British Red Cross

ODI

Changing climate, changing realities: migration in the Sahel

Full report

Acknowledgements

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Front cover photo © IFRC/British Red Cross. Nigerian Red Cross volunteers supported flood evacuations and provided psychosocial support and first aid.

Photo © Yuki Sugiura/British Red Cross
The Niger Red Cross supports people in the most vulnerable communities in Niger, on the frontline of climate change.

Abbreviations

AU	African Union
ECOWAS	Economic Community of West African States
EU	European Union
FGD	Focus group discussion
IDDRSI	IGAD Drought Disaster Resilience and Sustainability Initiative
IDMC	Internal Displacement Monitoring Centre
IFRC	International Federation of Red Cross and Red Crescent Societies
IGAD	Intergovernmental Authority on Development
INDC	Intended Nationally Determined Contribution
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
NAPA	National Adaptation Programme of Action
NGO	Non-governmental organisation
PRSP	Poverty Reduction Strategy Paper
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees

Executive summary

The Sahel region – the strip of land extending coast to coast from west to east Africa – has long-established patterns of human mobility, largely characterised by internal movement within countries or between countries. This mobility has acted as an important resilience strategy for people's survival and a way to create new economic opportunities during times of both crisis and stability. Existing research suggests that climate-related changes and risks might contribute to pressures to move for some people while constraining possibilities for mobility for others. Following already significant transformations in the Sahel's semi-arid to arid climate, projected changes in rainfall and temperature suggest that climate-related challenges may intensify further. Therefore, understanding the influence of climate change on mobility in the Sahel is an increasingly vital task.

However, the evidence on the relationship between climate change and migration in the Sahel remains nascent, and the evidence far sparser than in other climate-impacted regions. In addition, the research undertaken to date focuses primarily on the impacts of sudden-onset, short-duration climate shocks, as opposed to slow-onset, longer-duration changes.

Commissioned by the British Red Cross, this research seeks to fill these evidence gaps and to improve understanding of the links between environmental and climate change and migration, and their implications for future mobility patterns and associated humanitarian needs and vulnerabilities. Many of the findings presented in this report validate and expand upon existing knowledge on mobility as it relates to environmental and climate change in the Sahel; on people's coping strategies and adaptation strategies (longer-term adjustments that may enable people to remain in place or support choices about mobility); and the relationships between them.

The research considered Mali and Sudan as case-study countries. It took a wide focus, spanning both sudden-onset shocks and slower-onset changes, with experiences documented in Sudan predominantly reflecting the former and those in Mali the latter. It examined people's perceptions of the connections between climate change and migration, the ways in which people cope with or adapt to the adverse consequences of climate change, and the vulnerabilities, barriers, and needs experienced by those who use migration as an adaptation strategy.

Data in Mali and Sudan was collected through quantitative surveys, qualitative focus group discussions, and individual key informant interviews. The following were also analysed: regional and national policies and frameworks on migration, climate, and development produced by regional bodies, national governments, and international organisations; and existing research on the relationships between climate change and mobility in the Sahel region.

The research framed the inquiry into people's experience of climate change impacts within a broader perception of environmental impacts. This approach was deliberately chosen, given the difficulties of isolating the contribution of slow-onset climate shifts and wider environmental impacts among the many intersecting economic, political, social, and environmental or climate-related factors that shape people's decisions to move or stay. Climate-related migration is multi-causal, influenced by intersecting forms of vulnerability and differing levels of capacity – each shaped by gender, age, disabilities, and income. Attention to current and future interactions between these different factors is necessary to understand the complex causes and patterns of mobility, and in turn to inform more robust policies and programmes.

Photo © Samuel Turpin/ ICRC Part of Humans & Climate Change documentary project
This farmer in Sofara, south of Mopti in Mali, says that the weather has become unpredictable. Seasons are changing, periods of extreme heat are longer, and infrequent rains are so heavy, when they do come, that they destroy everything.

Key findings

Perceptions of environmental change, impacts and vulnerabilities

Virtually all respondents in Mali and Sudan observed environmental changes in their localities, with significant effects on their social and economic conditions and livelihoods. They reported major negative climate-related changes as being those affecting the variability, distribution, and concentration of rainfall, and associated secondary hazards such as floods and droughts. In both countries, the key negative environmental changes identified by respondents were those more easily attributable to manmade activities, including deforestation, reduction in or pollution of water sources, and soil degradation. Respondents in Mali and Sudan overall identified decreased agricultural production and decreased herd sizes as the key negative impacts of environmental change, followed by smaller fish catches, food insecurity, and negative impacts on employment and health.

Patterns of differentiated vulnerabilities shape the impacts of climate-related and environmental change. There emerged two broad categories of people who are considered particularly vulnerable in this context: farmers, herders and fishers, due to the outsized impacts of climate-related and environmental change on their livelihoods; and others that are vulnerable to both climate-related and non-climate-related stresses and hazards, due to wider socio-economic factors. Groups identified as most vulnerable to the impacts of climate-related and environmental change included elderly people; women (especially in Sudan), due to their household responsibilities; young men (especially in Mali), due to a lack of economic opportunities; poorer households, due to the absence of reserve resources; and ethnic minorities (in Mali), due to existing systems of marginalisation and inequality.

Key migration patterns and changes

Most respondents in Mali and Sudan observed that migration patterns are changing in their localities – due both to environmental and wider factors. Most respondents reported increases in both in-migration (i.e. migration into respondents' localities, from elsewhere in the country or from other countries) and out-migration (i.e. migration out of respondents' localities, toward other parts of the country or to other countries). In both countries most 'in-migration' is seen to involve people from neighbouring countries or within the same country. The same was true in terms of out-migration in Sudan and South Sudan. However, patterns of out-migration appear more varied in Mali, where cross-border migration toward neighbouring countries and other world regions were described more frequently. In Mali, changes in migration patterns were observed to have occurred mainly over the past four to 10 years, reflecting more gradual changes in migration trends (as well as slower-onset environmental changes). In Sudan, changes in migration were observed to have occurred mainly in the past one to three years, reflecting more recent patterns of sudden-onset hazards (i.e. flooding).

In both countries, migration from rural to urban areas, likely linked to economic opportunities, is seen as a key internal mobility trend – although respondents in Sudan also highlighted trends in rural-to-rural migration, linked to mining and

agricultural opportunities. Respondents in both countries also observed that migration is mainly temporary or seasonal, rather than permanent – although this varied within countries, reflecting localised patterns of mobility.

Economic factors were identified as the primary motivation for migration in both Mali and Sudan. Environmental factors were typically identified as secondary drivers – although there is significant overlap with economic motivations given the impacts of environmental change on livelihoods.

Mobility and adaptation

Respondents in both countries considered migration to be a common adaptation strategy, although more so in Sudan. This likely reflects differences in the type of environmental changes and challenges observed by respondents, notably recent flood-induced displacement in Sudan compared to slower-onset environmental changes in Mali. In Mali, migration was described as a 'last resort' in response to environmental changes, because respondents preferred to stay in place – and it is young people who tend to shoulder the burden of taking this last resort. 'Tipping points', where coping in place was no longer possible, were mainly associated with sudden-onset hazards, such as flooding or crop failure. As well as being a form of adaptation itself, migration can also provide the means to support other in-place adaptation initiatives through remittances – but this connection risks being overstated, and not all migrants are able to support such initiatives.

Like other coping and adaptation strategies, migration is not equally possible for all population groups, with older people, women, people with disabilities, and people experiencing financial difficulties facing the greatest barriers. These same groups are also among those most vulnerable to the impacts of climate-related and environmental changes. Family reasons and a desire to stay in place were the most frequently identified barriers to migration in Mali; these were also reported in Sudan (where financial barriers were considered most significant), reflecting strong attachments to community as well as a perception of potential losses associated with migration. In Mali, respondents highlighted logistical barriers to international migration, specifically documentation requirements and more restrictive migration policies.

Migration is just one of many strategies people use to cope with and adapt to climate-related and environmental changes and challenges. Overall, coping and adaptation strategies were reported by more respondents in Mali than in Sudan, likely reflecting differences in the types of environmental changes and hazards experienced (slow-onset environmental changes versus sudden-onset events) and the extent of adaptation possible. Changes in work and/or subsistence activities or to agricultural practices are common strategies people use to support in-place adaptation, while strategies people use to enable short-term coping include the creation of water or food reserves, the sale of assets, and changes in consumption habits.

Migration outcomes and plans for return

While migration can enable improved social and economic conditions, it is also associated with numerous social and economic challenges. In Mali, most respondents who had themselves migrated felt that their social and economic conditions had improved after migration, due to new employment or business opportunities, an ability to meet their basic needs, and the ability to send funds to support their families. However, they also described migration as being associated with numerous social and economic challenges. This was particularly true for people involuntarily displaced due to sudden-onset environmental hazards and conflict; in these cases, negative impacts include loss of social status, resources, and property.

In Sudan, where most respondents had been displaced by severe floods, the majority reported that their socio-economic conditions had declined after migrating.

While most migrant respondents in Mali plan to return to live in their locality of origin (i.e. long-term or permanent return), most migrant respondents in Sudan either wish to return but are not able to do so, or have no plans to return, for financial and environmental reasons (for example, because their home communities are flooded or due to increasing flood events).

Photo © George Osodi/British Red Cross
Mothers' Club members outside the Red Cross of Chad office in N'Djamena, Chad.

Policy responses

Existing regional climate, development, and migration policies and initiatives across the Sahel tend to focus mainly on cross-border and international migration and on long-term displacement, as well as border control initiatives. Until recently, less attention has been paid to seasonal internal movement, multi-year and circular intra-regional migration, and how climate change is influencing these existing trends. Across the Sahel, policies and legal frameworks either tend to frame migration overall and migration related to environmental and climate change largely as a problem or threat to be controlled or managed, or they do not mention the issue at all. Such policies tend not to acknowledge that migration may play a role in coping and adaptation strategies for climate-related and environmental change.

National policies are influenced by these wider policy frameworks. They typically present migration as a direct result of climate change, neglecting the complex interaction of environmental and socio-economic drivers and vulnerabilities that shape people's decision to move. In Mali and Sudan, climate and development policies frame environmental migration primarily as a problem to be prevented or controlled. In Sudan, the approach to migration prioritises border control and developing the capacity of law enforcement, while placing some focus on the provision of health and social services.

