts on natural resources availability and quality, is one factor exacerbating competition over land, water, and forest and river resources. Tensions over access, usage, and control of natural resources within and between different livelihoods groups are rising and increasingly escalating into violence. This dynamic in turn affects social cohesion, contributes to stigmatisation of certain groups, and plays a role in escalating cycles of violence. However, there is no simple and automatic causal link between climate change, resource competition, and violence. Factors including the availability of arms, the militarisation of conflict, the lack

of effective, inclusive, just, and conflict-sensitive governance and natural resources management, the creation of militias, and (localised) histories of contestation and marginalisation play an important role in translating competition over natural resources into conflict and violence.

4. Climate insecurity is caused by and widens already existing inequalities, eroding ability to adapt, and driving conflict further
Inequality is a key cause and consequence of climate insecurity. Neither the impacts of climate insecurity nor capacities to adapt are distributed evenly among the population groups. Certain groups, including women, are blocked from undertaking strategies used by others to adjust to changing dynamics. As a result, the combined impacts of climate change and conflict and related climate insecurity risk widen already existing inequalities, with layers of exclusion often overlapping. Climate insecurity also increases levels of gender-based violence. Respondents shared how marital tensions, rates of divorce, and domestic violence increased in response to livelihood difficulties linked to climate change and conflict. Other forms of violence discussed included early and forced marriage, marriage for exchange, sexual exploitation, harassment, rape, and limitations on rights. Concurrently, grievances linked to these unequal impacts and related barriers drive conflict dynamics. This interaction creates a vicious cycle of increasing climate insecurity, conflict, and inequality.

Recommendations

Continued changes in Mali's climate will further affect animal and human health, food security, and livelihoods. Concurrently, there is also significant concern that existing conflict dynamics may deepen, worsen, and spread to new areas. As a result, action to mitigate and adapt to climate change, address the root causes of conflict, and tackle drivers of climate insecurity is urgent.

The pathways outlined in this study show how climate change is one of many factors that interact with conflict and affect people's lives. A focus on climate security should not be a way of avoiding dealing with challenges of improving governance, tackling age, class, gender, and other inequalities, ensuring justice, and addressing other root causes of conflict. Further, an emphasis on environmental and climate action could have unintended consequences if done in heavy-handed and conflict-insensitive ways. Climate security interventions should instead seek to address interactions between these factors and climate change. The pathways show the different ways climate change exacerbates and interacts with conflict drivers and dynamics, and how conflict undermines the adaptive capacity and resilience of communities. These links provide entry points for integrated actions that combine climate change action and peacebuilding.

Furthermore, as focus and funding on climate security increase, it will be important for actors to engage with Malian scientists, conflict analysts, and community leaders to ensure that interventions are not just relabelled but rather actually address the climate security dynamics detailed in this Weathering Risk climate, peace and security assessment. With this in mind, we present the following climate security recommendations for the Government of Mali, civil society, donors, international NGOs and United Nations (UN) agencies, and MINUSMA.

Here we set out a summary of the seven recommendations which emerge from our analysis. A more detailed elaboration of the recommendations with exemplary entry points for targeted actors can be found in the full report.

1. **Improve collection and sharing of climate data** to enable better weather forecasts, modelling, and predictions, and communicate this information across government ministries, departments, and agencies, civil society, and the general public. Provision of reliable and weather and climate information will enable informed policy making, programming, and planning for climate adaptation and can also have trust-building and social contract reinforcing co-benefits between people and state.

2. **Raise awareness of conflict-sensitive climate adaptation** so people know how to adapt in ways that do not exacerbate inequalities and conflict. A greater understanding of shared challenges and the inclusive and joint process of addressing them can build social cohesion within and between groups.

3. **Improve inclusivity, accountability, and responsiveness of governance and security provision, particularly around natural resource management,** to address current frustrations and grievances and prevent deforestation and

A young Fulani woman carries her belongings in the destroyed Fulani village of Ogoussago, which was attacked by an opposing Dogon militia. © Andy Spyra

environmental degradation. Inclusion of all relevant groups in a way which provides them with the resources they require, safe space to be heard without fear of retribution, and genuine scope to inform and make decisions will not only ensure that decision making is more equitable and does not inadvertently harm some groups in favour of others, but also sustainable.

4. **Prioritise building climate security resilience in southern Mali** through improving social cohesion, addressing material realities, and improving climate resilience. Improving social cohesion and strengthening governance capacities to address material realities of those most at risk can improve climate resilience and mitigate the risks of current climate insecurity dynamics further undermining peace in the south of Mali.

5. **Encourage agro-ecological, climate-smart, and conflict-sensitive practices** by starting and expanding interventions and communications to improve food security and livelihoods in sustainable and conflict-sensitive ways. Sharing information across identity groups on mutually beneficial farming techniques can create trust and build social cohesion between groups, as well as enhance climate resilience and food security.

6. **Ensure ongoing and inclusive integrated climate security assessments of Mali.** Climate security dynamics are ever-changing, so regularly updated assessments are important to enable knowledge and mitigation of evolving climate security risks.

7. **Strengthen government, military and civil society capacity to support populations, particularly those socially excluded, to adapt to climate security risks.** Addressing underlying inequalities and ensuring inclusive and accountable processes can bolster the social contract between people and the state, mitigate the impacts of climate security, and reduce their risks of creating or further entrenching grievances.

A. Introduction and methodology

Over the past decade, Mali has experienced both rising insecurity and significant climate change, leading to growing attention to the ways climate and conflict interact. However, in the absence of clear data and analysis, many discussions on this topic happen without evidence, creating the risk of instrumentalising discourse and continuing the current focus on militarisation. Guided by the Weathering Risk methodology and analytical framework,[2] this paper contributes to filling this gap, presenting qualitative and quantitative data analysis of climate security risks in the country.

Methodology

This paper is based on the Weathering Risk methodology (Rüttinger et al. 2021) and informed by semi-structured[3] interviews with 87 respondents (28 women and 59 men) over a three-week period in June 2021. Researchers took an intersectional feminist approach (Kaijser & Kronsell 2014), guided by conflict sensitivity, gender integration, and social inclusion. Respondents comprised people engaged in farming, fishing, pastoralism, and trade, as well as community leaders,

Climate, peace & security assessment: Interview locations in Mali

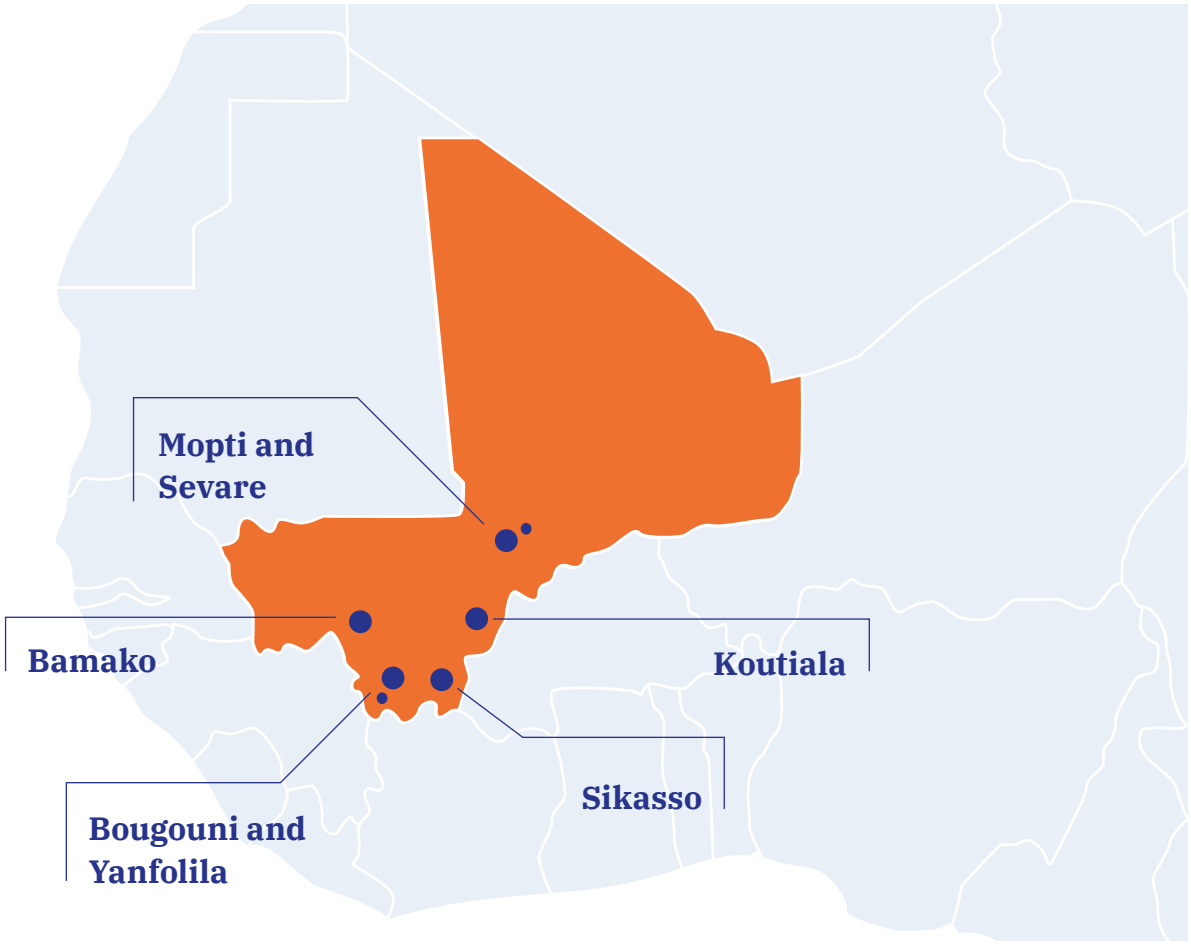


Figure 1: Map of interview location in Mali (source: elaborated by adelphi)

representatives of civil society, international non-governmental organisations (INGOs), and UN agencies, government officials, and researchers. They included people with disabilities, internally displaced people, and migrants. Interviews took place in Bamanankan, English, French, and Fulfulde in Bamako, Mopti and Sevare in the Mopti region, and Bougouni, Koutiala, Sikasso, and Yanfolila in the Sikasso region.[4] Notes were taken contemporaneously and analysed using a grounded theory approach with audio recordings serving as a reference point as needed. While the text refers to specific interviews where possible, it does not provide any additional information. Wherever the report does not specify source, findings are based on information gathered as part of the interviews with details withheld for privacy and security reasons.

The paper further draws on historical analysis and future projections of climate change impacts in Mali conducted at the Potsdam Institute for Climate Impact Research (PIK) detailed in the Annex. These analyses and projections were based on the methodology and products developed within PIK's AGRICA project[5], providing regionally explicit information about current and future climate changes and sectoral impacts under different climate change scenarios. The underlying data and analyses were based on PIK's Inter-Sectoral Impact Model Intercomparison Project (ISIMIP)[6] (Frieler et al. 2017).

Following the development of a draft report, findings were presented at an analysis workshop with climate and conflict experts from the Weathering Risk team in November 2021 and feedback was subsequently addressed. Limitations included inability to achieve respondent gender parity[7] and issues of security and access that restricted research locations in the Mopti region. Constraints of time and budget also meant it was not possible to conduct any data collection in northern Mali. Moreover, climate and environmental data from observations were only partially available as, due to the limited number of weather stations in Mali, only a few observational data were included in existing gridded datasets.

Overview of the paper

After providing a brief overview of country context and key trends, this paper presents current and future climate change data and selected sectoral impacts. Building on this background, it then outlines four key climate security pathways that emerge from the data as well as existing responses and lessons learned before concluding with recommendations for the Government of Mali, civil society actors, donors, INGOs, UN agencies, and the United Nations Multidimensional Integrated Stabilisation Mission in Mali (MINUSMA).

2 Please see https://weatheringrisk.org/en for more information about Weathering Risk.
3 An interview guide is available upon request.

4 Cited quotes may have been altered stylistically for the English translation.
5 Please see https://agrica.de/ for more information about AGRICA.
6 https://www.isimip.org/
7 While gender parity was achievable for community members, it was challenging for other categories as gender power dynamics in Mali meant men predominate in positions of designated community leadership, government ministries, NGOs, and UN agencies.

B. Mali context and trends

This section gives an overview of Mali, aiming not to offer comprehensive detail but rather to provide sufficient background to put later presentation of findings into context. It starts with recent developments and conflict dynamics before exploring the nature of the state, changes to demographics, social exclusion, gender, and economic precarity.

1. A turbulent start to the decade

In the wake of disputed legislative elections, thousands of Malians took to the streets in June 2020, calling themselves the Movement of June 5 – Rally of Patriotic Forces (M5). Including opposition figures, religious leaders, civil society, and trade unions, they demanded that President Ibrahim Boubacar Keita resign over perceived failures to tackle insecurity and improve the economy (Al Jazeera 2020d). Despite concessions offered and mediation by the Economic Community of West African States (ECOWAS), the M5 continued to hold President Keita accountable for what they characterised as governance failures (BBC 2020). Their campaign of mass civil disobedience intensified after opposition leaders were arrested, demonstrators occupied the National Assembly and state television, and security forces used excessive force in response. During three days of unrest in July 2020, at least 14 people were killed and over 300 wounded (Maclean 2020). Anti-government protests resumed in August 2020 and were met by tear gas and water cannons (Al Jazeera 2020c).

On 18 August, President Keita was detained by soldiers along with Prime Minister Boubou Cissé; he announced his resignation and dissolved the government and parliament the next day (Al Jazeera 2020a). Coup leaders announced the formation of the National Committee for the Salvation of the People (CNSP) with Colonel Assimi Goïta in charge. This second military coup in less than a decade was condemned by the African Union, ECOWAS, and the United Nations. The CNSP pushed through a charter to establish an 18-month transition to civilian rule which was rejected by the M5, which accused the military of desire to monopolise power (Al Jazeera 2020b).

A transitional government of military and civilian actors was formed in September 2020, but an already rocky transition was further derailed in May 2021. Hours after a cabinet reshuffle which replaced two coup leaders, interim President Bah N'daw, Prime Minister Moctar Ouane, and Defence Minister Souleymane Doucouré were detained by the military and resigned their posts shortly afterwards (International Crisis Group 2021). Colonel Goïta, the interim Vice President, was sworn in as interim President in June 2021. Subsequently, ECOWAS and the African Union suspended Mali's membership, the United States stopped security assistance, and France announced a reduction in military presence.

Despite initial promises, the military government proposed staying in power for a longer period in December 2021, citing security concerns. This continued uncertainty as to when elections would take place led to economic sanctions and closure of borders by ECOWAS. Humanitarian agencies warned that these sanctions risked heightening the country's humanitarian crisis (Dehghan 2022). Yet, despite this possibility and rejection of proposals by the opposition, the National Transitional Council (Mali's interim parliament) unanimously approved a five-year democratic transition plan, which contained no date for future elections, in February 2022 (Al Jazeera 2022).

At the time of writing, demands raised by the M5 movement for better governance, security, and economic conditions and an end to corruption and inequality, believed by the majority of Malians to be high according to a June 2021 survey, were yet to be met. An opinion survey conducted in June 2021 (Figure 2) found very high perceptions of corruption and impunity. Concurrently, recent months have seen a change in military support by external actors. With relations between France and Mali deteriorating since the August 2020 coup, France started to withdraw its military in February 2022 after nine years of engagement (Chrisafis and Burke 2022). Around the same time, as anti-Western sentiment grew in the country, the Malian military government welcomed the deployment of mercenaries of the Wagner Group, a Russian private military company (Roger and Olivier 2022; Burke 2022).

Malians' perceptions of corruption

An opinion survey of Malians living in all regional capitals and Bamako found that:

91%

considered corruption to be high or very high, especially in justice, the police, and customs

82%

felt impunity is frequent or very frequent

Wishes for the next five years were:

the return of peace and security

78.4%

youth employment

43.1%

good harvests and food security

34.3%

Figure 2: Friedrich Ebert Stiftung, Mali-Mètre, Enquête d'Opinion: 'Qui Pensent les Malien(ne)s?', June 2021

2. A country in conflict

Violent conflict in Mali emerged over the past decade, first in Gao, Kidal, and Tombouctou, then in Mopti and Segou, and, more recently, increasingly in southern and western regions. In January 2012, the Movement for the National Liberation of Azawad (MNLA) launched an armed campaign for independence against a backdrop of severe drought that damaged livelihoods, and highlighted northern political and economic marginalisation, which contributed to maintaining colonial era power relations in new ways. The presence of jihadi AOGs which worked with the MNLA, a spill over from the 1990s Algerian civil war, added to instability. Comprising people of all genders, these AOGs (MNLA and jihadi groups) captured significant territory. On 6 April, the MNLA proclaimed independence. Following a military coup d'état by soldiers unhappy with government response, the imposition of sharia codes, and with AOGs moving southwards to Bamako, France sent troops. Malian soldiers, with the support of French and other African military personnel (for example from Chad), retook major northern cities in January 2013. During this period, conflict parties perpetrated serious human rights violations, including sexual violence,[8] and direct and indirect civilian harm. According to respondents, the conflict also increased armed criminality and inter-communal tensions. Moreover, a peace and reconciliation agreement, signed in 2015, has yet to be fully implemented with root causes and key requirements around economic development still to be addressed.

8 AOG fighters in particular kidnapped, subjected to sexual violence, and forcibly married numerous women and girls (Possémé-Rageau 2016).

A patrol of the Malian Armed Forces in Sevare on the way to Djenne. The army must travel in convoys of at least half a dozen cars as only the inner cities are controlled by the army, with most of the countryside controlled by other armed factions, including ethnic militias and Islamists groups. © Andy Spyra

In response to these conflict dynamics, the Security Council established the United Nations Multidimensional Integrated Stabilisation Mission in Mali (MINUSMA) in April 2013 to support political processes and assist stabilisation (UNSC 2013). However, many civilians perceived MINUSMA as linked to a government whose officials engaged in predatory behaviour and part of an international community with declining credibility.[9] Moreover, after 2013, AOGs regrouped and new ones emerged.

From early 2015, insecurity spread across Mopti and Segou, which experienced increased banditry, cattle theft, and arms availability due to the northern conflict. Dynamics overlaid local histories of contestation and marginalisation, with AOGs concentrating recruitment on Fulɓe[10] communities, playing on grievances, and fuelling inter-communal tensions. It is difficult to define these conflicts: as a male peacebuilder interviewed said, "There is not a big general conflict but lots of different superpositions of small conflicts. Conflict has a multi-dimensional character."[11]

Meanwhile, southern and western Mali were comparatively stable, but conflicts were deepening (Marquette and Traoré 2020). The Sikasso region saw land speculation and grabbing, creating grievances over elite predation. There was dissonance between local customary and formal state norms, corrupt political practices, and the absence of or disregard for shared rules of use. Local institutions and customs that placed control of familial land in the hands of male elders worked against the structurally excluded. There was also conflict between farmers due to differences in delimitation of village boundaries and farmer-pastoralist disputes that led to theft, violence, and civilian casualties. Already, communities were starting to become alienated from the state with people retreating into identity-based mobilisation. The past year has seen some inter-communal violence and reports of attempts by jihadi AOGs to expand to the Kayes, Koulikoro,

9 A March 2021 survey found only 38% were satisfied with MINUSMA's work, feeling it does not protect the population against violence by armed groups (76.7%). There were also significant levels of dissatisfaction with the French Operation Barkhane, with 55.6% of men and 30.5% of women not satisfied (Friedrich Ebert Stiftung 2021).
10 A group with presence across west Africa as well as parts of central and east Africa. Also known as Fulani, Fula, or Peul, they have a history of migratory and semi-sedentary pastoralism, although there has been a rising tendency towards settling in one community and engaging in a range of livelihoods in recent decades.
11 Interview with male peacebuilder, conducted in Bamako in June 2021 in French. This quote was translated from French to English.

and Sikasso regions which, while isolated at present, point to worrying trends (Koné and Adam 2021a; Koné and Adam 2021b). If self-defence groups proactively mobilise or jihadi AOGs move southwards, there is a risk of violence escalating.