Assistance for coping and adaptation from government and non-governmental organisations is skewed towards meeting immediate needs after shocks, with less support to short-term coping or longer-term adaptation. The most commonly reported forms of assistance received by people facing environmental hazards in research locations in both countries were forms of short-term support (e.g. the distribution of food, cash, and non-food items) that, while alleviating immediate needs, did not directly address key challenges to coping and adaptation. In Mali, this support was provided by government and by NGOs, while in Sudan, most if not all assistance in the locations that were surveyed came from national and international NGOs. Differences in access to short-term government and NGO assistance across research locations may result from geographic differences in the impacts of climate-related and environmental hazards and changes, as well as the uneven allocation of that assistance.

Access to longer-term support (e.g. skills and livelihood training, agricultural inputs), though still relatively uncommon, were reported by a slightly higher proportion of respondents in Mali. While training support, agricultural inputs, and early warning systems are important for adaptation to environmental changes, few respondents reported benefiting from these. In Mali, community support initiatives also play important roles in facilitating coping and adaptation, alongside or in the absence of sufficient government and NGO assistance.

Recommendations

Recommendations for national and international humanitarian actors (including National Red Cross and Red Crescent Societies)

Ensure that programmatic action, organisational narratives and policy frameworks acknowledge and reflect the complex relationship between climate change and mobility:

- Strengthen engagement with the existing evidence on climate change and migration to inform communications and advocacy strategies and strategic plans on climate change and migration, ensuring these reflect and adjust to emerging evidence.
- Pursue more systematic dialogue between, and coordination among, actors working in different countries and regions of the same country, given the broad and transborder nature of climate change and its impacts.

Address vulnerabilities associated with climate change and mobility:

- Target and strengthen route-based humanitarian assistance and (re) integration support to people who migrate internally and regionally in response to climate-related and environmental changes.
- Ensure that support takes into account the differential effects of environmental and climate change along lines of gender, age, disability, livelihood type, and income. Responses should explicitly consider the needs of groups that are particularly vulnerable to the adverse effects of climate change, and who face barriers to adaptation (including mobility).
- Support governments and regional organisations to strengthen the development and implementation of laws and policies addressing climate-related mobility (see below) through policy engagement and humanitarian diplomacy. For example, National Red Cross and Red Crescent Societies can build on their role as humanitarian auxiliaries to national authorities.
- Advance partnerships between actors with a view to addressing gaps in the evidence base in order to better meet needs for support. In this respect, National Red Cross and Red Crescent Societies have a unique role to play in assessing conditions on the ground.

Support adaptation and community resilience strategies within climate-vulnerable communities, so that mobility remains a choice but is not the only option:

- Ensure that support goes beyond short-term needs by strengthening material support for longer-term coping strategies and locally-led adaptation initiatives.
- Ensure that support is provided based on an understanding of the key barriers to adaptation in specific communities and the needs of different groups. For example, ensuring that support for coping strategies and adaptation initiatives goes beyond the agricultural sector, to reflect the varied aspirations of young people.
- Expand community knowledge of and access to early warning systems and climate information, to support preparedness for climate-related hazards, anticipatory action and responses.

Recommendations for national governments and regional organisations

- Promote the consistent integration of climate-related mobility into relevant national and regional policy and legal frameworks and strategies.
- Recognise migration in response to climate vulnerabilities as a form of adaptation and as involving risks and losses, rather than as a problem to be managed and prevented.
- Avoid looking at climate-related mobility in isolation; instead, situate it within the context of the broader dynamics of environmental change that underpin climate-related vulnerabilities and migration patterns.
- Support the establishment of, and expand knowledge of and access to, early warning systems and climate information to support preparedness for climate-related hazards, anticipatory action and responses.
- Address elements of policy frameworks that create or exacerbate vulnerabilities among people on the move in general, which may impact individuals moving in response to climate-related and environmental changes.

Recommendations for international donors

- Invest in building an evidence base to improve understanding of how climate change interacts with existing and future patterns and drivers of mobility in specific contexts.
- Address vulnerabilities associated with climate change and mobility, including through investment in addressing the impacts of climate change on humanitarian needs both for migrants and for people remaining in place.
- Ensure that funding that aims to address vulnerabilities specifically associated with climate-related migration, as well as funding that targets wider vulnerabilities among migrants, takes a wider focus on all migrants in situations of vulnerability – including in the context of internal and intra-regional movement.
- Support international acknowledgement and consensus that mobility can be an important adaptation strategy to be enabled among a range of choices for people in climate-vulnerable communities.

Contents

1. Introduction

1.1 Context and Research aims

The belt of land known as the Sahel stretches from the Atlantic Ocean in the west to the Red Sea in the east and comprises 13 countries, including Mali, Burkina Faso, Niger, Nigeria, Mauritania, Chad and Sudan. It is characterised by semi-arid to arid climates, which have been experiencing significant changes – the result of human activities such as agricultural expansion, as well as global climate change. Some Sahelian populations have responded to environmental changes through mobility, while others have stayed in place and adapted. Patterns of migration in the region are shaped by deeply rooted histories of mobility as well as intersecting demographic, socioeconomic, environmental, and security contexts. The ways in which climate change affects migration – including types of cross-border movement ranging from the seasonal movement of livestock to migration for economic opportunities to displacement after extreme events – highlight the transboundary nature of climate change risks and associated adaptation challenges, and the importance of considering these risks and challenges at a regional as well as national level (Opitz-Stapleton et al., 2021).

Recent projections of future climate trends from Mali to Sudan suggest increases in annual temperatures and temperature (especially heat) extremes, increases in rainfall variability and extremes, longer dry periods, and delayed rainfall onset (Holmes et al., 2022; Richardson et al., 2022). These changes present potential interconnected risks related to water resources and water-dependent services, agriculture and pastoralism, fisheries and aquaculture, food security, health and mortality, settlements and infrastructure, and wider ecosystems (ibid.). Such changes and risks might contribute to increased pressures to move for some people while constraining the possibilities for mobility for others. Existing patterns of social marginalisation and inequality, linked to gender, age, income, disability, and more, significantly shape individuals' vulnerability to climate-related impacts and will in turn shape their vulnerability to future climate-related risks.

In anticipation of an increasingly changing climate, it is necessary to understand its influence on human mobility in the Sahel, whether that mobility is a positive adaptive practice or a response to crisis. Rather than problematising mobility and migration as risks to be 'managed' or 'controlled', migration

In this report, **human mobility** is used as an umbrella term to encompass all aspects and drivers of the movement of people, including voluntary internal and cross-border migration, planned and consented relocation, and involuntary internal and cross-border displacement (Advisory Group on Climate Change and Human Mobility, 2015). **Migration** refers to the movement of people away from their usual place of residence, within a country or across an international border, temporarily or permanently, and for a variety of reasons (whether forced or voluntary) (IOM, 2022a), in accordance with an inclusivist definition of 'migrants'. **Displacement** refers to the movement of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, especially because of environmental or human-made disasters, armed conflict, situations of generalised violence, or violations of human rights.

should be viewed simultaneously as part of a wider set of adaptive responses and as involving social losses (see Selby and Daoust, 2021). However, framing migration as a necessarily adaptive response should also be avoided (Schwerdtle et al., 2020).

In this context, this research investigates the links between environmental and climate change and migration in the Sahel, with a specific focus on Mali and Sudan. Three broad questions frame this research:

- How do people perceive the connections between climate change and migration, and what are the needs created by climate change, especially for vulnerable people?
- How do the population in general, and vulnerable groups in particular, cope with or adapt to the adverse consequences of climate change, and how does migration fit within these strategies?
- What are the vulnerabilities, barriers, and needs experienced by those who use migration as an adaptation strategy?

Many of the key findings presented in this report validate findings from previous academic and expert research on the relationships between environmental and climate change and migration in the Sahel, reinforcing (and expanding upon) existing knowledge on these relationships. These findings question simple organisational or policy narratives that present a direct relationship between climate change and migration. They also highlight the importance of drawing on a more nuanced understanding of climate change-migration relationships to inform organisational narratives and programming. And they highlight the intersecting nature of climate-related and broader environmental changes (which may be difficult to disentangle) on people's mobility decisions. This more nuanced approach will ensure that future resilience and migration responses will be more relevant to, and better aligned with, the needs of vulnerable communities in the Sahel.

1.2 Structure of the report

The report is structured as follows:

- **Section 2** presents the research approach and data collection methods.
- **Section 3** examines existing evidence on the relationships between climate change and migration in the Sahel, including findings on patterns in Mali and Sudan.

Sections 4 to 6 present the findings emerging from this research:

- **Section 4** focuses on perceptions of environmental change, causes of these changes, and their effects (including patterns of vulnerability).
- **Section 5** explores coping and adaptation responses to environmental and climate-related changes, including challenges and support.
- **Section 6** examines migration decisions and trajectories, including links to environmental and climate change and patterns of vulnerability.
- **Section 7** outlines the policy and legal frameworks shaping migration patterns and possibilities, and responses in the region as a whole.
- **Section 8** concludes the report, presenting emerging recommendations and directions forward.

2. Research framework and methods

2.1 Research framework

In examining factors that contribute to displacement and migration pressures, the data collection and analysis in this research involved a focus on intersecting climate-related and broader environmental changes. As noted in **Section 3.3**, existing studies of climate change and displacement or migration in the Sahel focus primarily on the impacts of rapid-onset, short-duration climate-related hazards (e.g. floods, storms) rather than slow onset, longer-duration changes in seasonal mean temperatures and precipitation. However, the effects of sudden-onset hazards on displacement are relatively clear, whereas the impacts of slower-onset shifts on population movement are more difficult to disentangle from other dynamics across the region, including socio-economic, political, conflict-related, and broader environmental dynamics.

Understanding these complex causes and patterns of mobility requires attention to the current and future interactions between climate change impacts and broader environmental changes. This understanding may then, in turn, inform more robust policies and programmes to support coping, resilience, and adaptation. This report's approach follows recommendations from a recent evidence review on climate change and migration, which suggests that 'a narrow focus on climate change-related migration should be replaced with, or complemented by, broader consideration of environment-migration linkages', given that 'climate change is far from the only environmental factor in migration' (Selby and Daoust, 2021: 66).

2.2 Data sources

Mixed methods were adopted for data collection, with quantitative and qualitative methods used to explore experiences and perceptions of environmental and climate change and associated responses and strategies. Data was collected through i) quantitative surveys, ii) qualitative focus groups discussions (FGDs), and iii) individual key informant interviews. For a detailed presentation of the methods and data collection tools utilised, see **Appendix 1**. The research in Mali and in Sudan was led by in-country research partners. In Mali, the research was led by Kéné Conseils, based in Bamako, and in Sudan, the research was led by a team at the Centre for Remote Sensing and GIS at the University of Gadarif. Tables summarising the full survey data from both countries are presented in **Appendix 2**.

Two categories of documents were also analysed for this research. A review was undertaken of existing regional and national policies and frameworks on migration, climate, and development produced by regional bodies (the African Union (AU), the Economic Community of West African States (ECOWAS), which includes Mali; and the Inter-Governmental Authority on Development (IGAD), which includes Sudan), national governments in Mali and Sudan, and international organisations (including the International Organization for Migration (IOM), the UN High Commissioner for Refugees, UNHCR, and the International Red Cross and Red Crescent Movement). An analysis of research on the relationships between climate change and mobility in the Sahel in the past 15 years in either English or French was also conducted, to inform an understanding of the existing evidence on the topic and to provide

some context for the findings emerging from primary data collection in Mali and Sudan.

2.3 Research sites in Mali and Sudan

Data collection sites (for surveys, focus groups, and interviews) in Mali and Sudan were determined in collaboration with in-country research partners. Sites were selected to represent both migration sending communities and migration destination communities, accounting for research partners' existing capacities and security and access considerations. However, as discussed in **Section 4**, research sites in Mali were characterised mainly by slower-onset environmental changes while those in Sudan were characterised by sudden-onset hazards (notably flooding), which influenced respondents' observations regarding environmental changes, coping and adaptation possibilities, and implications for mobility. **Table 1** provides an overview of the research locations and respondent numbers for both the surveys and the focus group discussions in the two countries.

Table 1. Overview of survey and FGD locations, and no. of respondents, in Mali and Sudan[1]

Region or state	Research location	No. of survey respondents	No. of FGD respondents
Mali		**100**	**88**
Bamako	Five communes	50	44
Kayes	Nine localities	50	44
Sudan		**165**	**118**
Gadarif	Elfao	50	33
White Nile	Dabat Bosin	55	48
	Elganaa	60	37

[1] Differences in the number of research sites in Mali and Sudan are a function of the context-specific approaches taken to identifying target respondents, combined with the data collection capacities of in-country researchers, and access constraints.

Research sites in Mali

In Mali, survey data was collected in 14 sites in two regions: sending and transit areas in the region of Kayes (focusing on communities known for high levels of internal and international out-migration) and destination areas for both internal and cross-border migration in Bamako. Kayes has long been a site of transit for internal and cross-border migrants due to its position in West African transport networks and its proximity to borders with Senegal and Mauritania, as well as Guinea (Lombard 2008). The region is home to a population of roughly 661,000, with 23% residing in urban areas and 77% in rural areas. Bamako, the country's capital, is home to over 2.4 million people.

Research sites in Sudan

In Sudan, data was collected in Elfao in Gadarif state and Dabat Bosin and Elganaa in White Nile state. The town of Elfao is near a large national irrigated agricultural scheme that has attracted many people as agricultural workers. Elfao also hosts a camp for people internally displaced due to recent flooding. The village of Elganaa represents a host community for cross-border refugees from South Sudan, due to its location near the Sudan-South Sudan border. The village of Dabat Bosin is a transit location, including for South Sudanese migrants displaced due to recent flooding in Upper Nile state, South Sudan. These South Sudanese communities have been relocated to different refugee camps managed by the Sudanese Commission for Refugees (COR) and supported by the UNHCR and other national and international NGOs. Some residents had experienced two flood disasters within six months: first in Elganaa refugee camp in 2021 and then in Dabat Bosin after relocating from Elganaa.

Key informant interviews

Alongside the FGDs, individual interviews were conducted with government officials and representatives of national and international non-governmental organisations (NGOs) and civil society organisations (CSOs) at national and subnational levels. The interviews focused on perceptions of migration patterns and motivations, patterns of environmental change, relationships between environmental or climate change and migration, and policy and programme responses. In Mali, individual interviews were conducted with five municipal and regional government officials and six representatives of international and national NGOs and CSOs (including migration-, development-, and women – and youth-focused organisations), including the Mali Red Cross, in Bamako and Kayes. In Sudan, interviews were conducted with representatives from the Sudanese Red Crescent Society.

2.4 Respondent demographics

Table 2 provides an overview of the socio-demographic characteristics of survey participants in the two countries.

Respondents in Mali. In Mali, the low proportion of women among survey respondents may reflect the focus on migrants, who (as discussed in **Section 6.5**) are mainly men, and the implementation of the survey via heads of household. Most respondents were relatively young, aged 45 or younger. Data collection via focus groups enabled a more representative range of perspectives, with separate groups held with women and men of different ages and with people with disabilities (see **Appendix 1**). Most respondents in Bamako were internal migrants. Survey locations were selected

to represent migrant sending, transit, and destination areas (as described above), which likely affects the findings on patterns of mobility, including the likelihood of identifying migration as an adaptation strategy. Professions varied across research sites, with more respondents involved in agriculture in Kayes and in trade in Bamako.

Respondents in Sudan. In Sudan, survey respondents in Dabat Bosin and Elfao were primarily women, because South Sudanese men stayed in their locality of origin to look after property after the flood, and most young men in Elfao had out-migrated looking for work. Most respondents were young, with a few aged over 55 years.

Disabilities were also more prevalent among respondents in Sudan (11%), potentially attributable to the many years of war. Most respondents were involved in subsistence farming, while most women also engaged in household work.

Photo © Samuel Turpin/ICRC Part of Humans & Climate Change documentary project

Mamadou's herd grazes on the bed of the Yamé River in Mali. It is the full rainy season in August, but the Yamé river, a tributary of the Niger, is still dry.

Table 2. Socio-demographic characteristics of survey respondents in Mali and Sudan

	Mali			Sudan			
Characteristics	Total (N=100)	Bamako (n=50)	Kayes (n=50)	Total (N=165)	Dabat Bosin, White Nile (n=55)	Elganaa, White Nile (n=60)	Elfao, Gadarif (n=50)
Respondent's gender							
Man	**81%**	70%	94%	**44%**	33%	70%	24%
Woman	**19%**	30%	6%	**56%**	67%	30%	76%
Disability status							
No disability reported	**90%**	98%	82%	**95%**	89%	98%	98%
Disability*	**10%**	2%	18%	**5%**	11%	2%	2%
Respondent's age							
Younger than 18	**1%**	2%	0	**1%**	2%	0	2%
18 to 24	**10%**	14%	6%	**18%**	18%	17%	18%
25 to 34	**27%**	42%	12%	**27%**	35%	28%	16%
35 to 44	**22%**	28%	16%	**24%**	16%	28%	26%
45 to 54	**14%**	14%	14%	**16%**	16%	10%	22%
55 or older	**26%**	0	52%	**15%**	13%	17%	14%
Respondent's household size							
1 to 5 people	**19%**	34%	4%	**39%**	55%	32%	32%
6 to 10 people	**33%**	46%	20%	**42%**	33%	42%	54%
More than 10	**48%**	20%	76%	**18%**	13%	27%	14%
Respondent's marital status							
Single	**16%**	22%	10%	**17%**	11%	22%	18%
Married	**79%**	72%	86%	**74%**	76%	75%	70%
Divorced	**2%**	4%	0	**2%**	2%	2%	2%
Widowed	**3%**	2%	4%	**6%**	9%	0	10%
Respondent's education level							
No formal education	**27%**	32%	22%	**45%**	62%	28%	46%
Qur'anic studies	**25%**	18%	32%	**4%**	0	2%	12%
Primary education	**28%**	36%	20%	**34%**	25%	40%	36%
Secondary education	**14%**	14%	14%	**14%**	11%	23%	6%
Higher education	**6%**	0	12%	**2%**	2%	5%	0
Respondent's profession							
Agriculture	**25%**	16%	34%	**48%**	47%	60%	34%
Fishing	**6%**	4%	8%	**25%**	62%	13%	0

Characteristics	Mali			Sudan			
	Total (N=100)	Bamako (n=50)	Kayes (n=50)	Total (N=165)	Dabat Bosin, White Nile (n=55)	Elganaa, White Nile (n=60)	Elfao, Gadarif (n=50)
Herding	**6%**	4%	8%	**11%**	18%	13%	0
Household work	**12%**	22%	2%	**56%**	67%	30%	76%
Trade	**34%**	46%	22%	**14%**	22%	8%	12%
Transport	**12%**	16%	8%	**2%**	2%	2%	2%
Employee	**19%**	24%	14%	**2%**	0	0	8%
Other †	**13%**	8%	18%	**25%**	25%	17%	36%
Respondent's time in current locality							
Entire life	**37%**	0	74%	**36%**	0	100%	0%
Less than 1 year	**5%**	8%	2%	**45%**	51%	0	94%
1 to 5 years	**19%**	36%	2%	**18%**	47%	0	6%
6 to 10 years	**16%**	28%	4%	**0**	0	0	0
11 to 15 years	**8%**	10%	6%	**0**	0	0	0
More than 15 years	**15%**	18%	12%	**0**	0	0	0
Respondent's migration status							
Resident in locality of origin	**36%**	0	72%	**36%**	0	100%	0
Internal migrant	**58%**	92%	24%	**30%**	0	0	100%
Transhumance	**1%**	2%	0	**0**	0	0	0
From another country ‡	**5%**	6%	4%	**33%**	100%	0	0
Main activities in the research location							
Subsistence agriculture	**92%**	94%	90%	**99%**			
Commercial agriculture	**29%**	30%	28%	**10%**			
Subsistence fishing	**15%**	6%	24%	**59%**			
Commercial fishing	**16%**	10%	22%	**10%**			
Subsistence herding	**47%**	48%	46%	**79%**			
Commercial herding	**39%**	38%	40%	**4%**			
Trade	**57%**	70%	44%	**26%**			
Mining	**22%**	22%	22%	**3%**			
Transport	**13%**	2%	24%	**2%**			

* Disabilities included physical, sight-related, and hearing-related disabilities

† Other includes handicrafts in Mali

‡ In Mali, migrant respondents came from Togo, Senegal, Niger, Nigeria, and Europe (return migrants). In Sudan, they came from South Sudan.

3. The evidence on climate change and migration in the Sahel

3.1 Climate variability, environmental change, and future climate change risks in the Sahel

Communicating climate change to non-specialists is not an easy task. The language of climate change, including the use of scientific jargon and 'big numbers', may not relate to people's day-to-day experiences (Corner et al., 2018). Therefore, this research has framed the inquiry into people's experience of climate change impacts in Mali and Sudan within a broader perception of environmental impacts.