Violence is exacerbated by arms availability and marked by militarisation and impunity for abuses committed, as described above. Indeed, respondents pointed to cases where leaders of AOGs or community militias were given political appointments. Human insecurity is particularly high in some regions: 60.7% of people surveyed in Kidal, 71.3% in Mopti, 73.6% in Gao, and 89.5% in Tombouctou felt insecure leaving their place of residence (Friedrich Ebert Stiftung 2021). These apprehensions were gendered with men worrying of targeting by armed groups, women and girls concerned about sexual violence, and people of all genders fearful of physical violence and theft (Spencer 2020). In addition, Malian security forces have committed grave abuses, including extrajudicial killings, enforced disappearances, torture, and arbitrary arrests (Human Rights Watch 2017). Casualty reporting shows Malian security forces killed more civilians than did jihadist groups (Casa África 2020). Respondents spoke of how soldiers engaged in sexual exploitation and abuse. According to a female human rights activist,

> **"Women and girls say it was not the jihadists [who raped them] but the military and are saying that the military engages in more [sexual] violations than the jihadists."[12]**

Further, as will be explored below, gender inequalities drive conflicts, ensure they have differential impacts, and provide men incentives to join armed groups.

3. Weak state service provision, exploitative state actors?

> **"The Malian problem is the state."**
> Male NGO representative, interviewed in Bamako in June 2021 (translated from French to English)

Mali has a multi-tiered governance system with state law and policy overlapping with community systems. According to respondents, already uneven state presence and service provision has further reduced in recent times, particularly in conflict-affected areas. For example, there is little presence of state officials outside regional capitals and major towns in the regions of Gao, Kidal, and Tombouctou. The last few years have seen this pattern echoed in the Mopti and Segou regions. Where the state is present, agencies provide needed support and services but are confronted with challenges that, according to government officials interviewed, range from the rainy season's impact on access to remote communities to insecurity putting officials' lives at risk. Often, they struggle to be responsive to developments, adapt policies to new realities, and have expertise to test approaches. Moreover, many respondents described how, due to actions of some officials, people often experienced the state as corrupt, exploitative, predatory, and rent seeking.

Where the state is absent, community leaders can be present. These leaders are elected, selected, or appointed through hereditary systems and recognised by the state. While some community leaders have been displaced or killed by violence, many find ways to co-exist and work with AOGs despite their state connection. Yet, in some communities, leaders are seen as working with corrupt officials for personal benefit. They could not play effective roles in conflict resolution with decisions assumed to be influenced by bribes.[13] The legacies of colonialism, during which time some community leaders were viewed as collaborating with the colonial administration, play a role (Benjaminsen and Ba 2009). This lack of trust intensified as post-independence governments imposed leaders and regulated and politicised them and as some leaders misused their power. As a male peacebuilding practitioner interviewed said, "When people started becoming corrupted by the state, this included the jowros[14] who started to think the land is for them. Whereas before there was a mentality that they managed it for others and it was their role to preserve and guard for others, this [thinking] was stopped in favour of a link with the state."[15] Yet, this dynamic is not uniform. In many

12 Interview with female human rights activist who works with victims, conducted in Bamako in June 2021 in French. This quote was translated from French to English.
13 This dynamic had been recognised by the Malian government with the Ministry of National Reconciliation stating that it was one of the main factors affecting the effectiveness of local conflict management mechanisms (Ministère de la Reconciliation Nationale et de la Cohesion Sociale 2018).
14 Community pastoral leaders who controlled access to pasture among playing other roles.
15 Interview with male peacebuilding practitioner with knowledge of intercommunal violence, conducted in Mopti in June 2021 in French. This quote was translated from French to English.

areas, people have faith in leaders and conflict resolution mechanisms. The region of Sikasso in particular sees more consensual management of natural resources, partly as community leaders act to ensure their legitimacy and influence (Marquette and Traoré 2020). However, even in Sikasso, there are communities where leaders are becoming seen as corrupt and ineffective.

AOGs take advantage of this vacuum of power and legitimacy. They are in control in many rural areas outside major towns in the Gao, Kidal, Mopti, Segou, and Tombouctou regions. Their actions further diminish state legitimacy by reducing its reach and relevance. A male government official interviewed spoke of how fishing permits were issued as recently as 2018 before stating matters had changed: "Since the jihadists came, people do not need the Malian authorities as they relate directly with the jihadists."[16] Furthermore, there is evidence to show that many view jihadist groups, for example in Mopti, as less likely to cause civilian harm, less corrupt, providing more equitable natural resource management, and dealing fairer justice than the government of Mali (Marquette and Traoré 2020). Linked to these dynamics, the Sahel has seen a rise in radical religious discourse over the last two decades, particularly among marginalised groups such as young people, those who are landless, religious students, and those from caste groups seen as formerly enslaved (Raineri 2018). Such discourse affords legitimacy to challenging state, local, and mainstream religious authorities that fail to provide just and effective governance as well as individuals and groups with power (ICG 2017). Its contestation of inter-generational hierarchies, other vectors of social exclusion, and the Malian state has increased its reach. However, it is important to remember that many radical actors are not violent, many violent actors are not radical or fundamentalist, and the link between ideology and joining violent jihadi groups is unclear: the most determining factor is rather the experience (or perception) of abuse and violation by government authorities (Raineri 2018).

4. Changing demographics and movement patterns

Similar to its neighbours, Mali has experienced population growth, urbanisation, a shift towards sedentarisation, and movement in search of economic opportunities. Mali's population growth rate rose from 1.35% in 1988 to 3.0% in 2020 and was one of the highest worldwide at the time of writing (The World Bank Group 2021b). A number of respondents believed this increase led to demographic pressures in rural areas, particularly in light of declining soil productivity due to changing agricultural practices and climate change. As a male politician said, "People in the zone who used to need one hectare of farmland to feed their families now need three hectares due to land degradation as [the land] does not give as much [harvest] as before and due to population growth."[17] The last thirty years have also seen increased numbers of people in urban areas: from 23.32% of the population in 1990 and 28.36% in 2000 to 43.9% in 2020 (Macrotrends 2021). Indeed, many young women and men are expected to migrate to earn incomes to remit to families (Spencer 2020). Other factors behind this move are the unsustainability of rural livelihoods and the need to escape age hierarchies and power dynamics that place youth at a disadvantage.

At the same time, certain communities[18] who followed seasonal and circular migratory patterns no longer do so. Those socio-economically disadvantaged are most unable to engage in seasonal migration (Hummel 2015). Fisherfolk said they no longer moved between Mopti and Sikasso, with elders settling decades ago and younger people joining them or moving to new areas due to insecurity in Mopti. Similarly, while some pastoralist families continue to migrate together, the majority changed their practice. Young men move with cattle alone, passing on this responsibility to younger relatives after some years. As well as perceptions of increased insecurity, these shifts are due to state policies that favour sedentarisation and cultural shifts as current generations wish to pursue education and leave a taxing nomadic lifestyle. Moreover, the droughts of the 1970s and 1980s have brought significant changes. Many pastoralists experienced profound social loss, saw 75% of livestock in some areas weaken and die, and lost almost all their cattle (de Bruijn 1999). For those still engaged in pastoralism, a portion of herds need to go on transhumance while other cattle stay with the family. Hence the rite of passage for young men where

16 Interview with male government official with oversight of fishing regulation, conducted in Mopti in June 2021 in French. This quote was translated from French to English.
17 Interview with male politician who previously had a portfolio concerning the environment and natural resource management, conducted in Bamako in June 2021 in French. This quote was translated from French to English.
18 Although livelihoods co-exist, overlap, and cut across communities, narratives held that groups such as the Arab, Bella, Fulani and Tuareg were pastoralists while the Bozo and Somono engaged in fishing and river transportation.

they 'go on an adventure' migrating with cattle, thereby asserting transition to adulthood, before joining families in settling in one community.

> **"Before, it was all families moving together and migrating but not now... It is difficult to go with a big family now, not only due to climate change, but as the family is bigger and there are more risks to go with the family as the world is not as safe as before. Now, the elders do not move but the animals are accompanied by young men of the family... It is an honour to move and if you come back, it is a success and you become a hero... It is a pride to conquer and come back. It's like war as you cannot eat as much as you want or go to the village to eat hot meals. It is even not possible to drink water every day."**
>
> Young Fulɓe man, interviewed in Mopti in June 2021 (translated from French to English)

5. Social stigmatisation, hierarchies and exclusion

Stratification by livelihoods, power holders, and the cadets sociaux[19] embed discrimination. Hereditary transfer of power within a small number of families in clientelist networks undermines majority aspirations and exacerbates polarisation. Hierarchies and delineation of certain communities as enslaved means all are not seen as having equal rights. Malian analysts characterise this social order as a structural conflict factor, with those marginalised motivated to join AOGs to gain power and relevance and avenge the injustices to which they are subjected.

A sense of discrimination is particularly acute among certain groups. For example, many pastoralists, partly due to policy weighted towards agriculture, feel the state favours farmers. According to a Fulɓe man, "The problem is that the Fulɓe are always penalised by authorities in any matter. This causes a lot of frustration among us."[20] The impunity granted to the MNLA but not to other armed groups in peace talks exacerbates the sense of abandonment – and need for self-protection – felt by some, particularly in areas where Fulɓe and Tuareg pastoralists compete for natural resources. In the wake of inter-communal violence in Mopti and Segou, they are often considered linked to AOGs by other communities and security forces alike and are therefore subjected to arbitrary arrests, extrajudicial killings (Human Rights Watch 2021b), and a cycle of reprisal attacks. As one male researcher said, "We need to transform this representation which is stronger than reality. For most of the population, the Fulɓe are the jihadists but this is not true. Are 8-year-olds jihadists? The Fulɓe have proximity towards jihadist groups but they are not the same."[21]

Simultaneously, age and gender hierarchies determine access to and ownership of resources. For example, in the Sikasso region, control of land by male elders works against women, young people, and migrants who are allocated less productive land or moved from land they worked as it improved in fertility. Young men in particular see privilege and power linked to marriage and establishment of households but face difficulties in meeting requirements due to economic realities, corruption, and nepotism. Indeed, in Mopti and Segou, conflict dynamics are partially understood as a crisis between generations, with older people hoarding power and wealth that younger people are barred from accessing in a highly unequal society.

6. The crucial (but underexamined) role of gender

Gender relations differ across communities. For example, nomadic hierarchies and forms of Islam in Gao, Kidal, and Tombouctou mean women have relative liberty and participate actively in peacebuilding compared to counterparts in Mopti or Segou. In the south too, particularly in urban areas, women have greater say in decision making. Nonetheless, as explained by respondents working on women's rights, most communities see gendered divisions of labour that are unequal. Gender hierarchies place women in economic roles that either lead to lower earnings or mean men control incomes and resources that flow from their labour. Pastoralist women sell milk and milk products while their menfolk graze and sell cattle. Women own and earn incomes from small ruminants

19 Those whose social characteristics such as age, community and/or gender limit social mobility, block access to economic networks, and exclude them from positions of power.
20 Interview with 55-year-old Fulɓe pastoralist man, conducted in Yanfolila in Sikasso region, in June 2021 in Fulfulde. This quote was translated from Fulfulde to French to English.
21 Interview with male social science researcher, conducted in Bamako in June 2021 in French. This quote was translated from French to English.

Working women on a market in the central area of Mopti. © Andy Spyra

such as poultry as opposed to cows. Fisherwomen mostly salt, smoke, and sell fish caught by men (although some women engage in fishing themselves). Women farmers plant different crops as well as work in fields seen as belonging to male relatives. These gender norms affect access to, control over, and ownership of resources and decision making. As a woman farmer and peacebuilder interviewed in the Sikasso region said, "The owners of land are seen as men... If my husband has land, he can give [me] land to cultivate but as soon as it becomes fertile, he comes to take it over. Generally, also in a big family, when the husband dies, you do not inherit the land and it goes to the family rather than the wife."[22]

Nonetheless, women are crucial not only to family livelihoods, but also conflict and peacebuilding. They play key intelligence gathering, supply, and recruitment roles in all AOGs and are involved as combatants in the MNLA. Jihadi groups used the strategy of alliances through marriage in an effort to establish themselves during their occupation in the north (Possémé-Rageau 2016) and some women are involved in search operations and low intensity fighting by the Movement for Unity and Jihad in West Africa (MUJAO) (Houinato and Traoré 2016). Older women in particular mobilise communities to support different causes and narratives.

22 Interview with woman farmer, leader, peacebuilder, and community educator on climate change impacts and adaptation, conducted in Yanfolila in the Sikasso region, in June 2021 in Bamanankan. This quote was translated from Bamanankan to French to English.
23 Interview with woman working for the United Nations on women's rights, conducted online, in June 2021 in French. This quote was translated from French to English.

They both encourage men to fulfil 'masculine' roles to protect the community and dissuade them from committing violence. In Mopti and Segou, a partner or spouse is the primary influencer for both women and men in deciding to join or leave an AOG, followed by mothers (Gorman and Chauzal 2019). Conversely, women such as those in Gao have served as regulators in ceasefire negotiations, convinced groups to disarm, organised civilian watch groups, and reduced intra- and inter-communal tensions (Gorman and Chauzal 2019).

Meanwhile, men and boys are viewed with suspicion by all conflict parties, targeted in operations, and (forcibly) recruited. While men of all ages, ethnicities, and livelihoods work for peace, norms around masculinities drive conflict and violence. Men, socialised to think of themselves as protectors, can feel compelled to join AOGs and community militias. Male combatants are viewed as manlier and more virile so these men gain community respect and have better access to women, including through sexual violence, and marital prospects than peers. According to a female UN worker, "For the young men, having a gun is part of their masculine image which influences conflict dynamics. It is part of their role as a protector. They have to show they assume this role and protect the interests of the family."[23]

7. Economic precarity and the attraction of informal and illicit trade

Livelihoods are increasingly difficult to sustain due to climate change, corruption, recession, inequality, insecurity, policies that erode rather than enable coping strategies, and social exclusion. The 1972–74 and 1982–85 droughts caused unprecedented displacement and affected livelihoods, particularly of nomadic pastoralists forced into urban informal economies (Briscoe 2014). Livestock is the major source of income for around 30% of the population and accounts for 35% of GDP, but is characterised by low herd productivity due to recurrent seasonal feed shortages, poor forage quality, limited access to pastures and water points, and critical challenges in delivery of animal health services (Dione, Traore, Wieland and Fall 2017). Concurrently, farmers and fisherfolk also face grave challenges including soil infertility, silting of rivers, and depleted fish numbers and variety.

Informal and illicit trade could provide more profitable livelihoods, social mobility and protection, particularly for young people and hierarchically subordinate clans (International Alert 2016). In the 1990s, levels of theft and banditry increased, ethnic self-defence militias were created, and intra- and inter-communal social cohesion was corroded. Mali has become one of the major routes through which cocaine from Latin America reaches Europe and the Middle East. Other drugs smuggled include cannabis, tramadol, diazepam, and other psychotropic drugs. Mercury and cyanide, used to separate gold from other minerals in the gold panning sites of Kayes, are smuggled into Mali from Benin, Togo, Burkina Faso and Senegal, posing grave risks to agriculture, fisheries, livestock, and human health (Koné and Adam 2021b). Mali is also a route for irregular migration through West Africa, with state authorities either complicit in migration or lacking effective presence and capacity to counter it (Molenaar and van Damme 2017). These networks are increasingly militarised as regional arms flows and vast profits lead to high competition over control of roads, creating a demand for protection (Assanvo, Dakono, Théroux-Bénoni and Maïga 2019).

C. Environment and climate change in Mali

This section presents climate change measurements based on quantitative data analysis modelling. It starts by discussing historical changes in climate and their impacts and ends with projected climate change parameters (temperature and precipitation) and related impacts on water availability and health in Mali until 2080.

Hotter, dryer and less predictable: How climate change will impact Mali

CERTAIN CLIMATE CHANGE AND IMPACT PROJECTIONS

Temperature: Depending on the GHG emissions scenario, **temperature in Mali is projected to very likely rise between 1.8 and 2.5 °C by 2030,** and between 2.0 and 4.6 °C by 2080, compared to pre-industrial levels. This temperature rise will affect the whole country, with higher temperature increases in northern Mali. **The annual number of very hot days** (with daily maximum temperatures above 35 °C) is **projected to increase** with high certainty all over Mali. This increase will be much stronger in the south, where by 2030 up to over 40 more very hot days annually are projected, as compared to the year 2000.

Health impacts: Rises in temperature and very hot days will result in **more frequent heatwaves,** which translate into an **increase in heat-related mortalities.** The population affected by at least one heatwave per year is projected to very likely increase from 2% in 2000 to between 3.6 and 9% until 2030, while heat-related mortality will increase from 2.5 to 4.7 deaths per 100,000 people until 2030 under both scenarios (best estimate).

LESS CERTAIN CLIMATE CHANGE AND IMPACT PROJECTIONS

Precipitation: **Precipitation projections are highly uncertain.** Geographically explicit precipitation projections differ significantly in both the magnitude of change and the level of certainty around the projected changes.

Likewise, projections on heavy precipitation events across Mali are highly uncertain and do not allow for identifying a trend of future precipitation intensity.

Water availability: Projections of water availability in Mali are highly uncertain under both GHG emissions scenarios. **Considering projected population growth, overall per capita water availability will strongly decline** by 2080 under both emissions scenarios, though uncertainty around current and projected available water volumes is extremely high. Based on this data, it is most prudent to plan for increasing uncertainty in regard to future water availability.

Crop yields: While yields of **millet and sorghum and maize are projected to decrease, rice yields will increase.** However, while all projections allow to discern trends in future crop yields, the uncertainty around the actual magnitude varies and increases with time under all projections.

Figure 3: Certain and less certain climate projections for Mali (Tomalka et al. 2020)

Figure 4: Topographical map of Mali with existing precipitation regimes (Tomalka et al. 2020).