Previous research in both Sudan and Mali shows increased variability of annual rainfall and temperatures.[2] Further evidence highlights the negative effects of increasing inter-annual and seasonal rainfall variability, rainfall distribution and concentration; and of increasing mean temperatures and changes in temperature extremes on vegetation cover, soil degradation, crop yields, food insecurity, and so on.[3]

Other studies have introduced nuance to these findings, however, showing that environmental and climate variability and their consequences are not reducible to anthropogenic climate change alone. For instance, a study in Sudan shows that forest biodiversity is affected by climate change-related drought, agricultural expansion, illegal woodcutting, and road construction (El Tahir et al., 2010), while declining soil quality is linked to rainfall changes as well as agricultural practices (Abdi et al., 2013). Similarly, research in Mali shows that declining crop yields may be attributed to changes in rainfall while also being driven by declining soil quality and fertility, or lack of needed inputs such as fertilisers (Liehr et al., 2016).

Projected climate change risks. Projected changes in rainfall and temperature in the Sahel resulting from anthropogenic climate change, including increases in annual average temperatures and temperature (especially heat) extremes, increases in rainfall variability and extremes, longer dry periods, and delayed rainfall onset may intensify current climate-related challenges.[4] Risks include negative effects on (ibid):

- agricultural and herding livelihoods (e.g. declining soil quality, soil erosion, changes in growing seasons, declining crop production and livestock health),
- fisheries (e.g. threats to fish stocks linked to changing water levels and temperatures),
- health (e.g. changing incidences of communicable diseases, health impacts of temperature extremes), and
- wider threats to biodiversity and ecosystems, alongside more acute hazards such as flooding.

These present risks to the vulnerable groups highlighted in this research and may exacerbate inequalities for farming

[2] Hiernaux et al., 2009; Elagib, 2011; Traore et al., 2013; Traore et al., 2015; Halimatou et al., 2017; Hamadalnel et al., 2021

[3] Hiernaux et al., 2009; Sulieman and Elagib, 2012; Traore et al., 2013; Generoso, 2015

[4] Holmes et al., 2022; Richardson et al., 2022

(especially low-intensity, low-input rainfed farming), herding, and fishing households and communities, along lines of gender, age, ability, wealth, geographic location, and more. These risks will not only be shaped by the impacts of projected climate change itself, but also by socio-political factors independent of climate change, such as future policies on resource (e.g. land, water) appropriation and fragmentation. These differences are highlighted throughout the report.

3.2 Coping and adaptation strategies in the Sahel

Coping and adaptation strategies

Existing studies provide insights into people's coping and adaptation strategies in response to climate variability and change in the Sahel, and their implications for displacement and migration. Recent research, including studies in Mali and Sudan, reports that the diversification of agricultural and non-agricultural income sources, modifications to agricultural practices (e.g. crop diversification, crop rotation, changes to planting dates, multiple plantings, use of inputs such as fertiliser), water conservation and small-scale irrigation, and changes in livestock species can reduce or otherwise affect migration pressures.[5] For example, a study in Mali shows that while drought is associated with increasing migration from rural to urban areas, mobility is lower where crops are more diversified, and is affected by how well households are able to adapt to climate-related constraints (Defrance et al., 2020). This reflects adaptation strategies used more widely across the region in response to environmental and climate-related changes, alongside the increasing involvement of herders in agricultural activities and changes in seasonal mobility patterns.[6]

Existing research in Mali[7] also identifies migration as an important coping and adaptation strategy, enabling households to diversify their income sources by accessing new resources, markets, or labour or income opportunities. In response to environmental change, 'migration serves as a coping strategy or an immediate reaction to bad conditions and as an adaptation strategy for income diversification in the long run' (Liehr et al., 2016: 155). However, previous research in Mali suggests that migration remains a difficult choice in response to environmental

[5] Ebi et al., 2011; Afifi et al., 2012; Brockhaus et al., 2013; Traore et al., 2015; Hummel, 2016; Liehr et al., 2016; De Longueville et al., 2019; Young and Ismail, 2019; Defrance et al., 2020; De Diallo et al., 2020; De Longueville et al., 2020; Etana et al., 2020

[6] Djoudi and Brockhaus, 2011; Afifi et al., 2012; Ickowicz et al., 2012; Djoudi et al., 2013; Opondo, 2013; Bonnet and Guibert, 2014; Bello, 2016; Koutou et al., 2016; Epule et al., 2017; Marega and Mering, 2018; Hermans and Garbe, 2019; Etana et al., 2020; Groth et al., 2020; Zoma-Traoré et al., 2020)

[7] Brockhaus et al., 2013; Sauvain-Dugerdil, 2013; Hummel, 2016; Liehr et al., 2016), Sudan (Ibnouf, 2011; Young and Ismail, 2019), and the wider Sahel (Djoudi et al., 2013; Djoudi and Brockhaus, 2011; Drees and Liehr, 2015; Deubel and Boyer 2017

change, perceived by people who move as a 'necessary but undesirable' form of adaptation due to the resulting instability and loss of social networks (Brockhaus et al., 2013).

Existing research points to the complementarity of migration and adaptation in the Sahel. On the one hand, some adaptation strategies may enable people to accumulate the financial resources needed to move, as shown in studies on responses to climate-related changes in Ethiopia (Etana et al., 2020; Groth et al., 2020). On the other hand, research in West Africa (Mali, Mauritania, and Senegal) and East Africa (Kenya) highlights the importance of transnational migrant networks as contributors *after moving* to adaptation in their localities of origin. This may involve the transfer of knowledge, technology, remittances, and other resources from migrants to their communities of origin, as well as support to initiatives such as water supply infrastructure, electrification, transport and health services, and more (Scheffran et al., 2012). Studies show that migrant remittances can strengthen households' ability to cope with hazards, poverty and food insecurity, and their capacity to mediate livelihood risks, including through investments in agricultural and herding livelihoods.[8]

Barriers to adaptation

Research on responses to environmental and climate-related change in the Sahel shows that coping and adaptation strategies are not equally accessible to all. In Mali and Sudan and the wider Sahel, possibilities for adopting these strategies are affected by existing patterns of inequality of access to resources such as land and water, financial resources (e.g. financial assistance, access to credit), technical assistance and training, market opportunities, and decision-making power at household and community levels, along lines of gender, age, ethnicity, and so on.[9] As highlighted in research in Sudan, adaptation options are also affected by broader governance practices including changes to land tenure systems, which may limit the adoption of 'traditional' adaptation strategies (e.g. regular changes to cultivation areas) (Young and Ismail, 2019).

In some areas, adaptation may become increasingly difficult due to future climate trends. Analysis of future climate projections for the Sahel and associated socioeconomic risks suggests that in some parts of the region, future climate-related changes have the potential to exceed adaptation limits during some periods of the year. For example, the combination of increases in temperature and humidity extremes may periodically exceed physiological limits for humans and livestock, presenting a threat to health and survival and in turn disrupting and limiting certain socioeconomic activities as well as

[8] Gubert et al., 2010; Brockhaus et al., 2013; Generoso, 2015; Ng'ang'a et al., 2016

[9] Djoudi and Brockhaus, 2011; Ebi et al., 2011; Ibnouf, 2011; Brockhaus et al., 2013; Djoudi et al., 2013; Doka et al., 2014; Alou et al., 2015; Traore et al., 2015; Deubel and Boyer 2017; Diallo et al., 2020

possibilities for adaptation (Holmes et al., 2022; Richardson et al., 2022).

Furthermore, some adaptation strategies can themselves have adverse environmental consequences by increasing pressure on water, land, and forest resources – then, in turn, intersecting with the effects of climate change to intensify migration pressures. For instance, agricultural expansion, irrigation development, and 'diversified' non-agricultural economic activities such as mining can create additional demand for water, especially in contexts of unpredictable rainfall (see Holmes et al., 2022). Large-scale responses to climate-related and environmental change – such as the 'Great Green Wall' initiative involving the restoration of 100 million hectares of 'degraded' land across 11 Sahelian countries by 2030 through reforestation, vegetation regeneration, and water harvesting measures (UNCCD, 2020) – will also likely increase pressure on water resources.

3.3 Relationships between climate change and migration in the Sahel

Existing mobility patterns in the Sahel

Across the Sahel, including in Mali and Sudan, migration has long been an adaptation strategy in the face of climate variability and environmental change as well as changes in livelihood and economic opportunities (Ouallet, 2008; Barros, 2010; Generoso, 2015; Hummel, 2016; Liehr et al., 2016; Young and Ismail, 2019). Most migration in the Sahel occurs within the region (Bluett and Davy, 2020), and is largely motivated by economic aims (Eizenga, 2019) as well as by violent conflict, as discussed below. In recent years, socioeconomic transformation (including changes in agricultural systems), food crises, and widespread insecurity have contributed to patterns of migration from rural areas to urban centres in the region (OECD/SWAC, 2014, 2020).

In 2020, there were roughly 486,000 international migrants recorded in Mali and 1.4 million in Sudan. Refugees accounted for about 71% of international migrants in Sudan but only 10% of those in Mali. There were 1.3 million international emigrants from Mali and 2.1 million from Sudan in 2020 (IOM, 2022b).[10] These figures have increased markedly in recent decades. In 2020 roughly 7,400 people were newly displaced internally by disasters (such as floods, storms, extreme temperatures, and droughts) and 277,000 by conflict and violence in Mali, while 454,000 people were displaced by disasters (especially floods) and 79,000 by conflict and violence in Sudan (IDMC, 2021).

Climate-migration relationships

The relationships between climate change and human mobility are complex. A multitude of contextual factors shape individuals'

[10] These figures are from the UN Department of Economic and Social Affairs, which include only people officially recorded as migrants and not those who move informally across borders, and which are based on data that may vary in quality across countries. They may not, then, be fully representative of current migration trends in the Sahel.

choice and ability to move, leading to overlapping continuums ranging from forced displacement to voluntary migration, and from temporary movement to protracted displacement or long-term migration (Opitz-Stapleton et al., 2017). Existing reviews of the evidence on climate change and migration highlight the complex, context-specific nature of these relationships.[11] A recent evidence review found 'no evidence that human-induced climate change is currently causing or contributing to migration in a uni-causal, direct or unmediated way', and existing studies consistently emphasise the multi-causal nature of climate-related migration and the influence of intersecting economic, political, social, and environmental or climate-related factors (Selby and Daoust, 2021: 66). Depending on the context, extreme climate-related events may be associated with increased or decreased mobility, within and across national borders (ibid). Another recent review shows that relationships between climate change, environmental degradation, conflict and migration are context dependent, indicating that there is no simple direct cause and effect (Peters et al., 2020). Indeed, 'seeking to isolate environmental factors from the complex interplay of ecological, economic, social and political factors that [drive] migration decisions would be close to impossible' (Hummel, 2016: 220).