1. Significant and increasing climate change

Variability in climate, both geographically and over time, is not new to Mali, but recent decades have seen a steep change, particularly in predictability of climatic events. Mali is located in the Sahelian zone typical for severe and frequent droughts, erratic precipitation, and degrading environmental conditions (Funk et al. 2012; WFP 2019). There are substantial differences in temperature and moisture regimes across regions. The country can be classified into the following major agro-ecological zones from north to south: desert; arid / Sahel; semi-arid / Sudan savannah; northern Guinea savannah; southern Guinea savannah; and derived savannah (Figure 4). While the south is characterised by steppe and tropical savannah zones and climatic conditions for agricultural activities, the north and centre of the country is mainly desert, with pastoralism serving as the main source of livelihoods (Tomalka et al. 2020).

AIR TEMPERATURE

Currently, the average annual temperatures reach between 27.6 – 30 °C, with higher maximum temperatures and larger temperature variations in the northern parts of the country. Highest average temperatures are found in Gao, Tombouctou and Menaka. Since the beginning of the 20th century, the average temperature in Mali has increased by approximately 0.96 °C (Figure 5). The highest temperature increases were recorded in Tombouctou (1.16 °C), Gao (1.11 °C), and Taoudenit (1.06 °C). Increasing temperatures have been accompanied by a considerable increase in very hot nights, while the number of extremely hot days has largely remained the same (The World Bank Group 2021).

PRECIPITATION

Mali has one single rainy season, typically stretching from May to October and peaking in August, as shown in Figure 4. Although rainfall and other climate patterns are not uniform amongst the numerous microclimates (Higazi and Ali 2018), average rainfall and length of rainy season tend to decrease while temperature variations tend to increase northwards. In the south of Mali, the rainy season lasts for up to six months with precipitation rates exceeding 1,100 mm/year, while in the north it only lasts for three months, with annual precipitation remaining below 100 mm/year (Tomalka et al. 2020; Baratta et al. 2021). Precipitation patterns are highly dependent on the Intertropical Conversion Zone[24] (ITCZ), which contributes to the high inter-annual rainfall variability across the country (USAID 2018).

24 The Intertropical Convergence Zone (ITCZ) is the global low-pressure trough through which northern and southern trade winds converge.

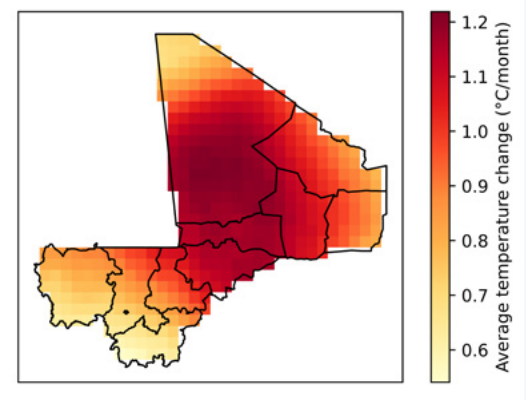


Figure 5: Change in 31-year average temperature since the beginning of the 20th century in Mali (change between 1901–1931 and 1990–2020 averages, own calculations based on the Climatic Research UNIT Time-Series version 4.05 dataset, for more information see Annex).

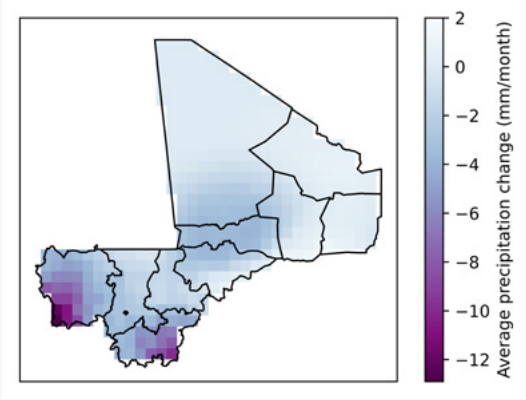


Figure 6: Change in 31-year average precipitation levels since the beginning of the 20th century in Mali (change between 1901–1931 and 1990–2020 averages, own calculations based on the Climatic Research UNIT Time-Series version 4.05 dataset, for more information see Annex).

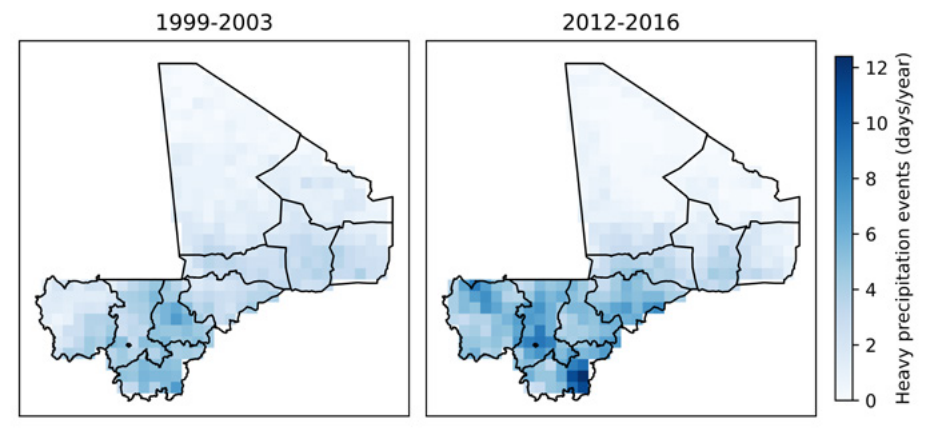


Figure 7a: 1999–2003 average

Figure 7b: 2012–2016 average

Figure 7 Average number of days with heavy precipitation events annually in Mali between 1999–2003 (Figure 4a) and 2012–2016 (Figure 4b) (own calculations based on the EWEMBI dataset, for more information see Annex).

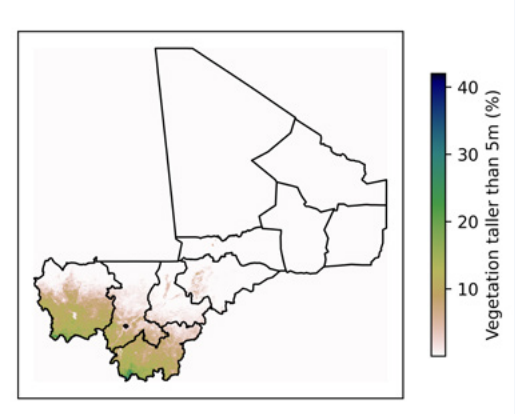


Figure 8: Tree canopy cover in 2000 in Mali (calculations based on the Hansen Global Forest Change v1.8 dataset, for more information see Annex).

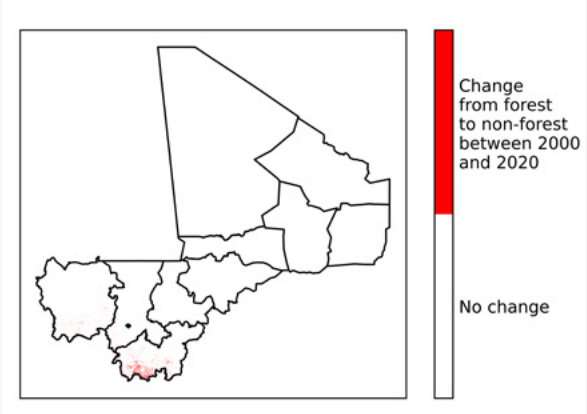


Figure 9: Forest cover loss (change between 2000–2020) in Mali (calculations based on the Hansen Global Forest Change v1.8 dataset, for more information see Annex).

Since the beginning of the 20th century, monthly average precipitation level decreased by 1.98 mm (5.07%), as shown in Figure 6. Particularly affected were the on average wetter southern regions (most strongly Kayes and Sikasso). The percentage reduction in average precipitation, however, was highest in the already very dry regions of Tombouctou and Taoudenit, where the average precipitation decreased by 12.4% (3.09 mm) and 15.1% (0.66 mm), respectively. In contrast, in the Kidal and Menaka regions, a very slight increase of 0.4 and 0.34% has been observed (Figure 6).

The frequency of extreme weather events has also increased. The average number of heavy precipitation days per year increased from approximately 2.9 between 1999–2003 to around 3.6 between 2012–2016 (Figure 7). On average, heavy precipitation days were already more frequent in southern Mali between 1999–2003 (Figure 7a) and continued to increase more strongly there (Figure 7b). In Sikasso and Koulikoro, heavy precipitation events amounted to more than 6 days per year between 2012–2016 on average, with significantly higher increases in certain areas, such as in the east of Sikasso (Figure 7b). Furthermore, the inter-annual rainfall variability has become more intense and frequent (The World Bank Group 2021; Traore et al. 2015).

Droughts across Western Africa have also increased in frequency since the 1950s (Trisos et al. 2022). After a relatively wet period in the 1950s, a growing number of drought events of varying degrees of intensity unfolded across Mali. Droughts were particularly severe in the 1970s and 1980s, contributing to significant humanitarian crises, particularly between 1972–1974 and 1983–1985 (Traore et al. 2007; GFDDR 2019). Precipitation partially recovered in the 1990s, but has not been subsequently increasing since 2000. Average precipitation from 2000–2009 remained about 12% lower than the average between 1920–1969 (USGS and USAID 2012), and droughts remained a recurrent phenomenon with pronounced drought periods between 2002–2003, 2011–2012, and 2015–2018 (GFDDR 2019). While drought hazards have increased more in already arid northern areas, the greatest impacts are in the more populous southern region (GFDDR 2019).

WATER RESOURCES

On average, Mali has relatively abundant water resources, estimated to range between 2,200 and 9,600 m^3/capita (likely range, see also Figure 13).[25] However, distribution strongly varies. Water resources are concentrated along the Niger and Senegal rivers[26] and the Inner Niger Delta (IND), which is fed by the Niger River. The Niger and Senegal rivers and their tributaries provide the most permanent sources of surface water, with a high flow season from June to November and a low flow season between December and May (Baratta 2021). The Inner Niger Delta (IND), an inundated wetland in central Mali that spreads over an area of about 30,000 km^2, supports over 10% of Mali's population with natural resources and livelihoods (Mariko et al. 2003). It provides fertile land for the cultivation of rice and other crops. Approximately 80% of the Malian fish is retrieved from the IND, which is also an important grazing ground for around 40% of Malian cattle (Liersch et al. 2019). While the Niger River provides enough water to supply agricultural demands in the IND during the wet season, water withdrawals during the dry season are limited (Baratta 2021; Liersch 2019). Moreover, within the IND itself, there is significant difference as the Niger River divides the area into the zone inondé, a wetland area which is covered with water from the start of the rainy season and completely flooded for a number of months in the year before the water recedes (Diallo 2015), and the zone exondé.

After the droughts in the early 1970s and mid-1980s, a general return to wetter conditions and an increase in flooding events have been observed across the Niger River Basin (Aich et al. 2015; Jury 2013; Hiernaux 2020). The number of people affected by heavy flooding events has increased substantially, particularly in the middle Niger. This increase in exposure has also been related to rapid population growth in the IND (Aich et al. 2016). Moreover, an analysis of extreme precipitation and flash flood occurrence for the city of Bamako found that extreme rainfall events and intensity and related flooding increased from 1982 to 2019. While about 58% of flood events have been caused by normal rainfall, 33.3% were related to extreme rainfall events (Fofana et al. 2022).

According to the Global Facility for Disaster Reduction and Recovery (GFDDR), water scarcity affects an average of 400,000 people in Mali every year, with significantly higher numbers in years

25 A country is under water stress (faces water scarcity) when water supplies drop below 1,700 (1,000) m^3 per person per year, according to the Falkenmark Water Stress Indicator.
26 About 47% of Mali lies within the Niger River Basin and 11% within the Senegal River Basin (Barratta 2021).

with below-average rainfall (GFDRR 2019). Water stress has been increasing in areas distant from the rivers and delta regions and is the highest in the northeast of Mali due to decreasing precipitation from southwest to northeast. However, apart from the information about the main rivers and related floodplains, other hydrological and water reserves data remain limited (USAID 2013).

ENVIRONMENTAL PRESSURES

In addition to these adverse climatic changes, Mali is exposed to additional major environmental pressures such as land degradation and, consequently, reduction in vegetation cover and loss of fertile land (CIA 2021). Land degradation is caused by multiple anthropogenic pressures from land use, compounded by adverse climatic impacts such as droughts, as well as wind erosion (Doso 2014).

Forest areas are situated mainly in the southern Kayes, Koulikoro and in Sikasso (see Figure 8). In the 1970s and 1980s, higher population pressure significantly increased the demand for agricultural land, firewood and charcoal production. Sale of these products was one way how people adapted to changing fortunes, resulting in massive deforestation. These dynamics are continuously exacerbated by the actions of corporations, with firewood and charcoal sales happening at commercial as well as subsistence levels. Even here, activities are gendered, with men tending to be the ones who cut large trees using machinery while women cut smaller trees or gather firewood. The conflict has also affected the environment with military encampments cutting trees in order to better view the approach of AOGs and prepare for attacks, whereas, conversely, some jihadi AOGs have forbidden the cutting of trees to ensure continued cover. Even though deforestation has slowed down more recently (Amadou 2020), it still remains considerable. Between 2001 and 2020, Mali has lost 366,000 ha of forest cover, which is equivalent to a 15% tree cover loss. Deforestation rates were by far highest in Sikasso, which experienced 73% of total tree cover loss between 2001 and 2020 (Figure 9) (Global Forest Watch 2021).

Despite massive population growth driving increased land use, including deforestation, ground-level observation and remote sensing reveal signs of regreening across the Sahel region, specifically in the Gourma region of Mali. The increased wetting and greening conditions started with the recovery of rainfall after the heavy droughts from the 1980s onwards. The few existing projections also point towards wetter conditions in the Sahel in the future, which might result in a continued increase in vegetation. However, the uncertainty is high for a number of aspects, including the precipitation uncertainties, the role of CO_2 as fertilizer with elevated CO_2 concentrations, lacking consideration of surface feedbacks in existing models, and human interventions (e.g. land use changes, large-scale afforestation, geoengineering) (Dardel et al. 2014; Pausata et al. 2020).

2. Projected climate change and impacts[27]

HOW TO READ THE FIGURES IN THIS SECTION*

The maps and plots below provide an overview of projected climate change parameters (temperature and precipitation) and related impacts on water availability and health in Mali until 2080 under two different climate change scenarios (Representative Concentration Pathways, RCPs): i) RCP2.6 represents a low emissions scenario that aims to keep global warming likely below 2 °C above pre-industrial temperatures, and ii) RCP6.0 represents a medium to high emissions scenario. Projections are provided until 2080, with each year showing the mean value of a 31-year period (further information in Annex).

The **line plots** show climate impact projections for the whole country, with the blue colour indicating the RCP2.6 scenario and the red colour indicating the RCP6.0 scenario. While the lines show the best estimate (representing the multi-model median of 10 climate models), the shaded areas show the likely range (strongly shaded area) and the very likely range (lightly shaded area), indicating the range of model agreement of at least 66 and 90% of all model projections, respectively.

How to read the line plots

The **map plots** display regionally explicit climate information under RCP2.6 and RCP6.0, in a spatial resolution of approximately 50 x 50 km. While the leftmost column represents the baseline period, the other three columns show future projections in comparison to that baseline period. The presence of a dot means that at least 75% of the underlying models agree on the change depicted (i.e. whether an increase or a decrease can be expected). Conversely, the absence of a dot represents a lack of model agreement over the predicted change (Tomalka et al. 2020).

AIR TEMPERATURE

Air temperature over Mali is projected to rise. Compared to pre-industrial levels, the average temperature over Mali is projected to increase by approximately 2.2 °C in 2030. In the long run, further increase will depend on the emissions pathway, as shown in Figure 5. Under RCP2.6, air temperature will increase by around 2.7 °C by 2080, while it is expected to increase by around 4.0 °C under RCP6.0 (multi-model median) (Tomalka et al. 2020).

Temperature increases will affect the whole country. Compared to the year 2000,[28] the increase will range between 0.75 and 1 °C under RCP2.6 and between 0.8 and 1.2 °C under RCP6.0 until 2030, with a stronger temperature rise in northern Mali. As shown in Figure 11 below, air temperatures will continue to rise steadily after 2030, again affecting the already hotter northern Mali disproportionately stronger. Long-term temperature increases will be significantly higher under RCP6.0.

The annual number of very hot days is also projected to rise all over Mali, with a more drastic increase in southern Mali across all time frames (Figure 12). Under both GHG emissions scenarios, models project a minimum annual increase of 11 to 12 additional very hot days in the north, and over 40 more very hot days in the south until 2030, as compared to the year 2000. Depending on future GHG emissions, the south of Mali might experience up to 120 additional very hot days per year by 2080 (RCP6.0). Sikasso and southern Kayes, Koulikoro and Ségou will be particularly affected. Higher heat stress poses a risk to the population's ability to work and live (Buzan and Huber 2020) and increases health risks (Tomalka et al. 2020).

*Note that all plots and most projections in this section are either directly derived from Tomalka et al. 2020, or based on Tomalka et al. 2020.
27 The symbol displayed in this chapter is to indicate the projections which are subject to high levels of uncertainty. These projections must be interpreted cautiously. For further information on uncertainties in climate change projections and guidance for interpretation, please see the text box "Uncertainties in climate change projections" in the Annex.
28 While the line plot on air temperature change (Figure 10) compares future developments with temperature changes between 1876 – 2000, this map plot (Figure 11) provides projected air temperature changes relative to the year 2000. Hence, projections of those plots are not comparable.

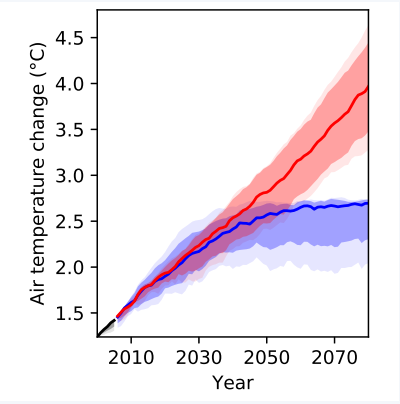


Figure 10: Air temperature projections for Mali for different GHG emissions scenarios, relative to year 1876 temperature levels[29] (Tomalka et al. 2020).

29 Changes are expressed relative to year 1876 temperature levels using the multi-model median temperature change from 1876 to 2000 as a proxy for the observed historical warming over that time period.

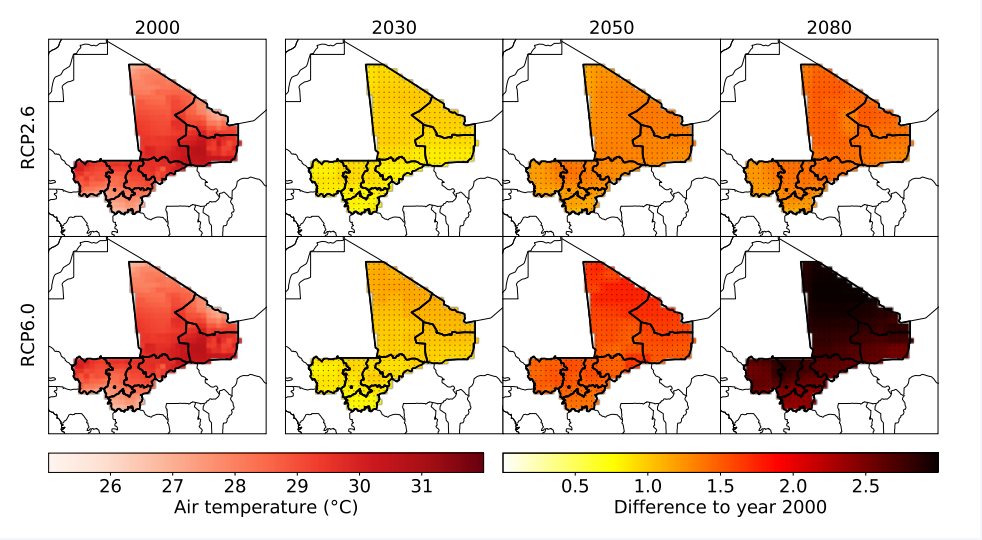


Figure 11: Geographically explicit air temperature projections for Mali for different GHG emissions scenarios, as compared to the year 2000 (Tomalka et al. 2020).