Existing evidence on climate change and migration in the Sahel and wider West and East Africa regions highlights these complex patterns. Previous studies point to mixed findings: that climate-related hazards may increase or decrease mobility, depending on the type of shock and the particular context.

Numerous studies in the Sahel and neighbouring regions report that heat extremes (Dillon et al., 2011), rainfall extremes[12] are associated with increased internal and cross-border migration – especially in areas more reliant on agriculture, because of impacts on agricultural productivity and incomes. In Mali, a study of young people in Kayes found that reasons for migration included seeking new opportunities in the face of inadequate and uncertain agricultural livelihoods (Daum, 2014).

However, other studies report that temperature and rainfall fluctuations are associated with decreased internal and international migration, likely because negative impacts on agricultural income impede the ability to move.[13] A study of Burkina Faso shows that temperature extremes (e.g. heatwaves) may deplete household resources and thus reduce migration options, while changes to rainfall (e.g. lower-than-average rainfall, or delayed onset of the rainy season) may be linked to increased internal, short-term migration but lower international, long-term migration

[11] see e.g. Borderon et al., 2019; Hoffmann et al., 2020; Selby and Daoust, 2021; Zickgraf, 2021; Piguet, 2022

[12] Nawrotzki et al., 2016; Nawrotzki and Bakhtsiyarava, 2017; Grothe et al., 2020), and drought (Defrance et al., 2020; Gray and Mueller, 2012; Hermans and Garbe, 2019

[13] Gray and Wise, 2016; Nawrotzki et al., 2016; Nawrotzki and Bakhtsiyarava, 2017; Mueller et al., 2020a, 2020b

(De Longueville et al., 2019). In other cases, decreased migration may be due to increased local work opportunities (e.g. in agriculture) associated with precipitation increases (Mueller et al., 2020a). Still other studies have found that climate fluctuations and drought have insignificant or inconsistent effects on migration (Gray and Wise, 2016; Grace et al., 2018; Owain and Maslin, 2018). A study of West African countries found that droughts were significantly associated with higher migration intentions in Senegal and Niger, but not in Mauritania, Mali, or Burkina Faso (Bertoli et al., 2020), pointing to the variability in climate-migration relationships across countries in the region.

Climate projections suggest that mobility patterns may change in the future – but that the changes are also likely to vary in a similar way. Analysis of future climate projections for the Sahel, and associated socioeconomic risks, suggests that environmental changes (including increases in annual temperature; in heat extremes; in annual precipitation; in rainfall variability and extreme rainfall events; or in number of consecutive dry days) may lead to changes in existing mobility patterns, especially among herding communities (Holmes et al., 2022; Richardson et al., 2022). While climate-related environmental changes present a range of risks that contribute to pressures to migrate, they may also present new or expanded opportunities that could act as 'pull factors' for in-migration. For example, projected increases in annual precipitation in the Sahel may contribute to increased agricultural productivity and associated economic opportunities, such as new or expanded agricultural opportunities, and in turn may affect patterns of migration, although there is no clear existing evidence on these dynamics (Selby and Daoust, 2021; Holmes et al., 2022). Furthermore, in its Sixth Assessment Report the Intergovernmental Panel on Climate Change (IPCC) highlights vulnerabilities generated by climate change (e.g. extreme weather and climate events) through displacement and migration, but concludes that 'migration patterns, in the near term will be driven by socio-economic conditions and governance more than by climate change' (IPCC, 2022: 15).

Climate-related migration patterns

Existing evidence suggests that most climate-related migration in the Sahel is internal and short-term. Recent studies across the Sahel, in West and East Africa, have found that migration in response to climate-related and broader environmental change is mainly internal and temporary or short-term (rather than cross-border or permanent), potentially building on histories of seasonal migration in the region.[14] Studies in Mali report that migration in response to environmental changes is mainly internal, often toward larger urban areas such as Bamako – although some migration does occur toward other regional capitals (Hummel, 2016; Liehr et al., 2016). Climate risk analyses of the Sahel and East Africa suggest that patterns of population mobility – including patterns of rapid urban expansion amplified by rural-to-urban migration – may increase risks

[14] Afifi et al., 2012; Opondo, 2013; Sauvain-Dugerdil, 2013; Gray and Wise, 2016; Hummel, 2016; Liehr et al., 2016; De Longueville et al., 2019; Hermans and Garbe, 2019; Bertoli et al., 2020; Mueller et al., 2020b

related to poor housing, sanitation, and basic services, especially in informal urban settlements (Holmes et al., 2022; Richardson et al., 2022). Research in Kenya, however, has found that most migration in response to flooding and rainfall variability occurs between rural areas (Opondo, 2013).

Migration choices and destinations are often influenced by social networks. Previous research in Mali shows that in response to environmental changes, migration destination choices are influenced by the presence of relatives and friends, who can provide information on migration routes, assistance with finding accommodation and work, and emotional support.[15]

3.4 Dimensions of climate vulnerability and connections to migration pressures and barriers

Climate-related vulnerabilities

Climate-related vulnerabilities are understood as vulnerabilities to the adverse impacts of climate-related (and wider environmental) hazards and changes and to the migration pressures or immobility that result. Current evidence provides insights into the contextual, sociocultural, and economic dimensions of vulnerability and mobility in the Sahel. A risk-informed approach highlights the complexity of the relationships between climate change and human mobility, acknowledging the multitude of individual and contextual factors that shape individuals' choice and ability to move (Opitz-Stapleton et al., 2017).
It is important to account for these multiple sources of vulnerability, which overlap and which may drive differentiated climate change risks. Intersecting forms of vulnerability and capacity determine people's options to move or stay in response to climate-related hazards and changes, which may in turn both increase pressures to move while also reducing the capacity to do so. Responses to risks associated with climate-related mobility should therefore consider not only those who move, but also those who cannot move due to socioeconomic or other barriers to mobility – especially for populations 'trapped' in situations of extreme vulnerability.

Gender

Gender contributes to climate-related vulnerabilities by shaping access to resources, economic possibilities, and options for mobility. Studies in Sahelian countries report that men are more likely to move in response to short-term temperature and rainfall fluctuations and drought while women are more likely to be 'trapped', and that migration can increase women's physical and social vulnerability.[16] For example, studies in Mali show that men are more likely than women to migrate in response to land and agricultural changes, due to sociocultural restrictions on women's mobility (Brockhaus et al., 2013; Hummel, 2016; Liehr et al., 2016).

[15] Streiff-Fénart and Poutignat, 2014; Hummel, 2016; Liehr et al., 2016; Bleck and Lodermeier, 2020

[16] Dillon et al., 2011; Djoudi and Brockhaus, 2011; Ibnouf, 2011; Gray and Mueller, 2012; Djoudi et al., 2013; Drees and Liehr, 2015; Gray and Wise, 2016; Hummel, 2016; Deubel and Boyer 2017; Mueller et al., 2020a

However, other research in Mali suggests a more complex picture, showing that in some communities, women may be more likely to move due to more entrenched patterns of migration among men or greater household reliance on men's income and thus more flexibility in women's movement (Grace et al., 2018).

Gender also shapes migration motivations and duration. Studies of responses to environmental changes in Mali find that men are more likely to identify economic or educational motivations for migration, while women are more likely to identify family-related (e.g. marital) reasons (Konaté, 2010; Sauvain-Dugerdil, 2013; Hummel, 2016; Liehr et al., 2016). However, in recent decades economic reasons have increased and family reasons decreased in importance among women migrants (Hummel, 2016). While men are more likely to engage in seasonal migration, women are more likely to migrate for longer durations or permanently (Liehr et al., 2016). Differences in migration patterns exist among women as well. A study in Kayes found that younger women are more likely to migrate than older women, and that migration is more common among women with at least primary education (Konaté, 2010).

Age

Existing evidence points to the mixed effects of age on experiences of climate-related mobility in the Sahel. Age can present vulnerabilities due to differential access to economic opportunities as well as physical capacities for migration. Studies show that younger people are most likely to migrate in response to short-term climatic fluctuations such as temperature extremes (Grace et al., 2018; Groth et al., 2020; Mueller et al., 2020a). Research in Burkina Faso has found that older people are more likely to engage in long-term migration to rural areas in response to poor rainfall conditions. However, the same study found that they were less likely to engage in long-term migration to urban areas or internationally due to the perceived risks associated with these forms of movement (De Longueville et al., 2019),

Employment and income

Recent studies show that people's differing motivations and patterns of movement (in terms of duration and destination of migration) can depend on whether their work is more or less 'climate sensitive'. Widespread reliance on agricultural activities in the Sahel, including subsistence and small-scale farming and herding (as sources of income and food supply), may increase people's vulnerability to environmental changes and changes in temperature and rainfall. In 2019, agriculture (including farming, herding, forestry, and fishing) accounted for 62% of total employment in Mali and 38% of total employment in Sudan (World Bank, 2021).

Impacts also vary with different levels of income – with the impacts of climate change potentially more severe for those with lower income and assets (who may have access to fewer protective or adaptative resources). Some studies show that people from poorer or landless households are more likely to migrate in response to drought and rainfall fluctuations (Gray and Mueller, 2012; Morrissey, 2013), although other research has found that wealthier households are more likely to have migrant members (Etana et al., 2020). A study of displaced communities in the East and Horn of Africa region found that while permanent relocation in response to climatic variability was rare, the poorest people were more likely to relocate (though internally) (Afifi et al., 2012). More broadly,

previous research in Mali identifies economic factors (e.g. seeking better employment and income opportunities) as the dominant motivations for internal and international migration.[17]

Education

Climate-related changes contribute to different motivations and patterns of mobility among people with different levels of formal education. Individuals with no or only primary education may be more likely to depend on climate-sensitive work and are thus more likely to face migration pressures in the face of environmental changes (van der Land and Hummel, 2013). However, they may also be less likely to have access to the resources needed to facilitate mobility. For example, a study in Kenya reports that people with at least primary-level formal education are more likely than those without formal education to migrate in response to climate fluctuations (Mueller et al., 2020a). A study in Burkina Faso shows that people with higher formal education are more likely to engage in long-term international migration in response to rainfall changes (De Longueville et al., 2019). Other research in Mali and Senegal found that educational level and economic activity do not have a significant influence on migration in response to environmental changes, although migration motivations may differ by education level (van der Land and Hummel, 2013; Hummel, 2016; Liehr et al., 2016). Studies in Mali show that people with no or only primary-level formal education are more likely than those with higher education to identify job opportunities and income as their main reasons for migration in response to environmental changes, while those with at least secondary education are more likely to migrate for further education or training (van der Land and Hummel, 2013; Hummel, 2016).

Conflict and insecurity

Across the Sahel, conflict creates conditions of vulnerability that may intensify the impacts of subsequent climate-related changes on people's livelihoods, contribute to migration pressures and barriers, and compound existing humanitarian needs (described in **Section 3.5**). Conflict-driven displacement and settlement in camps, damage to or destruction of infrastructure, food insecurity, livelihood disruption, and loss of resources and property intensify the forms of vulnerability described above and reduce people's capacities to cope with and adapt to climate-related hazards (Naess et al., 2022). Furthermore, ongoing armed conflict and insecurity in the region, as well as government restrictions on movement and border closures in response to armed activity, have disrupted agricultural and livestock production and trade, and in turn affected crop yields, income, food prices, and food security (FAO, 2019).

In Mali, for example, ongoing conflict since 2012 has meant that pastoralist migration and agricultural production, as well as access to markets for selling goods, have become more dangerous (especially for women) due to the operations of armed groups and military forces, impeding the livelihoods of those already vulnerable to climate-related

[17] Sauvain-Dugerdil, 2013; Daum, 2014; Hummel, 2016; Liehr et al., 2016; Kirwin and Anderson, 2018; Hoogeveen et al., 2019; Bleck and Lodermeier, 2020

changes (Tarif and Grand, 2021). In Sudan, agricultural and pastoral livelihood systems have been disrupted by ongoing intersecting local, national, and cross-border conflicts (localised inter-group conflicts, conflicts in Darfur between government-supported forces and other armed groups, and cross-border effects of conflict in Chad) (Young and Ismail, 2019), reducing people's capacities for coping with and adapting to subsequent environmental and climate-related changes.

Finally, armed conflicts can inhibit government and NGO responses to the adverse effects of climate change, by diverting resources to security or conflict-related crisis response, as well as impeding access to affected communities. Given the scale of ongoing conflicts across the Sahel – in Mali and the wider Central Sahel, in Sudan, in Ethiopia, and more – and resulting displacement, the impacts of conflict on climate-related vulnerabilities must be considered.

3.5 Humanitarian needs among migrants

Studies of internal and cross-border migrant experiences in the Sahel identify a range of overlapping risks, needs, and vulnerabilities. As in other world regions, people 'on the move' in the Sahel face numerous challenges, including legal and societal barriers to accessing basic services (e.g. health care, education) and safe housing; legal and societal barriers to accessing employment (e.g. difficulties accessing work permits, discrimination); poor working conditions; increased mental health and psychosocial support needs; and exposure

Photo © IFRC/British Red Cross

The Sudanese Red Crescent Society responded to flooding with first aid and psychosocial support, distributed food and emergency items and assisted families to move to higher ground.

to gendered, sexualised, and other forms of violence, exploitation, and abuse (Bluett and Davy, 2020; Anderson et al., 2021; Ihring and Meskers, 2021; OHCHR, 2021). Many of these challenges, including gaps in responses, are also shared by marginalised members of host communities.

As well as presenting challenges in themselves, these risks and needs faced by migrants can also intensify their vulnerability to the impacts of environmental and climate change. For instance, barriers to health care and lack of access to safe housing can render migrants more vulnerable to the health impacts of heat extremes, flooding, and so on, while barriers to employment can make coping with these hazards difficult or impossible.

Support and services for migrants are often insufficient in response to these needs and vulnerabilities, and are not equally accessible to different categories of migrants (Bluett and Davy, 2020). Despite 'free movement' frameworks, migration-related policies and practices within the Sahel have been shown to contribute to humanitarian vulnerabilities among migrants, through administrative and financial barriers to obtaining resident and work permits, and legal and societal barriers to healthcare and education services, housing, and employment (Bluett and Davy, 2020).

While some support (e.g. housing, education) may be provided to refugees by the UNHCR, other categories of migrants often do not benefit from similar support (ibid). Many people may move across borders outside of official processes, rendering them particularly precarious and vulnerable to exploitation.

Since 2020, national responses to the COVID-19 pandemic, including restrictions on mobility within and across borders, have presented additional barriers to migration. The pandemic has also intensified and created new risks for people on the move, alongside members of host communities, including the secondary impacts of policies intended to mitigate COVID-19 transmission. It has, for example, exacerbated issues relating to unsafe shelter and access to health care, while restrictions on commercial activities have posed challenges to livelihoods (Anderson et al., 2021; Ihring and Meskers, 2021).

4. Key findings: perceptions of climate-related and environmental change in Mali and Sudan

4.1 Observed environmental changes and perceived causes

Respondents in Mali and Sudan were asked to describe environmental changes they had observed in their home area (or region of origin) and the severity and length of these changes. These included sudden-onset hydro-meteorological hazards (such as heat, flooding, or storms) and changes in weather patterns, as well as longer-term changes related to land, water, and forests. While respondents were asked to describe both negative and positive environmental changes, the observations were given primarily in negative terms, with fewer positive changes identified.

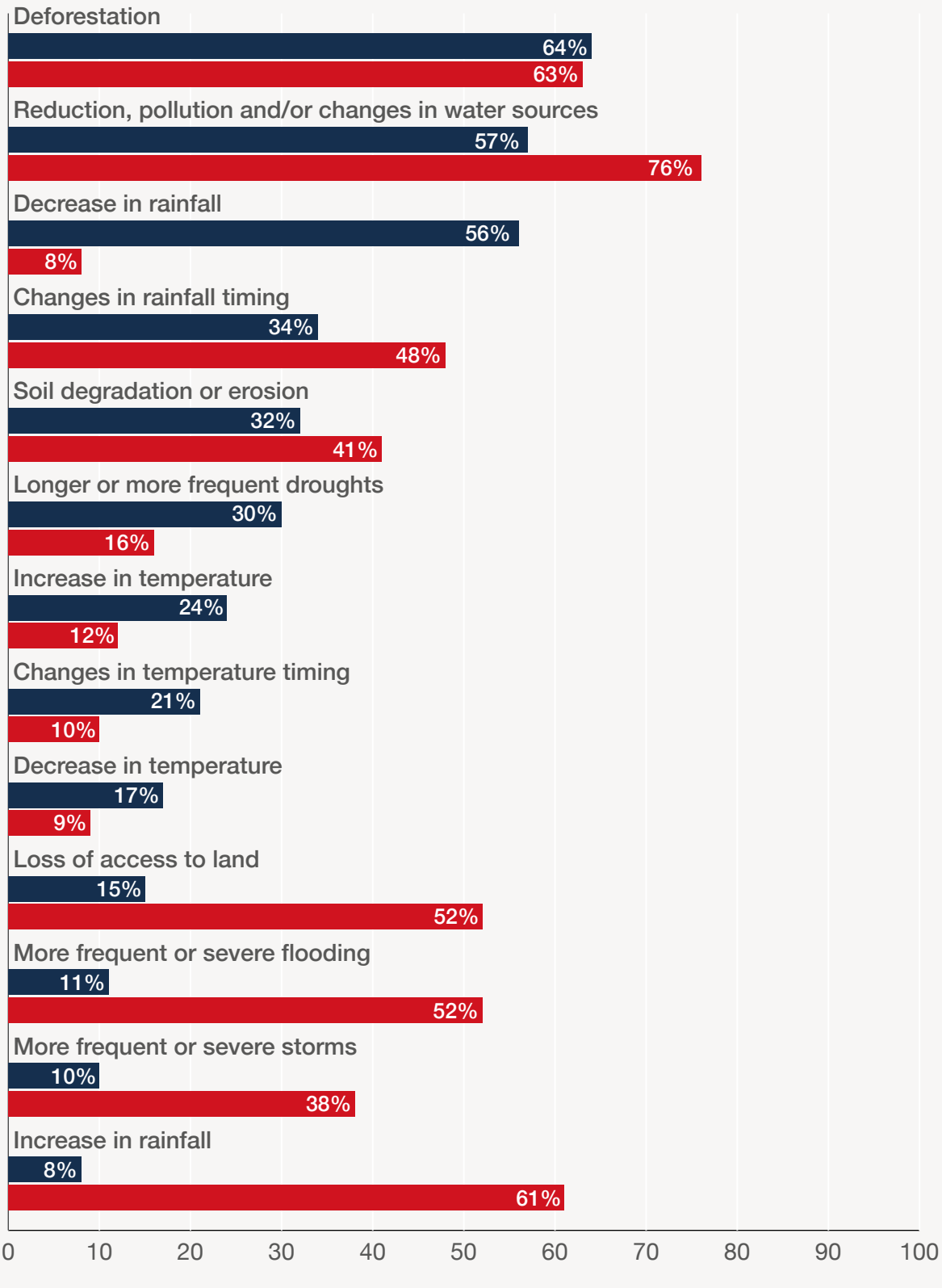
Virtually all respondents had observed environmental changes in their localities, with significant effects on their social and economic conditions. In Mali, 91% of respondents (94% in Bamako and 88% in Kayes) reported such changes. In Sudan, it was 100% of the respondents across the three sites of Dabat Bosin, Elganaa and Elfao – which can be explained by their recent experience of flooding and displacement, in addition to slow-onset environmental stresses. Most of the respondents across the two countries (92% in Sudan and 91% in Mali) classified these changes as 'very serious.'

Respondents in Mali and Sudan described major negative climate-related changes as those affecting the variability, distribution, and concentration of rainfall and their associated secondary hazards, such as flood and droughts (see **Figure 1**). Differences were noticeable between Mali and Sudan. In Mali, respondents reported a drier climate with decreased rainfall (56% of respondents) and rainfall delays, longer and increased droughts (30%), and increase in temperature (30%) and temperature extremes.