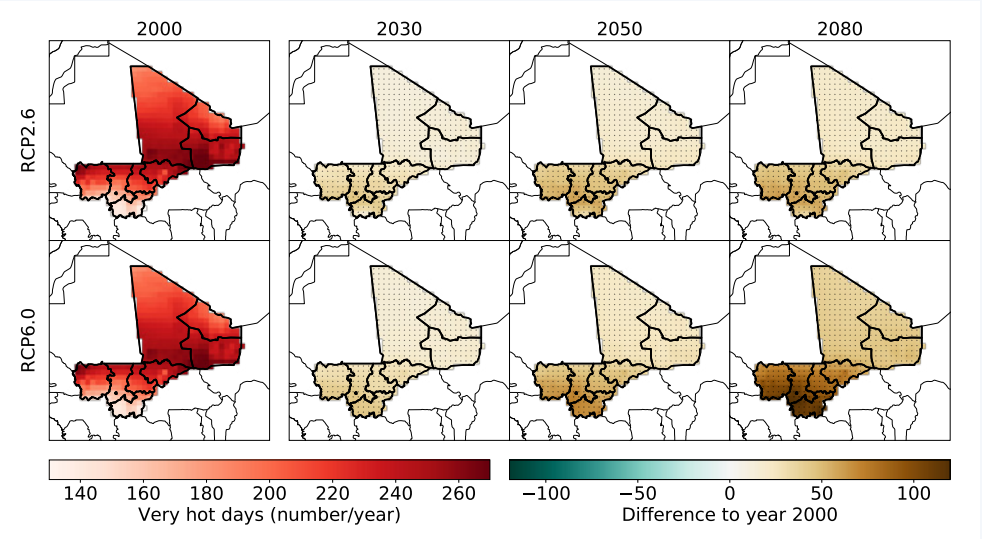


Figure 12: Geographically explicit projections of the annual number of very hot days (daily maximum temperature above 35 °C) for Mali for different GHG emissions scenarios (Tomalka et al. 2020).

Rising temperatures will result in more frequent heatwaves and heat-related mortalities in Mali. The population affected by at least one heatwave per year is projected to very likely increase from 2% in 2000 to between 3.6 and 9% until 2030, as shown in Figure 13. Even though heatwave exposure is projected to rise after 2030 under both scenarios, the increase will be much stronger under RCP6.0 in the long run, whereby the model agreement regarding future increases in heatwaves exposure decreases with time.

According to the best estimates, heat-related mortality will rise from 2.5 to 4.7 deaths per 100,000 people until 2030 under both scenarios, as seen in Figure 14. While under RCP2.6 heat-related mortality rate increases only slightly and eventually stabilises around the year 2050, under RCP6.0 it is projected to increase to almost 12 deaths per 100,000 people per year by 2080 (Tomalka et al. 2020).

PRECIPITATION

High levels of inter-annual and decadal rainfall variability make it difficult to discern a clear trend in future projections. Median model projections suggest a very slight decrease by 2080 under both GHG emissions scenarios. However, while some models project a decrease in precipitation, others project no future change or an increase. It also remains unclear whether the observed pattern of increasing precipitation variability will persist (ICRC 2021).

Likewise, geographically explicit precipitation projections differ significantly in both the magnitude of change and the level of certainty of projected changes, depending on the underlying scenario and the different timeframes. Overall, precipitation can be expected to increase in eastern Mali and in some parts of northern Mali until 2030, as shown in Figure 15. Precipitation in southern Mali and the very north might decrease under RCP6.0, but the modelling uncertainty over these regions is high, as depicted by the absence of dots within the plot.[30] This uncertainty particularly applies to the very north, but also to parts of Koulikoro, Sikasso and Kayes. Therefore, these projections need to be assessed carefully (Tomalka et al. 2020).

Changing precipitation patterns could further shift the wettest period towards the beginning of the rainy season (June and July) with a subsequent decline in precipitation (between 6 and 10%) for the remainder of the period (Baratta 2021). While overall, heavy precipitation events are expected to become more intense in response to increasing GHG emissions across western Africa (Trisos et al. 2022), projections for Mali are highly uncertain and do not allow for identifying a future trend (Tomalka et al. 2020).

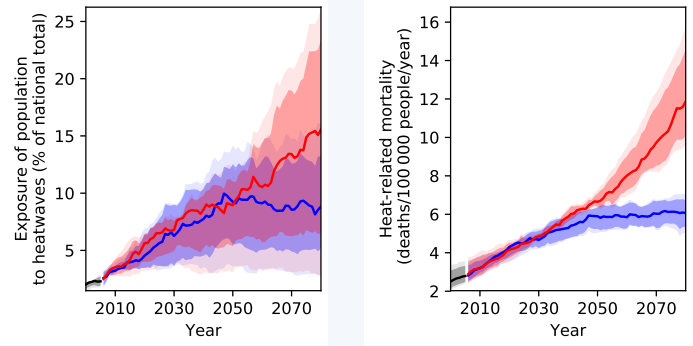
In terms of projections on flooding, according to global climate and hydrological models, around 0.05% of Mali's total land area and 0.13% of Mali's population are currently exposed to at least one river flood per year. According to the best estimate, by 2030 the population exposed to river flooding will decrease to 0.035% under RCP2.6 and 0.037% under RCP6.0. Until 2050, population river flooding exposure will decline to 0.008% under RCP2.6 and rise to 0.051% under RCP6.0 (Lange et al. 2020b).

The duration of meteorological drought across western Africa is projected to increase from approximately 2 months during 1950 – 2014 to approximately 4 months in the period between 2050 – 2100 under a high emissions scenario (Trisos et al. 2022). For the case of Mali, models project that currently around 2.65% of Mali's total land area and 1.4% of Mali's population are exposed to at least one drought per year (best estimates). Median climate models project a very slight long-term increase in total national land exposure to drought, amounting to 2.7% by 2030 and 4% by 2050 under RCP2.6, and an increase to 3.4% by 2030 and 3.5% by 2050 under RCP6.0. Annual population exposure to drought will amount to 1.7% in 2030 and to 2.4% by 2050 under RCP2.6, while under RCP6.0, 1.6% and 2% of Mali's population will be exposed to drought until 2030 and 2050, respectively (best estimates). These projections, however, should be treated very carefully, as the underlying models project strong differences in the magnitude of future changes under both scenarios and across the different time frames, ranging from 0 to 15% (Lange et al. 2020b).

WATER AVAILABILITY

The high uncertainties over future precipitation in Mali translate into highly uncertain future water availability (Figure 16). Averaged across the country, per capita water availability in 2000 amounted to 6,521 m³ (multi-model median), with estimates varying widely, ranging from 2,265 to 18,227 m³ (very likely range). Assuming a constant population level (plot A), per capita water resources will only decrease slightly towards the end of the century.

30 The presence of dots in the plot means that at least 75% of the underlying models agree on the change depicted (i.e. whether an increase or a decrease can be expected).



Figures 13 and 14: Projections of population exposure to heatwaves at least once a year for Mali for different GHG emissions scenarios and heat-related mortality for Mali for different GHG emissions scenarios assuming no adaptation to increased heat (Tomalka et al. 2020).

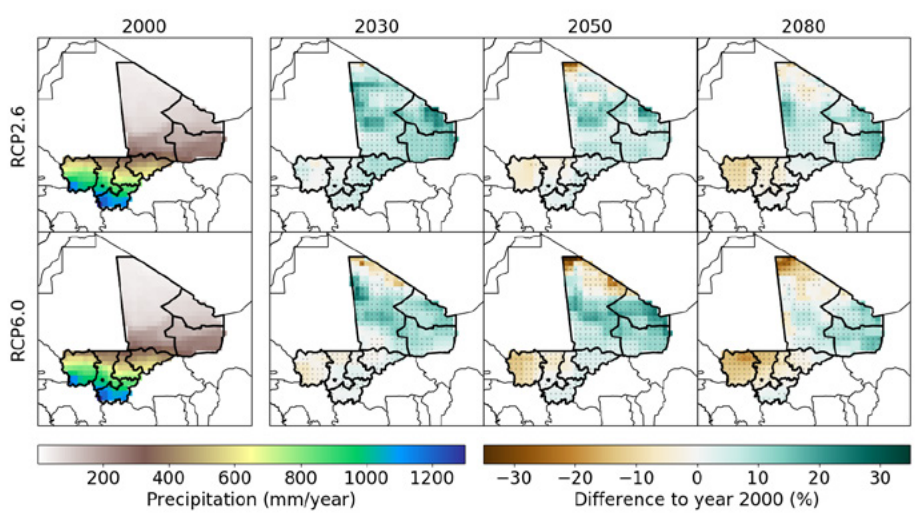


Figure 15: Geographically explicit annual mean precipitation projections for Mali for different GHG emissions scenarios (Gleixner 2021, based on Tomalka et al. 2020).

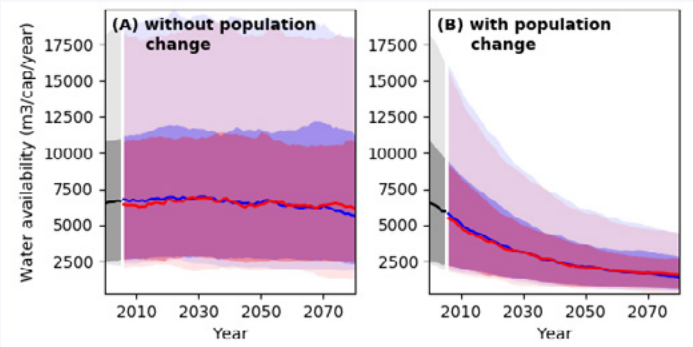
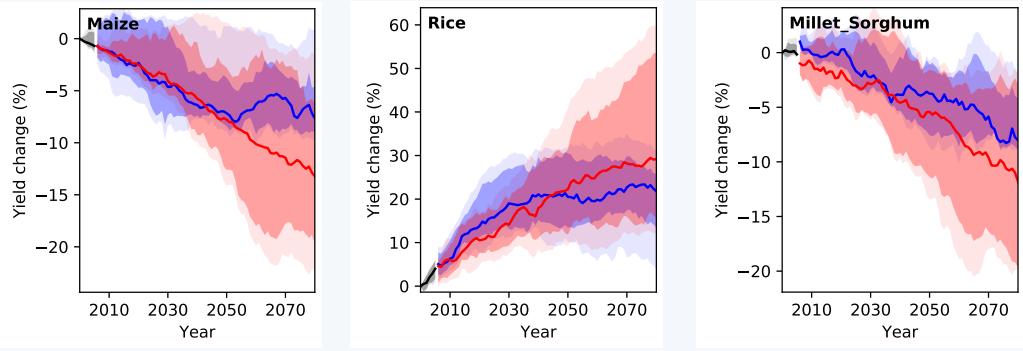


Figure 16: Projections of water availability from precipitation per capita and year with (A) national population held constant at year 2000 level and (B) changing population in line with SSP2 projections for different GHG emissions scenarios, relative to the year 2000 (Tomalka et al. 2020).



Figures 17–19: Projections of crop yield changes for major staple crops in Mali for different GHG emissions scenarios assuming constant land use and agricultural management (Tomalka et al. 2020).

However, water demand will increase with the expected rise in population. When accounting for population growth according to SSP2[31] projections (plot B), per capita water availability for Mali is projected to sharply decline to between 1,080 and 8,816 m³ (multi-model median of 3,117 m³) under RCP2.6, and to between 850 and 8,484 m³ (multi-model median of 3,078 m³) under RCP6.0 by 2030, relative to 2000 (Figure 16). Moreover, in the Klela basin in Mali, groundwater recharge is projected to decline by 49% and groundwater storage by 24% by 2050 under the RCP8.5 high emissions scenario (2.4°C global warming) compared to the 2006 baseline (Traore et al. 2015).

Climate change impacts on future river flow and flooding regimes within the IND are highly uncertain, with some studies projecting an increase in annual river inflow and flood extent, and others projecting a decrease. This uncertainty is largely due to a high discrepancy between simulations driven by different Global Circulation Models (Liersch 2019; Vetter 2015). Changes to flooding in the IND will also be strongly affected by increased irrigation needs and upstream water resources schemes such as the Sélingué Dam or the Markala Barrage (Thomson 2016). The planned construction of a large hydropower dam in Guinea (Fomi Dam) raises concerns about substantial changes in the flow regime, which, in combination with an increased abstraction of water for irrigation purposes, might reduce discharges into the IND by 13% in an average year and by 38% in very dry years (Liersch et al. 2019; Wetlands International 2020).

AGRICULTURE

Increasing temperatures and high rainfall variability will affect agriculture and food security, though the impacts of climate change on different types of crops will differ (Figures 17–19).

Studies found that sorghum and maize are vulnerable to a 2 °C temperature increase in the Sudanian savannah, including the south of Mali (Faye et al. 2018). Concurring herewith, model results indicate a negative trend in maize yields, which has also been related to changing rainfall and diminishing rainy season length (Diallo et al. 2020). However, model agreement regarding the extent of decline decreases the further into the future one looks. This translates into a change of between -9 to +10% by 2030, and by between -15 to -22% by 2080, in comparison to year 2000 levels. Millet and sorghum yields, Mali's main subsistence crops, are also projected to decrease, but with increasing modelling uncertainties over time. Under the medium to high emissions scenario RCP6.0, yields will very likely change by -6 to 4% by 2030, and decline by 2 to 20% by 2080, in comparison to year 2000 levels. On the contrary, rice yields are projected to very likely increase between 11 and 30% under RCP2.6, and by 7 to 23% under RCP6.0 until 2030. This increase might be due to a more resilient metabolism, compared to other plants (Tomalka et al. 2020). However, while the projections allow us to discern trends of change, the uncertainty around the actual amount of increase is relatively high and grows with time under both scenarios.

Climate change impacts furthermore negatively affect pastures and forage yields. Butt et al. (2005) found that forage yield could decrease by 5 to 35%, resulting in a decrease in the weight of the animals of 14 to 16% by 2030. Future climate change impacts on crop yields and pastures, as well as the expected population growth rates and continuous land degradation, will further threaten the country's food security.

31 Shared Socio-economic Pathways (SSPs) outline a narrative of potential global futures, including estimates of broad characteristics such as country-level population, GDP or rate of urbanisation. Five different SSPs outline future realities according to a combination of high and low future socio-economic challenges for mitigation and adaptation. SSP2 represents the "middle of the road" pathway.
32 See the Falkenmark Index.

D. Climate security pathways

There are four overlapping and interacting ways in which climate change and conflict are linked in Mali:

1. Climate change and conflict, separately and together, impact livelihoods, block adaptation, and affect social cohesion
2. Weak governance, rent seeking and corrupt behaviour negatively affect adaptation, conflict dynamics, and environmental degradation
3. Increasing competition over natural resources contributes to rising (intra- and inter-communal) tensions and violence
4. Climate insecurity is caused by and widens already existing inequalities, eroding ability to adapt, and driving conflict further

This section will examine each pathway in turn with social cohesion as a cross-cutting theme.

1. Climate change and conflict, separately and together, impact lives and livelihoods, block adaptation, and affect social cohesion

Climate change and conflict lead to significant livelihood changes and hinder adaptation. Populations have previously adjusted to either climate change or conflict, but their scale, coexistence, and interaction make doing so almost impossible for many. Moreover, strategies to adapt to climate change are diminishing social cohesion and worsening conflict dynamics.

> **The times are really hard in this country these days... The situation is very complex. Everyone thinks they suffer the most. The pastoralists think they suffer the most, the farmers think they suffer the most, the fishers think they suffer the most and everyone looks for a solution.**
>
> Fisherman, interviewed in Mopti in June 2021 (translated from Bamanankan to French to English)

Perceptions of climate impacts among Malians are in line with observed climate impacts (Traore et al. 2015). Changing climate affects human health either directly, through loss of life and injuries from more frequent and intense extreme weather events, or indirectly, through changing availability of food and water resources, patterns of disease transmissions, and physical and psychological impacts (Traore et al. 2015). Changing rainfall and temperatures deteriorate food security and correlate with low birth weight (Bakhtsiyarava et al. 2018). Heavy rainfall in Sikasso is positively correlated with an increase in child mortality (Han and Foltz 2021), while colder temperatures have decreased mortality among all ages (Bakshi et al. 2019).

Moreover, almost all respondents spoke of detrimental effects of changing climate on livelihoods. Reduced depth, shrinking and silting of water bodies make it difficult for fisherfolk to navigate and contribute to the disappearance of fish species which thrive and reproduce in deeper water. Government data show the length of the fishing season has more than halved from eight months (November to June) to two to three months (December to February).[33] As men are unable to catch as many fish, women cannot sell them, affecting household incomes. Pastoralists see changes in water bodies, reduction in quality and quantity of pasture and disappearance of grass species. This reduced nutrition decreases milk production, which affects the incomes of pastoralist women who sell milk and milk products. It also means animals are less resilient to disease. Farmers find it difficult to decide what, when, where, and how much to plant given rainfall unpredictability. Increased temperatures, decreased humidity, and heavy and insufficient rainfall affect harvest, particularly of certain crops such as maize which are no longer viable (Diallo et al. 2020; Krishnamurthy et al. 2012; Montaud 2019). Only 7% of the total agricultural land in Mali is suitable for crop cultivation (The World Bank Group 2021a) and in

33 Interview with male government official with oversight of fishing livelihoods, conducted in Sikasso in June 2021 in French. The quote has been translated from French to English.

A member of the special forces of the Malian Armed Forces walks past a group of inhabitants in the Fulani village of Ogoussago. © Andy Spyra

2018, only around 5.7% of the cultivated area was equipped for irrigation (FAO 2021). Current crop production cannot adequately meet needs and food insecurity is widespread: as of 2019, 10.4% of Mali's population was undernourished and the child stunting rate was at 26.4% (The World Bank Group 2021a).

As shown in Table 1, people have adapted through alteration of techniques, movement to new areas, diversification of livelihoods and engagement in new and sometimes illicit trades. Involvement in illicit trade in the north is partly driven by opportunities for more profitable livelihoods, social mobility, and protection. However, the extent of the already tangible climate change as well as its conjunction to insecurity also obstruct adaptation. New studies also document that the long-term effects of climate change have impacts on people's livelihoods that persist long after a hazard event. For example, in Mali, 30 years after 1982–1984, the period of most intense drought during the protracted late 20th century drying of the Sahel, the impact of drought on livelihoods and food security is still recognisable. The most food-secure households associated with persistent drought-induced famine were those that diversified livelihoods away from subsistence agriculture during and after the famine (Giannini et al. 2017).

At the same time, crime, banditry, and widespread insecurity lead to and are fed by the creation of militias, the securitisation of land management and pastoralism, and proliferation and use of arms. This insecurity gravely affects livelihoods. There is widespread cattle theft, sometimes of entire herds. Some pastoralists and fishers no longer migrate seasonally. Farmers are blocked from accessing farmlands. In over 100 villages, fields that extended up to 10 km away from villages in 2016 and 2017 were cultivated only in a radius of 500 m to 2 km in 2020 (Ibrahim 2020).[34] Locations in the Mopti region that saw a decrease in land area used for agricultural cultivation between 2016 and 2020 are places where numerous security incidents have been reported and there are strong intercommunal tensions and conflict between armed groups (Ibrahim 2020). As a result, respondents explained that no matter how hard they worked, they could not mitigate the effects of both climate change and conflict.

34 This report triangulated satellite imagery with data on armed conflict events and related deaths produced by the Armed Conflict and Location Event Data (ACLED) project.

How rural Malians are adapting to climate change

LIVELIHOOD	CLIMATE CHANGE IMPACTS	ADAPTATION
Pastoralists 	• Changes in water bodies • Reduced quantity and quality of pasture • Disappearance of grass species • Negative impact on animal health	• Split herds to hedge risk • Spend more time in search of pasture and water • Use grazing areas with better pasture • Raise new breeds and mix herds • Intensive pastoralism to increase yields • Grow grass, buy feed, trap water • Sedentarise and engage in agro-pastoralism • Diversify livelihoods away from pastoralism
Fisherfolk 	• Changes in water bodies – reduced depth, shrinking, silting • Difficulties navigating bodies • Disappearance of fish species • Reduction in length of fishing season	• Intensive fish farming in created ponds • Use smaller nets and new fishing techniques • Change migration patterns • Travel further away to fish • Buy and resell fish (vs. relying on catch) • Innovate preservation techniques • Diversify livelihoods away from fishing
Farmers 	• Difficult to plan when, where, what and how much to plant and harvest • Certain crops no longer viable • Reduced harvest due to drought, heavy rainfall, temperature increase	• Plant quick growing and drought tolerant seeds • Adjust planting and harvest to respond to rainfall patterns • Intensify agriculture (no fallow periods) • Expand farmlands • Construct dams and irrigation channels • Use tools and chemical inputs • Buy imports to resell (vs. growing crops) • Diversify livelihoods away from farming

Figure 20: How rural Malians are adapting to climate change (elaborated by adlephi).

Further, these climate adaptation strategies affect social cohesion and drive conflict dynamics in three major ways.

Firstly, diversification of livelihoods allows hedging against climate change impacts, but leads to reduced contact between groups. For example, in the past, women were often the locus of relations, with fisherwomen gifting fish to pastoralist and farmer counterparts who would give them milk and a portion of harvest in return. These interactions solidified positive relations and friendships. In some areas, each family had its corresponding family in other livelihood groups with whom it conducted such exchanges. In case of tensions, they would intervene to smoothen matters. These exchanges are now at lower levels as people have less milk, fish, and crops, therefore finding it difficult to give some away. Such exchanges are also no longer required as many people mix livelihood strategies and farm, have livestock, and fish. This shift reduces the quantity and quality of positive interactions between groups and could lead to increased competition. For example, fishers complained how other groups starting to fish had reduced the quantity of fish in water bodies as they had yet to accept custom not to catch small fish to give them time to grow.

Next, climate change adaptation measures could negatively impact others. For example, the use of chemical fertilisers, pesticides, and herbicides on farmlands, while temporarily resulting in higher crop yield, leads to degraded agricultural land in the medium- to long-term, as well as killing fish when chemicals are swept into rivers by heavy rains. Furthermore, respondents from Bozo fishing communities said they were banned from access to rivers by sedentary farming communities who started to fish and saw themselves as owning the land and water. Many Bozo respondents felt their status as non-indigenes gave them little recourse but to accept these developments while others tried to engage with farmers on the impacts of farmers' actions on their livelihoods.

Finally, migration, another key adaptation strategy, also interacts with conflict.[35] Seasonal, circular, cross border, and short-term migration were a way of life for generations. Even a decade ago, a third of the rural delta workforce migrated each season to urban areas in search of work (UNEP 2011). However, these patterns shifted in favour of longer, more permanent southward and urban migration trends, in part due to ecological, climate, and conflict factors. A culture of receptiveness to newcomers in southern Mali has weakened in response to high numbers of migrants, higher population density and growth, and increased livelihood precarity. This 'migrant' status tends to be long-term and continues across time and over generations. Unless wealthy, migrants' access to land and water is vulnerable and their inferior status could lead to grievances, while those perceived as prosperous could attract resentment (Marquette and Traoré 2020). Moreover, pastoralists who cross borders to Guinea and Côte d'Ivoire in search of pasture could face discrimination, discouragement, steep fines, and being seen as linked to jihadi AOGs. Meanwhile in the Sikasso region, there are some communities who banned migratory pastoralists moving southwards due to increased farmer-pastoralist conflict and worries about crop destruction.

This migration affects intra-group social cohesion and has unintended consequences. For example, while young people who migrate to urban areas send money back to family members if they can, their absence increases older people's labour. Migration patterns are also gendered, with men moving to cities, sometimes marrying new wives and setting up families. Women who stay behind struggle to earn enough and experience higher precarity as their incomes are affected by climate shocks while they are excluded from the resources required for adaptation (McOmber 2020). There is also some moral panic, with respondents concerned young women would experience sexual violence and engage in sex work and young men would use alcohol and drugs.

SEASONAL MIGRATION AND CONFLICT IN THE INNER NIGER DELTA

Dogon women and men used to migrate from the zone exondé to the zone inondé to work during the rice harvest and return home with rice as payment. A longstanding practice, more people started engaging in this seasonal migration to supplement incomes affected by climate change. However, due to a conflict frequently simplified as being between the Dogon and Fulɓe, Dogon people were reluctant to travel to the zone inondé due to fears of being targeted. This lack of seasonal migration affected their own food security and led to lower crop yields as rice farmers did not have enough labour to complete harvest in the shorter timeframe before crops spoiled, which was itself another consequence of climate change. At the same time, Fulɓe pastoralists who migrated from the zone inondé to the zone exondé to graze cattle could no longer do so for the same reason. They remained in the zone inondé even during the agricultural season, with their cattle therefore more likely to destroy crops.

Climate change has the potential to trigger cascades of security risks (von Uexkull and Buhaug 2021). Climate-induced increase in urbanisation via migration and displacement might exacerbate risks of conflict in cities if they lack capacities to sufficiently absorb and manage inflows of migrants (Koubi 2019; Reuveny 2007). Migration, climate, and conflict are also linked in other ways. Many young men from Gao, Tombouctou, and Kidal migrated to Algeria and Libya as a result of the 1970s and 1980s droughts. There, they were exposed to revolutionary and anti-government ideas (Benjaminsen 2016). On their return, elite lack of action in the face of their real hardship, government officials' theft of drought relief aid, and historical grievances were some factors which combined to reignite calls for secession.

35 Research with refugees, returnees, and internally displaced people from the northern Mali conflict found that those who were employed while displaced were less willing to go back to the north while those who owned a gun were more likely to plan to return (Hoogeveen. Rossi and Sansone 2019).

> We think natural resource [related] conflict is mostly in the centre but there was a migration of people into Algeria and Libya due to the 1970s droughts which caused lots of famine and deaths. That is where they learned war, jihadism, got arms, and returned. A good part went to Libya where they integrated into army, stayed in Libya during the start of the crisis in Mali then left the Libyan army and came back with arms.
>
> Male researcher, interviewed in Bamako in June 2021 (translated from French to English)

2. Weak governance, rent seeking and corrupt behaviour negatively affect adaptation, conflict dynamics, and environmental degradation

Weak governance and rent seeking, corruption, and conflict-insensitive behaviour by government and community leadership authorities constrain adaptation to climate change, feed grievances, and contribute to ineffective conflict resolution. As a result, they weaken trust and confidence between the population and the government and drive conflict dynamics further, with AOGs actively exploiting these grievances to strengthen their legitimacy and gain support.

Many people see state officials and community leaders as focused on maximising personal financial gain rather than acting in the community interest. Moreover, due to withdrawal of services, many people primarily experience the state in terms of levies of payments, corrupt justice processes, and security force operation. As a male analyst stated, "The capacity of the state to cover the land is important – as there are zones where the state is never seen or had occupied and forgotten."[36] In addition to this absent yet predatory nature, the state's inability to support people to deal with changes to the climate, insecurity, and other challenges exacerbates, in the eyes of some respondents, these difficulties. An analysis of climate-smart agriculture implementation, for example, identified major challenges to policy makers' efforts to adopt climate-smart agriculture, including difficulties identifying options and portfolios, valuing them, and prioritising investments (Andrieu et al. 2017). Together, this weakens vertical cohesion (the relationship between the government and the population) and undermines state legitimacy.

Areas of particular grievance are access to and control over natural resources and dispute resolution mechanisms. In the Mopti region, access to pasture and fishing is dependent on jowros and the maîtres de l'eau. While payments used to be symbolic, the amounts required, particularly for migrants, have become higher to the extent that many can no longer pay, constraining adaptation to climate change and driving grievances. This causes conflict when jowros and the maîtres de l'eau sell exclusive access to the same land or section of water to different people and also leads to environmental degradation, overfishing, and overgrazing.

Conversely, in the Sikasso region, access to land and water is not dependent on individuals, which leads to fewer grievances. Yet, this system is changing with migrants in particular having to seek permission or being barred. In Yanfolila for example, whereas Bozo people have been able to come, fish, and leave as they pleased before, they now need to come to an understanding with a community representative first. While trust and confidence in community leaders and state officials is generally higher compared with Mopti, respondents spoke of 'contagion' from other areas. They see community systems in some areas becoming more politicised and corrupted. Those with fewer social networks in the area and lesser resources to make payments particularly expressed grievances. Conflict resolution mechanisms seen to work best by respondents include the perspectives of women, young people, pastoralists, fishers, and farmers as well as the village chief and his advisers. Natural resource management is also seen as better in areas where there is high belief in the use of occult and magic to punish action that contradicts norms.

NARRATIVES SHAPING ENVIRONMENTAL PROTECTION

There are strong narratives around the need to safeguard the environment and a history of doing so. Followers of indigenous faiths are particularly able to manage natural resources, believe there are forests and trees that should not be touched, and respect and protect nature. Moreover, while environmental pressures such

36 Interview with male researcher and analyst, in Bamako in June 2021 in French. This quote was translated from French to English.

as land degradation and changing rainfall patterns certainly exist, false narratives can be harmful. Since the colonial period, the idea of the desert expanding due to natural trends and poor land management practices (i.e. overgrazing and misuse of forests) has been used to justify authoritarian state policies such as militarised forest protection and dispossession of land. Portraying rural Malians as incapable of managing their own natural resources played a crucial role in allowing outsiders to make decisions for them. At the time of writing, many local and international actors promoted 'desertification' narratives although the limited scientific evidence available suggests this narrative is incorrect: the Sahel as a region actually shows signs of regreening and the desert is not expanding (Benjaminsen and Hiernaux 2019; Pausata et al. 2020). Furthermore, Malians have engaged in farming, livestock raising, and fishing for centuries, facing and coping with environmental change. As a result, where contemporary environmental challenges lead to conflict or environmental degradation, the question to ask is 'What has changed that prevents local resource management systems from working effectively?'

Moreover, environment and climate interventions could increase grievances against the state and community leaders. As discussed above, Mali saw significant deforestation since the 1970s and respondents themselves noted a two-way relationship between this trend and environmental and climate changes. They said deforestation contributed to changed wind speeds,[37] higher temperatures, erosion and silting of rivers, different rainfall patterns, and reduced availability of pasture. The disappearance of forests, together with hunting, was seen to have led to the migration and disappearance of wild animals such as antelopes, elephants and lions. This deforestation is not inevitable, but rather linked to policy decisions including around the pricing and distribution of gas and lack of reforestation. As a man working for a NGO, interviewed in Mopti, said, "National policies do not encourage the reforestation of the forests but their deforestation. Multinational corporations destroy forests. When you analyse everything, you ask where is the part of nature? Everything has become about money. Nothing else has any value."[38]

Government policy was not only largely ineffective in curbing and contributed to largescale deforestation but gave rise to grievances which drove conflict. The paramilitary Services of Eaux et Forêts, established to stop desertification and enforce conservation, was strengthened in the 1980s, under influence by the sustainable development agenda and in response to donor priorities. At the same time, the International Monetary Fund and the World Bank-mandated structural adjustment programme cut public spending, service provision, and civil servants in other domains. While the state retreated from provision of necessary services, it became more present in policing forests and increasing severity of penalties. Officials interviewed stressed the necessity of combating deforestation to mitigate its impacts on populations and as environmental protection was a constitutional obligation. They delineated their challenges, speaking of the need for increased resources, training of personnel, political will, and better communications. They reflected on the heavy-handed and predatory approaches taken by some Eaux et Forêts agents who taxed, imprisoned and fined women collecting firewood and pastoralists grazing livestock (Benjaminsen and Ba 2018). Other respondents described agents committing physical violence and sexual harassment of women and girls. They said that, if you paid money to agents, you could cut trees and use banned fishing nets. Certain communities in particular felt targeted, with disadvantaged Fulɓe bearing the brunt of harassment, extortion, and maltreatment, partly linked to accusations aimed at pastoralists that they caused desertification, despite all livelihood groups engaging in firewood collection (Raineri 2018). A male respondent working on peacebuilding and natural resource management said, "People associate Eaux-et-Forêts as the enemies. If they take a small twig to brush their teeth, they fine them 200,00 XOF. Eaux-et-Forêts are interested in money and there are lots of cases of repression… so it becomes difficult to convince pastoralists to even agree to meet them."[39]

These actions lead to frustration, especially given the roles forests play in food security by offering needed produce such as fruit, roots, leaves, medicinal plants and bushmeat, providing sources of

37 Please note that wind speeds have overall very slightly decreased between 1979–1993 and 2002–2016, with this decrease mostly affecting the northeast and very south of Mali: calculations based on the EWEMBI dataset, for more information see Annex.
38 Interview with man working for an NGO, interviewed in Mopti in June 2021 in French. This quote was translated from French to English.
39 Interview with man working for an NGO on peacebuilding and natural resource management, interviewed in Mopti in June 2021 in French. This quote was translated from French to English.

energy, and supporting livestock by providing fodder high in water. Dependence on forest products increases during extreme weather events and when agricultural production is low (UNEP 2011). As a result, this conduct hinders capacities to pursue livelihoods and cope with shocks. It degrades relationships and drives conflict dynamics, with jihadi AOGs exploiting grievances (Benjaminsen and Ba 2018). Many pastoralists "support or have actively joined these groups due to their anti-government, anti-elite and pro-pastoralist discourse" (Benjaminsen and Ba 2021). The behaviour of some Eaux et Forêts agents also makes forest conservation efforts ineffective as they struggle to engage with communities. Indeed, due to these dynamics, most outreach is dependent on NGOs.

Other examples of conflict-insensitive actions include sedentarisation policies, perceived embezzlement of aid aimed at addressing drought impacts, and marginalisation of pastoralism for agricultural expansion (Watts 2012). In addition, interventions to address climate change's impacts could create or exacerbate conflict. For example, new wells meant for pastoralists in the Tolodjé reserve in Mopti caused Dogon farmers to settle and assert rights over neighbouring land, worsening farmer-pastoralist relations (International Crisis Group 2020). Due to above dynamics, jihadi AOG's could be seen by some to provide better justice and more equitable access to natural resources than community leaders and the state (Raineri 2018). For example, katiba Machina abolished fees to access pasture between 2016 and 2018 before re-establishing some smaller fees on request from jowros in 2019 and, when these fees remained despite people's refusal to pay them, some pastoralists left katiba Machina to join Dawlat il Islamia, another jihadi AOG (Benjaminsen and Ba 2021).

> **Many have joined the jihadists because: 1) they protect the environment for themselves; 2) they give justice as Allah has demanded due to the installation of sharia and Islamic empire; 3) revenge against the administration of repression - prefets, commandants, justice who does not give justice, Eaux-et-Forêts.**
>
> Male NGO representative working on peacebuilding, interviewed in Mopti in June 2021 (translated from French to English)

40 As also emphasised by the most recent report of the Inter-Governmental Panel on Climate Change.
41 Interview with man working for a peacebuilding NGO, conducted in Mopti in June 2021 in French. This quote was translated from French to English.

3. Increasing competition over natural resources contributes to rising (intra- and inter-communal) tensions and violence

Climate and environmental change, through its negative impacts on natural resources availability and quality, is one of the factors exacerbating competition over land, water, forest and fish resources. Tensions over access, usage, and control of natural resources within and between different livelihoods groups are rising and increasingly escalating into violence. This dynamic in turn affects social cohesion, contributes to the stigmatisation of certain groups, and plays a role in escalating cycles of violence. However, there is no simple and automatic causal link between climate change, resource competition, and violence.[40] As a male peacebuilder explained, "I do not see a direct link but if climate change is there, the conflict multiplies exponentially because there is more pressure on resources."[41] While there has always been competition over natural resources, it is now more likely to lead to violence due to many (non-climate change-related) factors. These factors include the availability of arms, the militarisation of conflict, the lack of effective, inclusive, just, and conflict-sensitive governance and natural resources management, the creation of militias, and (localised) histories of contestation and marginalisation.