FGD participants and key informants from the government and NGOs echoed these findings, adding that winter periods were shortening, often from four to two months. By contrast, Sudanese respondents reported a wetter climate with increased rainfall (61%) and changes in rainfall timing (48%), more frequent or severe flooding (52%), and more frequent and severe storms (38%). FGD participants specified delayed onsets of the rainy season, and changes in rainfall patterns (long spells during the rainy season and above-average rainfall in some seasons, leading to crop damage). However, in White Nile, Sudan, 54% of respondents viewed increased rainfall positively, as it improved agricultural output in rainfed farming.

Perceptions of a drier climate in Mali are influenced by historical events and their consequences. The Sahelian droughts in the 1970s and 80s have had profound and lasting effects on people's understandings of climate-related and environmental changes in the region (Liehr et al., 2016), including the belief that rainfall has declined over the past decades, even though rainfall over the Sahel has in fact recovered since the 1990s (Holmes et al., 2022). In Sudan, perceptions of a wetter climate can be explained by the makeup of the respondent group: they had all experienced devastating floods that forced them to move. This is also supported by the perceived length and timing of changes reported, as 78% of respondents in Sudan stated that they had happened within the last one to three years. In comparison, over half of respondents in Mali (55%) reported observing changes within the past four to 10 years, and a third reported that they have occurred for more than 10 years.

Figure 1. Negative climate-related and environmental changes observed by survey respondents in ■ Mali and ■ Sudan



In both countries, the key negative environmental changes identified by respondents were those more easily attributable to manmade activities, including deforestation, reduction or pollution of water sources, and soil degradation (**Figure 1**). In Mali, 88% of people attributed these changes to human intervention, including agricultural practices (69%), energy demands (61%), mining (53%), industrial activities (49%), and herding practices (43%). Numerous FGD and interview respondents identified the over-cutting of trees for firewood and desert encroachment as the main reason for deforestation and soil erosion. Others noted the overuse of pesticides and fertilisers in agriculture and chemical products in mining as contributing to water pollution and decreased fish species. Mining was described by one interviewee as more dangerous than climate change. Some respondents also mentioned the seizure of land by elected officials, conflicts over livestock grazing land between herders and farmers, and the actions of security forces or armed groups as affecting access to land, water, and forest resources and contributing to environmental degradation.

In Sudan, the small minority of survey respondents (13%) who attributed environmental changes to manmade actions reported that the expansion of large-scale mechanised farming, which now covers millions of hectares at the expense of natural vegetation cover, was the key driver of deforestation. This was highlighted in Elfao, Gadarif State and Elganaa, White Nile State. Moreover, South Sudanese informants in the Dabat Bosin refugee camp reported that a major issue they faced back home before displacement was insecurity due to conflicts over land grazing and water for cattle. However, most respondents (nearly 90%) attributed the observed environmental change to the will of God.

The differences in perceptions of the drivers of climate-related and broader environmental change (i.e. human vs divine influences) between Mali and Sudan may be explained by the types of hazard that people experienced. In Sudan, the majority of respondents suffered from rapid-onset events (i.e. floods) – these types of events may be more affected by anthropogenic climate change than the kinds of hazards experienced by those in Mali. Without a scientific understanding of the linkages between greenhouse gas (GHG) emissions and hydrometeorological impacts, respondents may have resorted to God to rationalize the disasters that affected them. This interpretation is supported by the 13% minority that attributed environmental changes to human intervention, who focused on environmental impacts that can be easily attributed to manmade actions, including the impact of agricultural practices on water resources and soil erosion and reduced access to land due to large-scale mechanised farming.

These findings align with previous research on the interaction between agricultural and land policies, livelihood practices, and environmental change. The existing literature on Mali and to some extent Sudan illustrates the impacts of agricultural expansion (including large-scale commercial agriculture) on environment, land access, agricultural and herding livelihoods, and mobility (Lind et al., 2020; Marega and Mering, 2018; Sulieman, 2013; Sulieman and Elagib, 2012; Young and Ismail, 2019). Meanwhile, wider research on changes to agricultural and herding livelihoods in the Sahel has highlighted the impacts of agricultural development and expansion; land tenure and resources

management systems; and governance reforms, all interacting with the effects of climate change to shape migration pressures and barriers across the Sahel.[18]

4.2 Impacts of climate-related and environmental changes and differentiated vulnerabilities

The main regional economic activities identified by respondents highlight the significance of agricultural activities, including farming and herding, across the two countries (see **Table 2**, **Section 2.4**). In Mali, more than 90% of respondents in both Bamako and Kayes identified subsistence agriculture as the main economic activity, while commercial agriculture was identified by about a third of respondents. Subsistence herding was identified as the main economic activity by nearly 50% of respondents in the two regions and commercial herding was identified by about 40%, pointing to the significance of commercial livestock markets in the region. Trade is a more central economic activity in Bamako, while fishing activities and the transport sector play a greater role for respondents in Kayes. Similarly, in Sudan, subsistence agriculture is the key economic activity (99%), together with subsistence herding (79%) and fishing (59%). Differing from Mali, respondents in Sudan engaged far less in commercial activities – which are generally more profitable – except for a limited number of commercial livestock traders.

Respondents in Mali and Sudan identified decreased agricultural production and decreased herd sizes as the key negative impacts of environmental change, followed by smaller fish catches, food insecurity, and negative employment and health impacts (see **Figure 2**). These impacts were most prominent in Sudan, where almost every respondent had suffered from lower agricultural output and smaller herd sizes. This reduced food quantity and quality, and led to higher food insecurity and impoverishment (linked to declining income and the rising costs of cereals and other foods), hunger, and illness – as well as having subsequent effects on household stability and migration. The huge incidence of food insecurity in Sudan (99% of respondents) compared to Mali (32%) can be attributed to the predominance of subsistence activities

In Mali, three quarters of respondents reported decreased agricultural outputs, whereas around one third reported experiencing the other impacts. In addition, FGD respondents in Mali also mentioned an increase in heat-related illnesses and malaria; the emergence of new diseases; the effects of poorer water quality on health; and difficulties accessing health care due to declining income as further negative impacts of environmental and climate-related changes. A minority (13%) of respondents in Mali reported less severe food insecurity due to environmental change, whereas virtually no positive impacts were perceived by respondents in Sudan.

[18] Benjaminsen et al., 2010; Ickowicz et al., 2012; Bouaré-Trianneau, 2013; Bonnet and Guibert, 2014; Doso, 2014; Hiernaux et al., 2014; Kiema et al., 2014; Daouda 2015; Koutou et al., 2016; Nilsson et al., 2020; Zoma-Traoré et al., 2020

Two broad categories of people emerge from the research as being particularly climate-vulnerable: firstly, farmers, herders and fishers, due to the outsized impacts of climate and environmental change on their livelihoods; and secondly, people who are vulnerable to both climate-related and non-climate-related stresses and hazards, due to wider socio-economic factors (e.g. gender inequality, poverty, conflict) (see **Figure 3**). Interviews and FGDs in Bamako and Kayes, Mali emphasised the challenges facing farmers, including the loss of cultivable land, insufficient water (for rainfed agriculture) due to irregular rainfall, and poor soil quality resulting in declining crop yields, as well as heavy rainfall that destroys crops – with each of these challenges reducing their resilience.

For herders, challenges came from the degradation and loss of pasture land, difficulties accessing sufficient water and food for livestock, and the increasing prices of water, fertilisers, equipment, and livestock feed as a consequence of environmental change. As noted during a focus group with older men in Bamako,

> **"At the time of [our] parents, it was raining enough and the animals had grass to graze for a long time, which allowed them to stay in shape for wintering… Today the opposite is happening."**

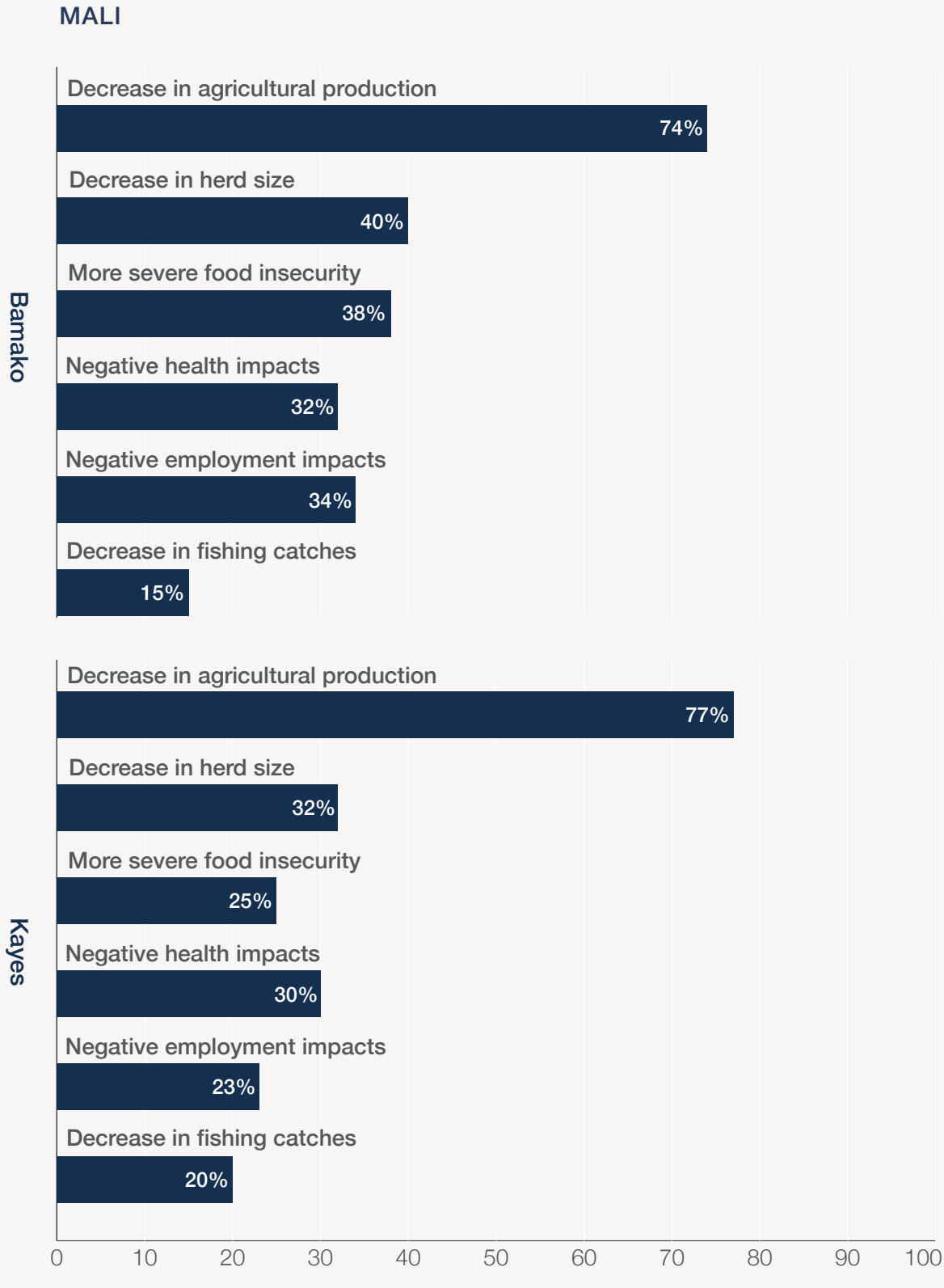
According to one survey respondent, these challenges were leading to 'massive abandonment of herding.' For fishers, challenges were associated with reductions in river water levels and, in turn, reduction in the quantity of fish catch, and a decline in or disappearance of certain plant and animal species. Others noted that armed conflict has prevented farmers from cultivating their fields. These wider socioeconomic and security factors underpin and exacerbate vulnerabilities to environmental and climate-related changes.