It is also important to remember Mali's history of good relationships between and within different groups. Customs regulated natural resource management. Different groups used land at set times to mutual benefit. For example, pastoralists grazed elsewhere during the planting to harvest period, arrived using known grazing routes and grazed cattle on crop residue thereby improving soil productivity. When conflict occurred, it was more or less resolved amicably. Even in the Mopti region which saw high levels of tensions, largely harmonious relations continued until recently. Over time, relations have become strained. Soil fertility has decreased, linked partly to climate change, necessitating farmers and pastoralists to use more land for lesser benefit. Farmers explained how yield provided by one hectare now required planting ten hectares. Pastoralists said they had to travel farther to find pasture. Meanwhile, the changes to water bodies and fish presence discussed above

Natural resource conflicts are increasing and take different forms

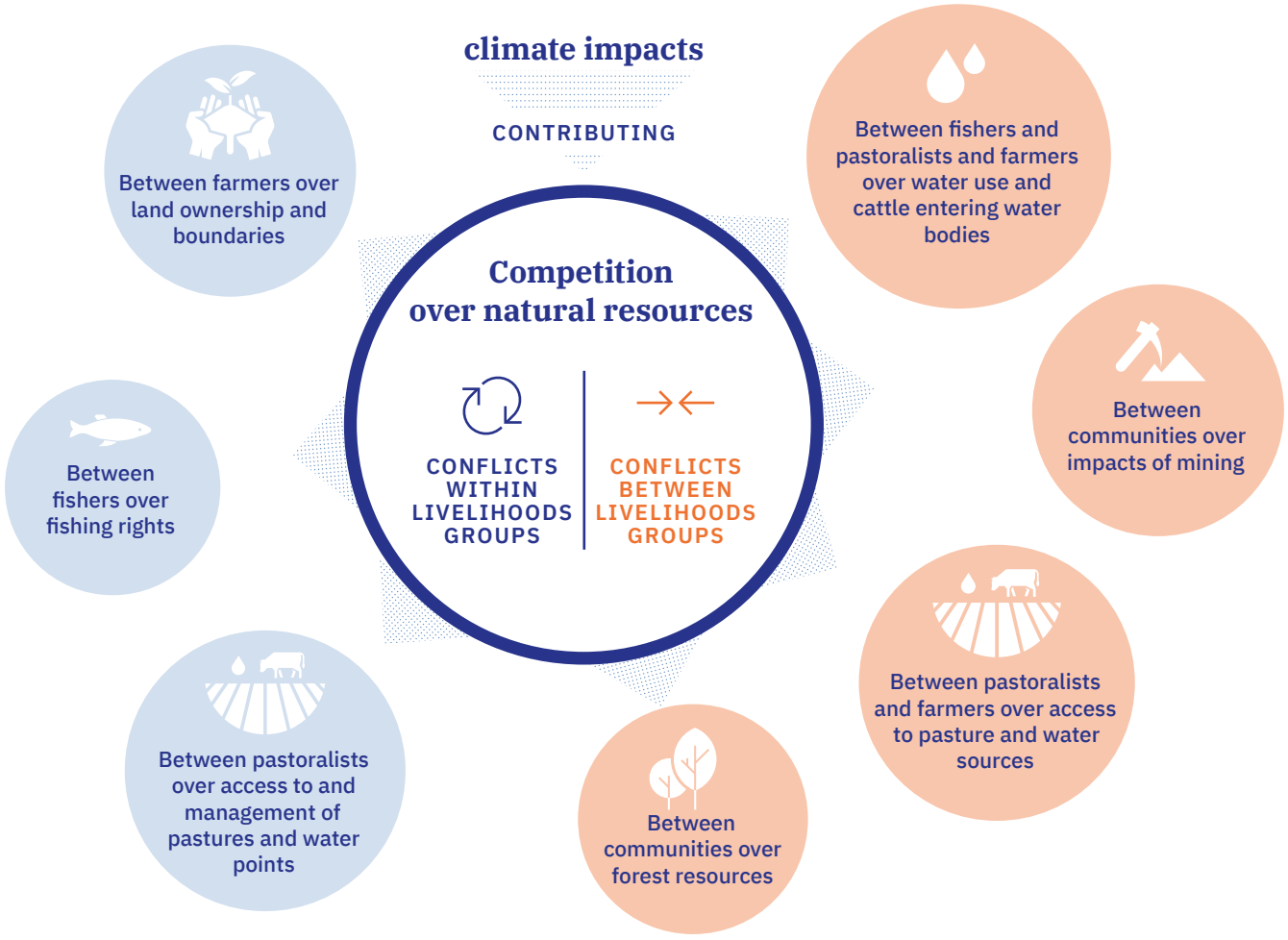


Figure 21: Competition over natural resources (elaborated by adelphi).

meant fisherfolk went farther to get a good catch. A 2019 study stated that most attacks in the Mopti region were linked to lack of space (Centre for Humanitarian Dialogue and Institute for Security Studies 2019) and the present context saw issues of access, usage, control, and securitisation, with communities claiming ownership of land and water and banning others from access. These dynamics contribute to tensions between as well as within livelihood groups. There is increased class conflict, as elites who mediate access to and control over resources benefit from funds meant for communities and those without power see livelihood prospects worsen and struggle to provide for families.

> **“There used to be calendar for everything: for fishing, pastoralism, farming, etc. and designated routes for grazing and fields for cultivation. But that has finished with policies favouring certain ways of life and not others.”**
>
> Male NGO representative, interviewed in Mopti in June 2021 (translated from French to English)

These hierarchies determine vulnerability, but times of extreme weather events, economic crisis and violence also change power positionalities (van Dijk 1999).[42] For example, following the 1970s and 1980s droughts, some pastoralists were unable to rebuild herds while others held hundreds of head of cattle. Poverty led to loss of identity, inability to command respect, and left individuals with little option but to migrate to start new lives. For example, due to these droughts and related diminution in livestock, and worsened by lack of education and professional training and limited state support, an estimated 70% of pastoralists left the Tombouctou region since the 1984 drought (Higazi and Ali 2018). Today, some pastoralists do not own their own cattle but herd others’, symptomatic of inequalities and hierarchical relationships. Plus, whereas social hierarchies were embedded

42 Positionality here refers to the occupation of a particular position in relation to others, drawing attention to the conditions under which the position of an individual in a social structure arises and is maintained.

with reciprocal relationships between nobles and non-nobles[43] in the past, this safety net for the poor has disappeared (de Bruijn 1999). As a result, while ideas of social superiority and inferiority continue to have resonance, help to those in need is no longer as forthcoming. In general, as there is less to share during crisis, people are reluctant to give gifts, an exchange key in easing tensions, imposing limits on selfishness, and cementing social relations (de Bruijn 1999). Related to this worsening intra-pastoralist relations, there are tensions over access to pasture and water points. For example, in the Tenenkou Cercle of Mopti, there are seasonal intra-Fulɓe clashes between the Sow and Sall over access to and management of pasture (Centre for Humanitarian Dialogue and Institute for Security Studies 2019). In the north, there is conflict between different pastoralist groups over water points, for example between Fulɓe (Toleebe) and Daoussahaq pastoralists in the Mali-Niger borderlands (Centre for Humanitarian Dialogue and Institute for Security Studies 2019).

AN ACCOUNT OF CHANGING FORTUNES AND CHALLENGES FACED BY PASTORALISTS

> “My family lived in Bandiagara and Douentza. Before 1994, our parents were pastoralists, by nature nomads. They would come towards to the delta and the Pays Dogon and, when the rainy season arrived, would go back to Douentza where there were not any problems. The animals had enough food and the agriculture was always good. It has been since 1994 that this started to change and we left Douentza for Bandiagara because of the droughts as there were no resources [in Douentza but in Bandiagara] all the resources were occupied by fields, even the plains. The small places that remained were fought over by pastoralists themselves. There was not enough grass and water, which created tensions between pastoralists. There was enough space at Bandiagara before to have access to resources but between 1994 and 2018, all the space there was transformed into agricultural fields. There are too many people now for the space. Before, you could have a small amount of space for a large harvest but now you need lots of space and get a small harvest. Pastoralists also need a larger amount of space to graze cattle nowadays. There is not the same grass and some species of grass have even disappeared… These grasses that have disappeared would give a lot in terms of value and utility to the animals but now, the grasses don’t have nutrition and animals have weakness, get lots of illnesses, and many animals die… The grasses with nutrition value used to grow in the places now occupied by the fields as farmers also look for places that are fertile and make fields there. There are always tensions between farmers and pastoralists. Before the hivernage farmers and pastoralists are like brothers but when the hivernage arrives, there is no longer any brotherhood.
>
> 47-year-old Fulɓe man, trader, and displaced person, interviewed in an IDP camp in Mopti in June 2021 (translated from Bamanankan / Fulfulde to French to English)

Meanwhile, farmers are in conflict over ownership of land, delineation of boundaries, or as stronger rains wash away farm inputs from one field to another. Previous border demarcations, such as forests between two villages, no longer exist. In Sikasso, neighbouring villages along a river could believe they had rights over water including that of drawing some away for irrigation. Access to fishing areas or over the fish present in dams, sales of the same fishing zone to multiple buyers, and contestation between two neighbouring villages over fishing rights could cause strain between fishers. There is conflict between communities over forest management, with villages who have depleted surrounding forest areas going longer distances to cut trees and gather firewood, even though neighbouring villages were unhappy with their activities.

There is also natural resource-based conflict between different livelihood groups. Pastoralists entering water bodies with cattle or farmers who draw water for irrigation projects affect fishing livelihoods and strain relations. In areas of Sikasso, riverine communities agreed to the dredging of the river for gold in exchange for payment but fish died due to related silting and were harmed by machinery. The mercury used in gold mining made its way into rivers and caused poisoning of cattle, fish, and other animals. In some locations, Bozo communities met riverine villages who agreed to no longer

43 The social hierarchy of Fulɓe society, established in the nineteenth century, included a division between the nobles (elites and pastoralists) and non-nobles (other groups) and between the free and non-free (those enslaved). Nobility was associated with wealth, symbolised by cattle, and having control over people and livestock. Having no wealth and no cattle negated nobility and, as a result, the widespread loss of animals significantly affected Fulɓe identity (de Bruijn 1999).

View of the harbour of Mopti, located at the riverbank of the Niger River. Due to the security crisis, almost all ship movement has been banned, eliminating job opportunities and thus further escalating drivers of instability in the region. © Andy Spyra

allow companies access to the river. However, other Bozo communities, conscious of their status as non-indigenes, believed farming villages would not listen to them.

Moreover, there is significant violence linked to farmer-pastoralist conflict. Variability in rainfall affects the timing of planting and harvest so past seasonal timetables no longer work. As a result, farmers delay harvest, sometimes by three months, so crops are still in fields when pastoralists need to access farmlands. Concurrently, farmlands expand towards and into grazing lands, including those bordering water bodies, meaning pastoralists have fewer areas to graze cattle and access water. In the Tombouctou region, tensions often arise between mainly Songhai and sedentary Tuareg farmers and Arab, Fulɓe, and Tuareg pastoralists along the Niger River as availability of grazing land decreases as cultivation expanded (Higazi and Ali 2018). In the Mopti region, Dogon communities have migrated from the mountains due to soil erosion and infertility to the areas grazed by pastoralists' cattle. These changes lead to more instances where cattle destroy crops, with cases less likely to be resolved amicably due to low levels of trust in community and state arbitration systems.

Difficulties with pastoralist livelihoods exacerbate the tendency towards agropastoralism with sedentarisation of most family members who farm and take care of some cattle while successive generations of young men move to graze the remainder. These measures mitigate climate change impacts to some extent, but mean the brunt of climate insecurity falls on the shoulders of these young men. In addition, as there are new sets of young men engaging in this work every five years or so, some knowledge of areas through which they pass and relationships with the people in them is lost. However, research also found that even young herders with few social ties along migration routes made friends, sought hosts, and maintained good relations with communities where they hoped to stay or graze cattle (Brottem 2014).

Conflicts around natural resources have affected social cohesion. In the Mopti and Segou regions, one narrative posited that everyone was to be blamed for violence committed by their group members and so a legitimate target. Actions of self-defence militias exacerbated a cycle of reprisals, which heightened inter-communal anger for loss of loved ones, property destruction, displacement, and disabilities. To an extent, these perceptions mapped onto and deepened historical and local grievances. A key sign of reduced social cohesion is a decrease in intermarriage and, in some cases, couples from different communities divorced due to family and community pressure.

Yet, some respondents, even those displaced by violence, insisted they had no problems with their neighbours but blamed others such as government actors and self-defence militias for deteriorating relations. Further, there were counter-movements such as the Dana Atem, consisting of Dogon people who condemned violence perpetrated by community militias against Fulɓe villages and argued for direct negotiations with Fulɓe groups (Benjaminsen and Ba 2021).

> **"These are communities which marry among each other, who have cohabited for a long time. When there is inter-community conflict, there is divorce to take back their girls married to the other community... These women stay in their communities with their father and brother. They are not stigmatised but somehow still seen as part of the other community [into which they married into]. Their children stay with their father because they are seen as part of him and their community wants to cut all ties. It is very difficult for women to be forcibly separated from their children [in this way]."**
>
> Women's rights activist, interviewed in Bamako in June 2021 (translated from French to English)

4. Climate insecurity is caused by and widens already existing inequalities, eroding ability to adapt, and driving conflict further

Inequality is a key cause and consequence of climate insecurity. Neither the impacts of climate insecurity nor capacities to adapt are distributed evenly among the population groups (Moseley 2011). Certain groups are blocked from undertaking strategies used by others to adjust to changing dynamics. As a result, the combined impacts of climate change and conflict and related climate security risk widening already existing inequalities, with layers of exclusion often overlapping. Concurrently, grievances linked to these unequal impacts and related barriers drive conflict dynamics. This interaction creates a vicious cycle of increasing climate insecurity, conflict, and inequality. While inequality plays a role in all of the pathways outlined before, in this section we specifically focus on those groups and topics not yet explored in detail. Recognising it is not possible to be comprehensive, this section will briefly describe six axes of social exclusion and their interaction with climate security.

Firstly, those with lower socio-economic status have difficulties to adapt to changes in the climate and security contexts. They struggle to afford adapted seeds, new tools, and techniques, to access information as to which strategies to pursue and how, and to restart livelihoods destroyed by conflict as they have lower savings. Farmers without access to dams, irrigation channels, water pumps, tractors, and other machinery cannot use these methods. Female farmers of this class have specific issues as they can only use agricultural tools and tractors when menfolk are finished with them, which often does not align with the shortened periods of optimal time for land preparation, sowing, and harvest brought about by climate change. Poorer pastoralist men face difficulties in buying the animal feed or planting the grass necessary to supplement the diet of livestock, which are unable to undergo artificial insemination due to lack of nutrition. Their female counterparts do not have the means to conserve milk prior to sale. Among fishing communities, there is wide discrepancy in the quality, quantity, and size of nets and types of fishing vessels owned by families. Poorer households have to hire canoes to undertake annual migration and / or have to work for those better off (Dixon and Holt 2010). Geography also plays a role. People with access to and control of land alongside the river struggle less with rainfall variability, while those farther away need to rely on irrigation which may not be possible depending on their resources. This reality increases prices of land adjacent to rivers which increasingly falls into the hands of richer individuals and companies. Others are forced to labour for others rather than having the greater incomes and control from working their own land.

Relatedly, climate insecurity impacts gender dynamics in significant ways. With many men killed, (forcibly) recruited, migrated in search of work, unable to financially contribute to family incomes, or detained by security forces, women have both higher vulnerability and agency. Their tasks and responsibilities increase, but they can also have more household and community decision making power. However, this shift depends on location. In areas with presence of jihadi AOGs, they impose restrictions on women that reduce their livelihoods, role in the community, and access to property, services, and other resources. In conflict-affected areas, women may no longer be

able to go to markets due to insecurity and so lose control over these incomes (Spencer 2020).

Moreover, women could be blocked by patriarchal social norms from many adaptation strategies or not have the same level of assistance as their male relatives. They struggle to access and control land, with women farmers speaking of being allocated the least productive areas. Wives and children supported men's livelihoods, for example farming lands seen as belonging to men, with resulting incomes under the control of these male relatives. Indeed, men could decide to marry additional wives to source supplementary labour. Yet, the converse did not apply: women often do not have family assistance to do the additional work brought about by climate change.

Women respondents testified that men had more resources, power, tended to own animals such as cattle which provided higher incomes, and could call on children's labour to graze animals in a way that they could not. In many fishing households, although women dried, salted, preserved, and sold fish, they were required to give money earned to male relatives. As one women's rights activist said, "Climate change has increased the problems of women who are always in second place due to rarity of resources. Who is able to strategise how to still earn despite this rarity are men."[44] Climate insecurity also increases levels of gender-based violence (GBV). Respondents shared how marital tensions, rates of divorce, and domestic violence increased in response to livelihood difficulties linked to climate change and conflict. Other forms of violence discussed include early and forced marriage, marriage for exchange, sexual exploitation, harassment, rape, and limitations on rights.

> **We do not have access to tools to labour and to tractors. That is what requires us to depend on men. The women are not given the tools to work until the men finish working in the fields and, before we can use them, the time to work the land has passed which means we are late and this really affects the harvest. The women also do not have the means to do irrigation for vegetables as we do not have access to water, which is what leads women to cut wood for consumption or making into charcoal. The land is leached of nutrition so we need these tools to have power.**
>
> Woman farmer, livestock keeper, fish farmer, and women's association representative, interviewed in Bougouni in June 2021 (translated from Bamanankan to French to English)

Thirdly, children bear the brunt of climate insecurity in ways different from adults. They experience an increase in quantity and difficulty of labour; for example, farming children are exposed to the dangers of coming into contact with herbicides and pesticides, while pastoralist children walk further with cattle to access pasture and water. Due to livelihood difficulties, children migrate to work in mining sites, for example in Gao and Kidal, to carry out tasks including digging, carrying heavy loads, and performing support roles such as cooking in return for meagre payment. Girls are subjected to early and forced marriage and other forms of GBV due to conflict and displacement linked to extreme weather events and natural disasters, while children of all genders have been recruited into AOGs and community militias (UNSC 2018; UNSC 2020).

> **With conflict, people have to be displaced... They leave their environment which is known to them and where they are protected to an environment unknown. Regarding climate change, there is an issue with water points, especially at times where there is not much water so women and girls need to walk far which exposes them to risk. With desertification and the cutting of trees, there is no longer any wood nearby so they need to walk further away which exposes them to armed groups. This is why see we increased incidence of GBV... Also, we only have rain in August and this affects people's ability to do agriculture and have livelihoods and women are saddled with survival sex as they do not have anything to eat. The only opportunity is for them to do this. Host community can perpetrate this as do armed groups. Women and girls go with anyone they can to get something to eat... There are also women who testify that we marry our girls to have something to eat or to armed groups in order to have some peace.**
>
> Woman working for a UN agency on GBV, interviewed in Mopti in June 2021 (translated from French to English)

Next, migrants, the internally displaced, and people perceived as such are subjected to social exclusion. Extreme weather events and conflict lead to humanitarian crises and linked displacement and migration. As of December 2021, there were over 350,000 people displaced within Mali (UNHCR 2021). Those displaced are often forced

44 Interview with women's rights activist, conducted in Koutiala in the Sikasso region in June 2021 in Bamanankan. This quote was translated from Bamanankan to French to English.

Displaced inhabitants from the Fulani village of Ogoussago, which was attacked and 31 people killed in February 2020.

to leave animals, nets, boats, and tools. Displaced people and migrants find it difficult to meet their basic needs, particularly given the variable nature of humanitarian aid. They struggle to pursue livelihoods and have access to land, water, and other natural resources, especially if they do not have local family and historical ties. Moreover, certain communities are seen as 'strangers' everywhere due to their mobility (de Bruijn, van Dijk and van Dijk 2001), even in areas where communities have had presence for a long time. For example, Bozo fisherfolk who migrated between Mopti and Sikasso for generations before settling in Sikasso years ago are still considered as newcomers, believed to be the last to arrive or with 'real homes' elsewhere. As a result, fishing communities find it difficult to access land to pursue agricultural livelihoods. Pastoralists, often seen as 'strangers,' could also be denied access to land to graze cattle, particularly as inter-communal tensions have risen.

Further, people with disabilities find climate insecurity reinforces pre-existing marginalisation, stigmatisation, and overprotection from families that stymies chances for learning, earning, and independence. As societal discrimination means they tend to be engaged in more precarious livelihoods, with reduced options, and engaged in tasks others did not wish to do, they earn lower incomes. Shocks therefore lead to even greater financial impacts, food insecurity, and risks of poverty. They discussed their increased financial precarity and lower security of income linked to climate change and conflict. These impacts are also not uniform and much depends on gender, class, education status, and the nature and severity of disability. For example, disabled women face discrimination based on their gender and disability and are marginalised in discussions between people with disabilities (dominated by men) and those between women (directed by non-disabled women).

> "Every time there is a problem, it is augmented for people with disabilities. Nature has already created a problem [for us] and, with climate change, people with disabilities feel the effects more... Those of us who are farmers need to pay someone else to work the land as we don't have the strength needed to do so and this adds another cost to us. After all these payments, we need to have something left to invest in the earth once more and our costs become more than our revenues. We have three problems. Climate change has reduced harvest and incomes. People with

> **disabilities have less income and financial means and resilience anyway. Plus, we have to hire someone else to work the land which [further] reduces our profit margin.**
>
> Male disability association representative, interviewed in Sikasso in June 2021 (translated from French to English)

Finally, young people are subjected to age hierarchies while finding it difficult to access respect and status due to climate insecurity. Young men are both stigmatised as more prone to join jihadi AOGs and community militias and (forcibly) recruited into them. In the Mopti and Segou regions, Fulɓe people are seen as linked to jihadi AOGs, with young men bearing the brunt of resulting suspicion, violations, and violence. Relatedly, there is conflict between generations. Some young people no longer accept age hierarchies and subordinate status. The inter-generational social contract whereby youth proffer respect to elders who support them in life has withered. Mechanisms of inter-generational exchanges, such as older people providing sex education, reorientation, hygiene tips, and marital advice are no longer as strong. Migration has split families and communities and weakened bonds; income generation responsibilities has reduced the time for rites of passage, and modernisation means such exchanges are not always valued. Moreover, some young people see elders as corrupt, politicised, and/or incapable of helping. This dynamic is a factor behind youth migration to cities where they have greater freedom, independence, and control over incomes. Upon their return, they could find they were yet again subjected to the same roles, rules, and restrictions on mobility as before departure (Spencer 2020). Many respondents of all ages spoke of the need to build understanding across generations.

> **“Now, everyone works for the head of the family. If the youth works in a collective field and there is not enough harvest, this creates problems as it is the head of family who controls and can decide to manage all the money after harvest. For example, if someone wants to get married, if someone is injured and needs to get to the hospital, it is he who decides how much will be spent. But we don’t agree with this and it is a difference of ideology which creates the problems. This is one of the reasons for migration as the youth want to be independent.**
>
> Male youth leader, aviculturist, entrepreneur, and farmer, interviewed in Bougouni in June 2021 (translated from French to English)

The social exclusion described above not only leads to reduced resilience to climate security and lower social cohesion but also, by widening inequality and driving grievances, could negatively affect conflict dynamics. This marginalisation interacts with the other climate security pathways discussed above. For example, in the Mopti and Segou regions, jihadi AOGs and community militias play on inter-communal tensions by offering particularly young men a chance to seek protection in highly insecure times and revenge against those who harmed them. Some young Fulɓe men in these regions who formed a social movement to voice their grievances to the state and international organisations to little avail changed their tactics and joined jihadi AOGs (de Bruijn and Both 2017). Lack of economic opportunities for young people, as well as legitimate grievances against the state, community leaders, elites, and older generations, and the social prestige linked to taking up arms are all factors in recruitment. They are especially relevant for young unmarried men and linked with specific notions of masculinity (Brottom and McDonnell 2020). There is a serious risk of this dynamic moving to relatively stable areas, as joining gangs and engaging in banditry and theft can provide levels of income difficult to reach for those subjected to social exclusion otherwise. For example, respondents said that mining sites risked being sites of AOG recruitment, as workers there live in precarity and groups offer arms to protect themselves, the possibility of having clout, and social protection with economic power.

> **“A youth who is not married cannot access privilege in the community as marriage confers privilege, power, and place in the community. For marriage, bride price is obligatory but young men cannot access the economic resources necessary so they go towards radical groups that suppress the idea of bride price as not present in Islam. Also, they give them arms which confer power and with which they can access a means of resistance.”**
>
> Man working for a peacebuilding NGO, interviewed in Bamako in June 2021 (translated from French to English)

E. Existing responses and lessons learned

1. A need for caution and evidence

Climate security is much discussed in government, non-governmental organization (NGO), and UN circles, but actors struggle with lack of data and analysis on and capacity to conduct climate security assessments. As one male UN official said, "We don't have enough data to be able to do the trends. We take it seriously but need to understand [it better]."[45] For example, MINUSMA has a mandate for environmental protection and takes climate security risks into consideration, mitigating the mission's environmental impact, integrating climate change into analysis, and understanding how creation of resources, such as digging wells, affects dynamics.[46] Yet, a male MINUSMA official said links between climate change and insecurity and additional actions needed were unclear.

Further, there is disquiet around instrumentalisation, with respondents characterising climate security as the latest issue of (donor) interest, that other factors are more pertinent, and that focus on climate change without tackling wider governance, exclusion, and marginalisation would be counterproductive. They stress that international actors should not use Mali and the wider Sahel as a testing ground for climate security interventions not based on contextual evidence of specific risks. As analysts noted, "Several actors, both Sahelian governments and international organizations, may find it more convenient to adhere to a general and largely apolitical climate-conflict narrative rather than more complex explanations of conflicts involving political struggles at various levels from the local to the international" (Benjaminsen and Ba 2021). Yet, peacebuilders also spoke of needing to understand interactions between climate change and conflict.

> **"Climate and conflict? I don't think we should focus on it. [Climate change] is an exacerbating factor but not the main factor. This is an arid Sahel region so it is always climate vulnerable. Conflict is driven by marginalisation, exclusion so the entry points are primarily governance and exclusion. Climate exacerbates it by eroding livelihoods [but] I think climate security is a donor narrative. I see it increasingly used by… donors, mostly those who are context blind. If you are designing a project in the Sahel, climate and conflict sounds great… Some donors do not follow this terminology – mostly those based in the Sahel focus more on natural resource management, land management, and just outcomes for marginalised groups."**
>
> Man working for an international NGO, interviewed in Bamako in June 2021

Moreover, in recent years, donor and INGO focus has moved away from humanitarian assistance in Gao, Kidal, and Tombouctou to Mopti and Segou. This shift is largely due to uptick in violence and lack of access and there is contestation as to if these regions are suitable for development and peacebuilding or the domain of purely humanitarian and military approaches. A similar dynamic may move attention away from Segou and Mopti towards the south and west. However, stopping interventions rather than improving access is not the solution. Not only is up-to-date knowledge of dynamics in northern regions, particularly outside regional capitals, lacking, but militarised and stabilisation approaches have manifestly not worked, but rather led to more human rights violations and grievances which have driven conflict.

More broadly, the analysis presented in this paper shows how climate change is one of many factors that interact with conflict and affect people's lives. A focus on climate security should not be a way of avoiding dealing with challenges of improving governance, tackling (age, class, gender, and other) inequalities, ensuring justice, and addressing other root causes of conflict. Further, as shown above, emphasis on environmental and climate

45 Interview with male UN official, conducted in Mopti in June 2021, in English.
46 In its mandate renewal in 2018, the UN Security Council (UNSC) recognised the adverse effects of climate and ecological changes and natural disasters on the stability of Mali and noted the importance for the Malian government and the UN to take into consideration their security implications. In subsequent mandates, including the most recent one, the UNSC emphasised the need for adequate risk assessment and management strategies related to climate security and environmental factors, but operational paragraphs no longer include language linking climate and environmental risks to peace and security. For more on MINUSMA's approach to climate security please see: Destrijcker 2021; Hegazi et al. 2021.

action could have unintended consequences if done in heavy-handed and conflict-insensitive ways (Raineri 2020). Climate security interventions should instead seek to address interactions between these factors and climate change, for example by consciously addressing and reducing inequalities through climate change adaptation interventions. As this analysis shows, there are many ways climate change exacerbates and interacts with conflict drivers and dynamics, and there are many ways conflict undermines the adaptive capacity and resilience of communities. These links provide entry points for integrated actions that combine climate change action and peacebuilding.

2. State and non-state interventions struggle to meet needs

The government officials interviewed described at length the work of their agencies. They sensitise and provide training to farming, fishing, and pastoralist populations on new and innovative techniques to adapt to changing climate. They engage in irrigation projects and create new water points. They distribute and loan items, including new varieties of adapted seeds, nets, and tractors. They subsidise farm inputs and provide vaccination services for livestock. However, the lack of government financial resources and human resource capacity mean interventions could be inadequate to meet needs and are not provided in all communities. They tend to be focused in areas where the state is present and supported by NGOs, UN agencies, and donors. NGOs and UN agencies also work directly with populations to provide training in the management and restoration of land and hydro-agricultural techniques, delineate perimeters to benefit women, conduct sensitisation on anti-erosive measures, and put in place demonstration fields with new techniques to build confidence before community adoption. They engage in community forestry interventions which involve and learn from communities on forest management, leading to reduced deforestation and planting of trees.

Respondents also characterised interventions as favouring certain groups, locations, and ways of life. For example, there is a strong push towards agricultural livelihoods and sedentarisation since independence. Some analysts characterise current conflicts around land as revealing a governance crisis in the pastoral world and contestation of the identity and economic marginalisation of nomadic societies.[47]

Moreover, there are certain locations that see fewer interventions. Partly due to insecurity, there are many areas of Mali where the state is not present and cannot provide needed services – in terms of livelihood support as well as education, health, and other services – to the populations living there. Within the Mopti region, there are more state and non-state interventions in the zone exondé, enabling those living there to develop other forms of agriculture, irrigation, and water projects, thereby increasing food security, access to safe water, and resilience. However, basic service provision cannot always be ensured, contributing to tensions and unrest. Mali's zone inondé is covered with water for months of the year, during which time access is difficult and time consuming. Consequently, a lack of interventions has meant communities in the zone inondé face the impacts of climate change and conflict and do not have outside support to cope.

3. Effective conflict resolution and peacebuilding practices exist in some areas

The problems of conflict resolution in some communities were discussed above. Yet, there are areas, particularly in southern Mali, where communities, often supported by local organisations and with government involvement, take efforts to mitigate conflict risk. For example, in areas of Kayes and Koulikoro, farmers are dissuaded from planting on grazing routes due to sensitisation efforts about the potential for tensions and conflict. In addition, the Commissions Foncières (CoFo) is a community-based mechanism, created by law in 2009, to mitigate conflict. In many communities, CoFo exist only on paper, but in some Sikasso communities it works well, particularly where it has inclusive representation and is mandated with conflict resolution. Members trained in mediation and conflict resolution intervene when there are tensions and, if necessary, escalate the matter to government authorities. Villages also have a commission of village heads who decide when to reach out to state officials for intervention. Moreover, Sikasso has a number of additional mechanisms

47 For example, Poudiougou and Zanoletti see the rise in violence in rural areas as linked to the dynamics of state formation which led to breakdown in nomadic institutions. A focus on agriculture to the detriment of pastoral land, a process of land and livestock grabbing by farmers and civil servants, and substitution of historical elites took place against a context of impoverishment of pastoralists following the 1970s and 1980s droughts and neglect of nomadic livestock activities, mobility, geographical and socio-economic spaces by state authorities (Poudiougou and Zanoletti 2020).

to ensure peace. For example, the fetiche, as they were believed to have supernatural powers and so engendered fear, could be called upon to manage conflict, whereas the filankuluya is a mechanism whereby people of the same generation come together and can deal with problems.

> **Sikasso is the area where pastoralists go on transhumance from the north through Segou towards the Côte d'Ivoire border. We have secured this grazing route. It was a long process. First, the local population were asked by pastoralists to respect the grazing route which had been there for a long time. We identified the communes through which this route passed and did consultations. They agreed animals would use this grazing route without going into fields of farmers. Then, we signed social accords between the owner of the land and the chief of the village that communes would recognise this route. The mairie [municipal authority] made this resolution. Then, we started to mark the grazing route and built beacons so pastoralists knew the route to go.**
>
> Man working for a Sikasso-based NGO, interviewed in Sikasso in June 2021 (translated from Bamanankan / French to French to English)

Much is dependent on the nature of the leaders involved. If they are seen as politicised and liable to be paid off to use their influence for the benefit of those providing money, levels of trust in any process that included them is lessened. Respondents contrasted the state of these mechanisms in the Sikasso region with their equivalents in the Mopti and Segou regions. Although corruption is seen to be present throughout the country, as discussed above, it is believed to be at lower levels in the Sikasso region where there are areas with leaders working in community interests. Moreover, many conflicts could be beyond the ability of local mechanisms to resolve. Government and NGO responses to conflict, whether they be mediation, dialogue, or development initiatives, tend to be made in a scattered manner at local, national, and regional levels by a number of state and non-state actors. These interventions have positive results to show, but limited impact in the absence of coherent and coordinated policy response, involving all affected including those often marginalised from such fora (Centre for Humanitarian Dialogue and Institute for Security Studies 2019).

> **Respect for the mechanism is a function of the legitimacy of the people involved. If they are not legitimate, it affects the monopoly of power in these traditional mechanisms so people will not consult them... When it comes to Sikasso, [community leaders] are more engaged and respected. Corruption is everywhere but there is more resistance to this in the south and, as a result, leaders have more legitimacy and are seen as working in the interests of the population.... But this has started to change... We have some cases of villagers being unhappy with their village heads but not to the extent as in the centre."**
>
> Male researcher, interviewed in Bamako in June 2021 (translated from French to English)

4. Agro-ecological practices provide alternatives that improve self-reliance, reduce environmental impact, and are conflict sensitive

There has been a move towards use of chemical fertilisers, pesticides, and herbicides, and engagement with agri-businesses that sell these items as well as seed varieties in general. However, there are also communities that continue to practice and innovate agro-ecological alternatives, sometimes supported by NGOs. They plant trees in empty spaces to mitigate soil erosion, encourage rainfall, and reduce wind speeds. They make their own inputs using biological methods such as using neem as pesticides. During harvest, they bank seeds for the next year. Those who engage in such methods point out that they are better for the health and lead to improved soil quality. The ability to be self-sufficient rather than having to pay for seeds, fertiliser, herbicides, and pesticides is also a draw as, once one uses chemical inputs, it is difficult to stop using them as it could take years for the earth to recover from the resulting soil degradation. These practices also have positive peace impacts in terms of not creating or exacerbating existing tensions between farmers and fisherfolk due to chemical products leaching into water bodies and killing fish. However, using these techniques could require significant manual labour, as it takes time for soil fertility to improve and women who engage in these methods could see their land taken away from them when it becomes more productive.

F. Conclusions and recommendations

Mali has seen both increased changes in climate and insecurity in recent years. To design tailor-made, context-specific responses addressing peace and security risks in a changing climate, it is crucial to understand *when, where* and *how* climate and security are linked in Mali. To this end, this report provides a comprehensive assessment of the past and current climate security dynamics in Mali and future risks from climate change, drawing on the methodology developed as a part of the Weathering Risk initiative.

Climate variability and unpredictability have been increasing in Mali, including higher temperatures, increasing numbers of very hot nights, as well as more and higher intensity precipitation variability, droughts and heavy precipitation events. These dynamics are linked with loss of life and injuries due to extreme events, changing availability of food and water resources, greater food insecurity, and livelihood precarity. They also interact with conflict dynamics, with climate security pathways overlapping and interacting. Both climate change and insecurity impact livelihoods, blocking adaptation, and affecting social cohesion; are affected by elite rent-seeking and corrupt behaviour; and drive increased natural resource competition, which contributes to rising tensions and violence. Moreover, the impacts of climate security do not fall evenly but affect the already socially excluded and marginalised more severely, further widening inequalities and exacerbating related grievances.

Pathways of climate-related security risks

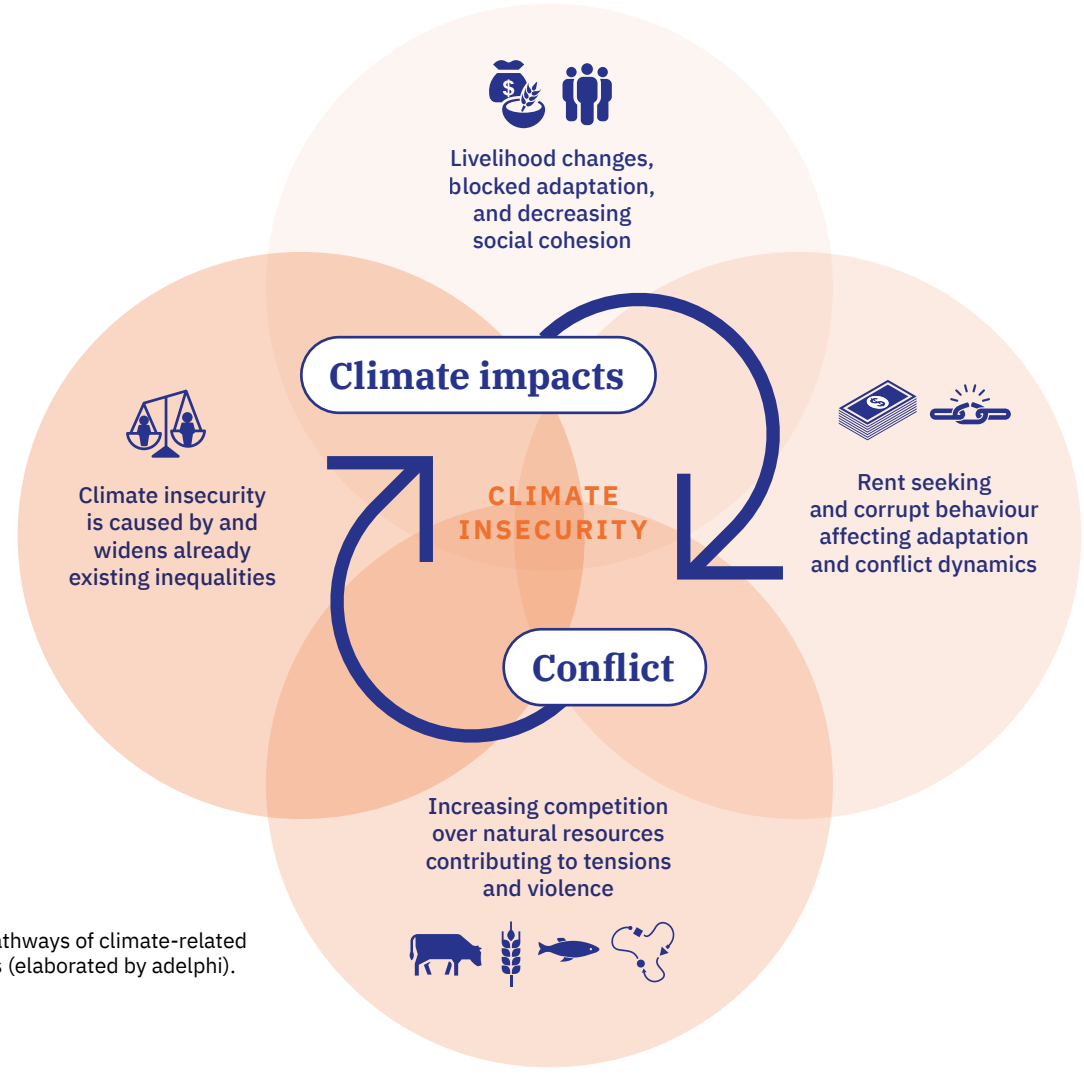


Figure 22: Pathways of climate-related security risks (elaborated by adelphi).

Looking to the future, temperatures and the numbers of very hot days are projected to rise while there is uncertainty as to future rainfall and water availability trends. Continued changing climate will further affect animal and human health, food security, and livelihoods. Concurrently, there is also significant concern that existing conflict dynamics may deepen, worsen, and spread to new areas. As a result, action to mitigate and adapt to climate change, address the root causes of conflict, and tackle drivers of climate insecurity is urgent.

However, there is a need for caution here. Government actors and the international community are paying growing attention to climate security across the Sahel, yet there is a need to guard against the instrumentalisation and militarisation that this discourse and associated policy and programming often attracts. Focus on climate change alone without improving governance and tackling exclusion and marginalisation, or acting in conflict-insensitive ways that deepen existing grievances around natural resource management will be counterproductive and risk driving climate insecurity further. Furthermore, as focus and funding on climate security increases, it will be important for actors to link with Malian climate scientists and conflict analysts and ensure interventions are not just relabelled (a tendency often seen, for example, by actors presenting livelihoods programming as climate security work without addressing any relevant factors) but rather actually address the climate security dynamics detailed in this paper. With this in mind, this section now turns to presenting climate security focused recommendations for the Government of Mali, civil society, donors, international NGOs and UN agencies, and MINUSMA.

1. IMPROVE COLLECTION AND SHARING OF CLIMATE DATA to enable better weather forecasts, modelling, and predictions, and communicate this information across government ministries, departments, and agencies, civil society, and the general public by

- Increasing support to Mali's national meteorological agency Mali Météo via reliable government funding, staffing, technical assistance, and technological infrastructure to enable them to improve local capacities to operate station networks, build reliable climate databases, and enhance capacity to use (process, understand and communicate) the climate information.
- Enhancing international cooperation, including finance, to support the expansion and modernisation of Mali's national weather observational network.
- Using available climate data (e.g. from Agrica.de, isipedia.org, and/or Mali Météo) to undertake regional and thematic studies on climate security in Mali to inform decision making around relevant areas such as infrastructure, food and agriculture, and peacebuilding.
- Building on existing available climate data and existing tools (for example the AU Continental Early Warning System and/or the ECOWAS Early Warning and Response Network) to establish climate risk-informed early warning, and investing in capacities and institutions to support early response.
- Integrating an environmental and climate lens into already existing analysis and reporting mechanisms, tools, and products including monitoring, evaluation and learning, fostering information sharing between relevant actors, and integrating environmental and climate-sensitive analysis systematically in information-sharing and decision-making platforms.
- Developing public information campaigns to share this climate data (including extreme weather warnings and daily and seasonal forecasts) with the general public, with particular focus on reaching those most vulnerable to the impacts of climate change and/or facing greater barriers to accessing information.

→ Provision of reliable and regular weather and climate information information will enable **informed policy making, programming, and planning** for climate adaptation and can also have **trust-building and social contract** reinforcing co-benefits between people and state.

LEGEND

Government of Mali	UN agencies	African Union
Donors	Civil society	Economic Community of West African States
INGOs	MINUSMA	Donors engaging in bilateral defence assistance

2. RAISE AWARENESS OF CONFLICT-SENSITIVE CLIMATE ADAPTATION so people know how to adapt in ways that do not exacerbate inequalities and conflict by

- Involving those who struggle to access information (particularly women, those living in remote areas, and those with disabilities), by conducting specific outreach and ensuring they participate meaningfully[48] in decision making.
- Bringing people from different livelihood groups together to discuss climate adaptation as an entry point to increase social cohesion.

→ Understanding of shared challenges and the inclusive and joint process of addressing them can build **social cohesion** within and between groups.

3. IMPROVE INCLUSIVITY, ACCOUNTABILITY, AND RESPONSIVENESS OF GOVERNANCE AND SECURITY PROVISION, particularly around natural resource management, to address current frustrations and grievances and prevent deforestation and environmental degradation[49] by

- Adequately including women, young people, representatives of all communities present in localities including migrants, and other groups normally excluded in such fora, for example in adequate numbers and in decision making roles.
- Prioritising local knowledge and will to protect nature rather than engaging in heavy-handed militarised approaches.
- Raising awareness amongst migrants and those who pass through areas (such as pastoralists and fisherfolk) on agreed natural resource management rules.
- Working with relevant civil society such as market women groups, young pastoralist groups, and people with disabilities, to increase inclusivity and accountability of natural resource management.
- Developing and implementing accountability mechanisms such as community meetings, safe feedback and complaints processes, to improve governance quality.

→ Inclusion of all relevant groups in a way which provides them with the resources they require, safe space to be heard without fear of retribution, and genuine scope to inform and make decisions will not only ensure that decision making is more **equitable** and does not inadvertently harm some groups in favour of others, but is also **sustainable.**

48 Efforts to include people from groups traditionally marginalised in decision making in such forums can be tokenistic and tick box exercises. In contrast, meaningful participation means that people from these groups are able to influence outcomes. Doing so means they must be present in large enough numbers to form a critical mass (for women, this means at least 30% of those present must be female) and in positions of leadership. Barriers that prevent them from contributing to discussions must be addressed, for example, through providing ramps and sign language interpretation to enable the participation of people with disabilities, or socio-cultural barriers such as ways women who are outspoken are seen) must be addressed. Moreover, they must have access to information and be supported to seek input from and provide feedback to their wider constituencies to be able to properly represent them.

49 Evidence shows that good governance of natural resources is a contributory factor to community resilience to violence and climate change. Land and grazing laws are more likely to be adopted, understood, supported, and implemented if derived from an inclusive process and result in customary titles being formalised (Raineri 2018).

4. PRIORITISE BUILDING CLIMATE SECURITY RESILIENCE IN SOUTHERN MALI through improving social cohesion, addressing material realities, improving climate resilience by

- Initiating public dialogues, consultations and media discussions – including around climate security – to address growing perceptions of politicisation and corruption.
- Developing tailored conflict-sensitive, climate-smart, gender-transformative and socially inclusive interventions based on early warning information.
- Prioritising investment in conflict prevention and peacebuilding efforts between communities around access to natural resources and food production.
- Demarcating grazing routes with involvement of all livelihood groups and local civil society.
- Examining lessons learned from places where community forestry is seen as working well to implement these best practices elsewhere.
- Investigating migration-related grievances to identify areas most at risk of violence and mitigate this possibility, for example by investing in inclusive dialogue and mediation processes involving migrants and host communities to tackle grievances.

→ Improving social cohesion and strengthening governance capacities to address material realities of those most at risk can improve **climate resilience** and **mitigate the risks** of current climate insecurity dynamics further undermining peace in the south of Mali.

5. ENCOURAGE AGRO-ECOLOGICAL, CLIMATE-SMART, AND CONFLICT-SENSITIVE PRACTICES by starting and expanding interventions and communications to improve food security and livelihoods in sustainable and conflict-sensitive ways by

- Supporting farmers to improve self-sufficiency and soil productivity, including via community seed banks and investing in production of bio fertilisers, herbicides, and pesticides.
- Building on the expertise of the many women who use agro-ecological methods and assisting them to engage in community outreach and capacity building.
- Improving systems to monitor biomass production, water ponds, and droughts across the seasons and socialise this up-to-date information to pastoralists.
- Supporting dialogue channels for farmers to reach out to communities affected by the use of chemical products to explore joint ideas for recompense and share information on alternative agro-ecological and climate-smart processes.

→ Sharing information across identity groups on mutually beneficial farming techniques can create trust and build social cohesion between groups, as well as **enhance climate resilience and food security.**

50 Given rising urbanisation, it is crucial that future research on climate security departs from solely focusing on rural contexts towards a better understanding of the urban implications.
51 Given levels of urbanisation in Mali, climate change adaptation and conflict prevention strategies need to strengthen their focus on cities.

52 Evidence shows that balanced gender power relations and better social cohesion contribute significantly to strengthening young people's resilience to involvement in violent armed groups – and that without women's contributions to redefining social gender relations, resilience among young people is impossible (Raineri 2018).

6. ENSURE ONGOING AND INCLUSIVE INTEGRATED CLIMATE SECURITY ASSESSMENTS of Mali by

- Innovating ways to gain insights and testimonies of people outside regional capitals.
- Ensuring sufficient investment for regular updates of assessments, for example every two years, with focus on rural, urban, and urbanising areas.[50]
- Ensuring assessments particularly look at gender and social exclusion dynamics by having gender-balanced teams and specific gender and social inclusion expertise.
- Strengthening national and regional capacities for climate security analysis, for example through:
  - data sharing within and between ECOWAS and AU; investing in regional expertise (e.g. bolstering support for the West African Science Service Centre on Climate Change and Adapted Land Use and building climate security analytical capacities therein); and
  - better use of existing analytical tools and approaches such as ECOWARN for national and transboundary climate security analysis.

→ Climate security dynamics are ever-changing, so regularly updated assessments will be important to enable **knowledge and mitigation** of evolving climate security risks.

7. STRENGTHEN GOVERNMENT, MILITARY AND CIVIL SOCIETY CAPACITY TO SUPPORT POPULATIONS, PARTICULARLY THOSE SOCIALLY EXCLUDED, TO ADAPT TO CLIMATE SECURITY RISKS by

- Analysing localised climate security, conflict, gender, and social exclusion dynamics in the communities in which they work.
- Preparing urban areas to adapt to rising urbanisation, including through inclusion of migrants into the labour and housing markets and conflict prevention and mitigation strategies.[51]
- Investing in building accountability structures within natural resource management mechanisms, such as a civilian complaints forum.
- Addressing civilian harm and human rights violations committed by defence and security forces and improve civilian-military relations by:
  - providing training to personnel to better understand their impacts on resilience and livelihoods and develop strategies to ensure they do not further undermine them;
  - strengthening monitoring and accountability for violations;
  - instituting civilian-military feedback forums and outreach to civilians; and
  - training personnel how to support processes of natural resource management.
- Using accessible communication channels such as radio programmes to raise awareness of stigma, marginalisation and inequitable access to resources and social networks faced by people with disabilities.
- Prioritising processes to facilitate inclusion of marginalised groups in natural resource management, including forestry management mechanisms, for example by establishing a safe space for consultation of women forest users, and channel outcomes into main decision-making processes, so all can meaningfully participate and inform decision making.

→ Addressing underlying inequalities and ensuring inclusive and accountable processes can **bolster the social contract** between people and the state, **mitigate the impacts of climate security** and **reduce their risks of creating or further entrenching grievances.**[52]

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Annex: Methodology for the provided plots

The projected climate change and related sectoral impacts are based on the data and modelling work from PIK's Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) (ISIMIP2b; Frieler et al. 2017). ISIMIP provides regionally explicit information about current and future climate impacts under different climate change scenarios for different sectors. The simulated impact projections are derived from four global climate models and a range of sector-specific impact models, including i.a. global and regional hydrological models, global crop models, and global vegetation models. Future projections are based on two different GHG emission scenarios, which are the low emissions scenario RCP2.6 consistent with the Paris Agreement target, and the medium to high emissions scenario RCP6.0. With the aim to provide government and development actors with regionally specific information on future climate change impacts, PIK's AGRICA[53] project draws on ISIMIP data to develop a series of country-specific Climate Risk Profiles (CRPs). The map and line plots of projected climate impacts applied within this analysis are either directly derived from or based on AGRICA's CRP: Mali (Tomalka et al. 2020). For additional future climate impacts or information on the methodological approach and the underlying models, please refer to the CRP as well as to the supplemental information provided by AGRICA (Lange et al. 2020).

CLIMATE DATA AVAILABILITY IN MALI

Observational climate data are an important basis for climate impact analysis. In many African countries, availability and accessibility of observational data are limited, often due to low and declining investments in weather stations. Also, periods of conflict can disrupt availability of such information (Dinku 2019). Mali is no exception. The more easily measurable data such as precipitation and air temperature levels are largely available across the country. However, there is a substantial lack of climate data on parameters that are more complex to measure, such as rainfall intensities, wind speeds and air pressure, for which additional, more advanced measuring devices are required. Collection of such climate information is challenging in Mali since the network of well-equipped weather stations across the country is scarce and scattered. Furthermore, Mali Météo, the national meteorological agency, has difficulties in maintaining the automatic weather stations installed across the country. This is also due to the high maintenance costs and the limited budget for replacing defective equipment. And finally, many weather stations had to cease their work due to security risks: of the 19 synoptic weather stations across Mali, only 13 were operating in November 2021 (Interview with Mali Météo official). Moreover, Mali Météo has difficulties with the systematic collection and processing of climate data. The observation data need to be transferred to notebooks and sent back to the Mali Météo headquarters, where they are digitized. Many climate data which have been collected in the past have not yet been digitized because of lack of financial resources. For the available climate data, Mali Météo charges access fees and hence, for those who cannot pay those fees, the data are difficult to access (Interview with Mali Météo official).

A) INPUT DATA FOR PLOTS ON HISTORICAL CLIMATE AND ENVIRONMENTAL CHANGE IN MALI

Input data on observed near-surface air temperature and precipitation levels are based on the Climatic Research UNIT (CRU) Time-Series (TS) version 4.05 dataset. This dataset provides average monthly data on temperatures (°C / month) and precipitation (mm/month), from 1901 to 2020, for 0.5° x 0.5° land grid cells (Harris et al. 2020). Grid-cell level 31-year averages (i.e., for 1901–1931 and 1990–2020) of air temperature and precipitation and the change between the averages have been calculated to capture the historical effect of the changing climate.

53 AGRICA is a project implemented by PIK in cooperation with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). For more information, see www.agrica.de.

Information on **heavy precipitation events and wind speeds** was generated using the EWEMBI data. EWEMBI data was compiled within the PIK's Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b; Frieler et al. 2017) using the following data sources: ERA-Interim reanalysis data (ERAI; Dee et al. 2011), WATCH forcing data methodology applied to ERA-Interim reanalysis data (WFDEI; Weedon et al. 2014), eartH2Observe forcing data (E2OBS; Calton et al. 2016), and NASA/GEWEX Surface Radiation Budget data (SRB; Stackhouse Jr. et al. 2011). EWEMBI provides daily 0.5° x 0.5° land grid cell observations on atmospheric climate variables between 1979 and 2016 (Lange 2019). Daily total precipitation rates (Kg m^{-2} s^{-1}) from EWEMBI were converted to (mm / day) using the 86,400 factor. Then, the first 20 available years (1979 – 1998) were considered as a baseline to determine the heavy precipitation events. These latter are days with a total precipitation exceeding the grid-cell specific 98th percentile of the daily precipitation of all wet days in the baseline. A wet day is one with a total precipitation of at least 0.1 mm. Thereafter, five-year averages have been calculated to absorb interannual fluctuations. Data on near surface wind speeds (10 meters above the ground) in metres per second were derived from the EWEMBI dataset to assess the changes in wind speeds. Fifteen-year averages were calculated to compensate for inter-annual fluctuations in wind speeds.

Forest cover and loss are based on the Hansen Global Forest Change v1.8 (2000 – 2020) dataset, which provides results from time-series analysis of Landsat images in characterising global forest extent and change between 2000 and 2020. Tree canopy cover is defined as the "canopy closure for all vegetation taller than 5m in height" in 2000, whereas forest loss is defined as a "stand-replacement disturbance (a change from a forest to non-forest state)" during the period 2000 – 2020 (Hansen et al. 2013).

B) INPUT DATA ON PROJECTED CLIMATE CHANGES AND RELATED SECTORAL IMPACTS

The projected climate change and related sectoral impacts are based on the data and modelling work from ISIMIP (phase 2b). ISIMIP provides regionally explicit information about current and future climate impacts under different climate change scenarios for different sectors, averaged over an area of approximately 50 x 50 km. The simulated impact projections are derived from four global climate models and a range of sector-specific impact models, including i.a. global and regional hydrological models, global crop models, and global vegetation models. Future projections are based on two different GHG emission scenarios, which are the low emissions scenario consistent with the Paris Agreement target RCP2.6, and the medium to high emissions scenario RCP6.0. With the aim to provide government and development actors with regionally specific information on future climate change impacts, PIK's AGRICA project draws on ISIMIP data to develop a series of country-specific Climate Risk Profiles (CRPs). The map and line plots of projected climate impacts applied within this analysis are either directly derived from or based on AGRICA's CRP: Mali (Tomalka et al. 2020). For additional future climate impacts or information on the methodological approach and the underlying models, please refer to the CRP as well as to the supplemental information provided by AGRICA (Lange et al. 2020).

UNCERTAINTIES IN CLIMATE CHANGE PROJECTIONS

It is important to acknowledge that uncertainties are always part of climate change projections. Uncertainties arise from a variety of factors, including natural variabilities, uncertainties in GHG emissions scenarios and differences in the models used (Masson-Delmotte 2021). Consequently, no future (climate change) projection comes without some level of uncertainty. The levels of (un)certainties, however, differ. We present the results of ten different global models. To indicate the (un)certainty of the projections we consider model agreement. The more these models agree, the higher the certainty, and the more they disagree, the lower the certainty. For example, if different models project a similar result under the same scenario, the projected changes demonstrate low levels of uncertainty, however, if they project very different changes (in terms of range and even direction) under the same scenario, then the projections are uncertain.

Line plots and map plots depict uncertainty differently and cannot be compared: The line plots indicate the level of certainty through the shaded areas, depicting the likely (central 66%) and very likely (central 90%) range of all models. Generally, the smaller the shaded areas, the more certain the projections (for an example of a relatively certain projection, see Figure 7, while for an example of a highly uncertain projection, see Figure 13). The map plots depict the level of certainty through the presence or absence of dots (see section "How to read the plots"). If dots are present, at least 75% of all models agree on the direction of change or in other words an increasing or a decreasing trend (for an example, see Figure 8. If the dots are absent in a specific region or scenario, then model agreement within this specific region and scenario is below 75% (for an example, see Figure 12).

To simplify the interpretation of the projections, all line plots and map plots that are subject to high levels of uncertainty are marked with a symbol (). This does not imply that these plots have no informational value, but rather draws attention to the limitations of such projections for future planning. Consequently, they should be very carefully interpreted when they are used for planning measures. In the case of high uncertainty, additional information will be provided on how to interpret the data.

Acronyms

AOG	Armed Opposition Groups
CNSP	National Committee for the Salvation of the People
CoFo	Commissions Foncières
GBV	Gender-Based Violence
ECOWAS	Economic Community of West African States
INGO	International Non-Governmental Organisation
IND	Inner Niger Delta
M5	Movement of June 5
MINUSMA	United Nations Multidimensional Integrated Stabilisation Mission in Mali
MNLA	Movement for the National Liberation of Azawad
NGO	Non-Governmental Organization
UN	United Nations

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