Elderly people were among those identified as the most vulnerable to the impacts of climate-related and environmental change in both Mali and Sudan. This was far more pronounced in Sudan (70% of respondents) than in Mali (22%) despite the fact that the former had a lower share of respondents aged over 55 (15%) than the latter (55%). This may be influenced by the fact that most Sudanese respondents observed first-hand the hardships faced by elderly people during their displacement journeys, shaping their view of older people's vulnerability. In comparison, respondents in Kayes, Mali (which is a sending destination of migrants) were in their locality of origin and may not have had a comparable experience shaping their perceptions. In FGDs in Mali, respondents also indicated people with disabilities, especially among the elderly, as being particularly vulnerable.

The higher vulnerability of elderly people and people with disabilities is associated with their lower tolerance to temperature extremes and to the effects of malnutrition as a result of impoverishment. Some respondents also linked the challenges affecting older people to their responsibilities as head of their families, which intensify the pressures resulting from environmental changes and negative effects on livelihoods, incomes, and ability to meet household needs. Many groups facing vulnerabilities to the impacts of climate-related and environmental change also face barriers to coping and adaptation strategies, as discussed in **Section 5.2**.

Particularly in Sudan, women were perceived to have increased vulnerability to the effects

Figure 2. Effects of climate-related and environmental changes reported by survey respondents in ■ Mali and ■ Sudan



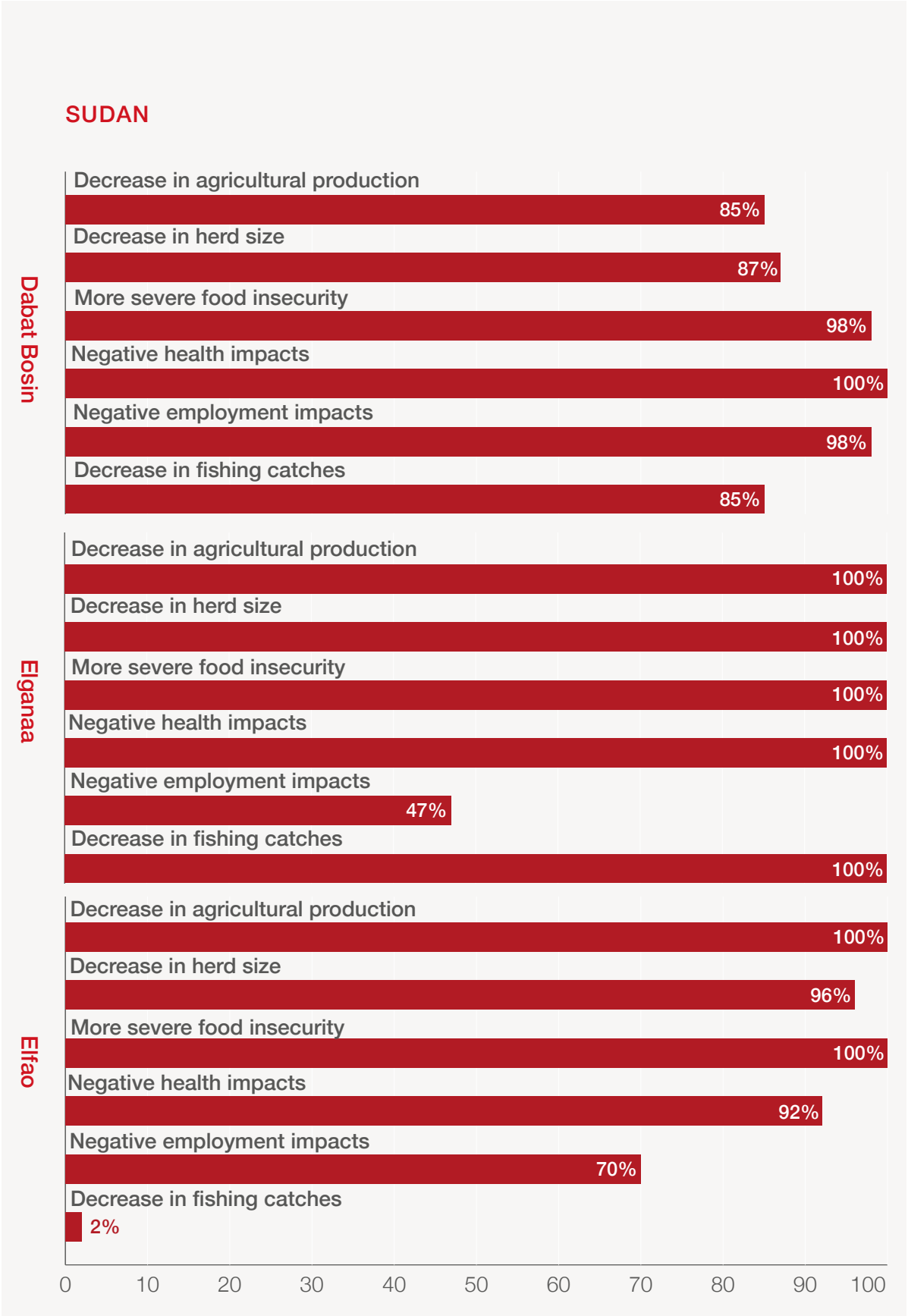
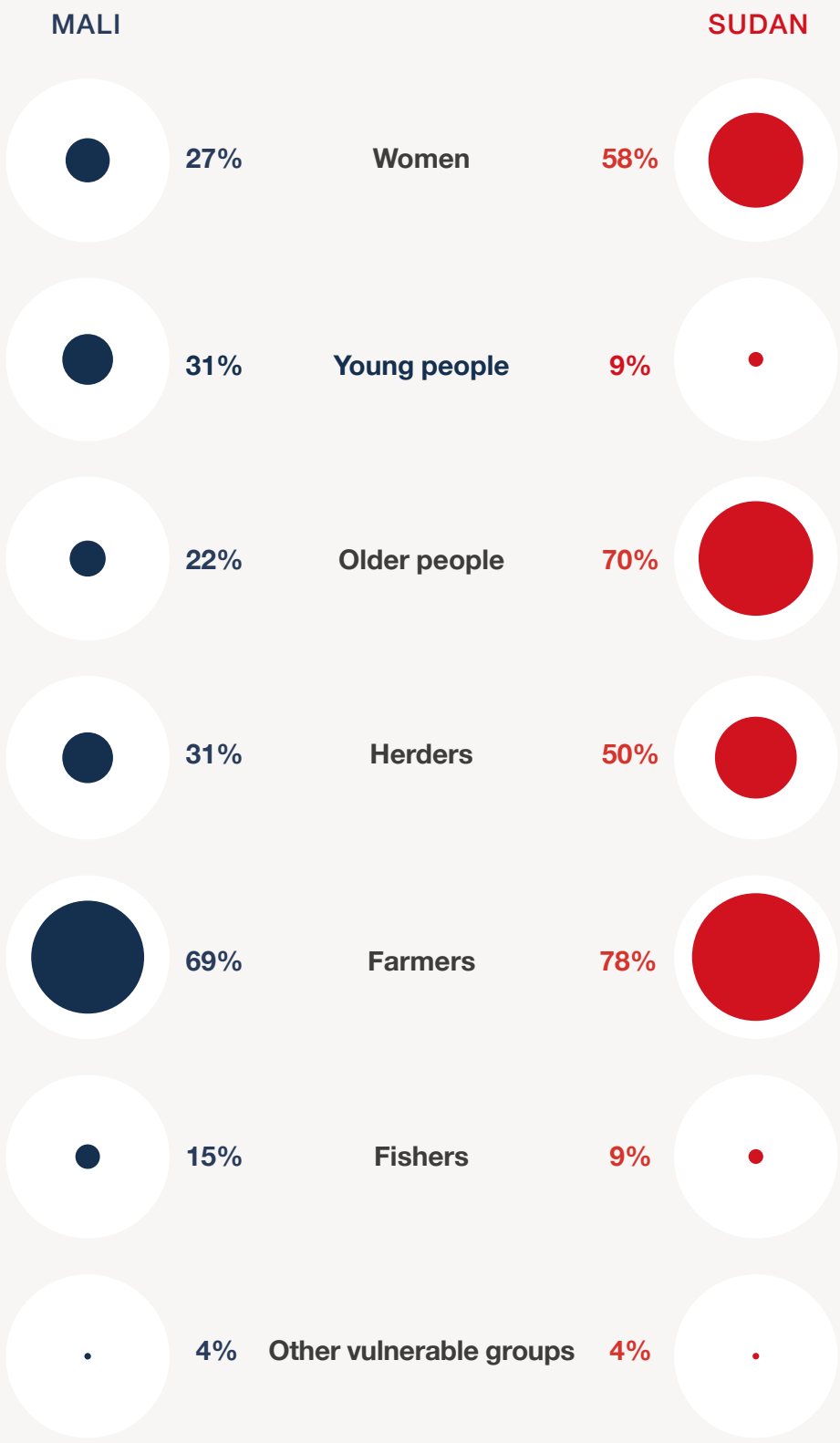

SUDAN
Dabat Bosin
Decrease in agricultural production
85%
Decrease in herd size
87%
More severe food insecurity
98%
Negative health impacts
100%
Negative employment impacts
98%
Decrease in fishing catches
85%
Elganaa
Decrease in agricultural production
100%
Decrease in herd size
100%
More severe food insecurity
100%
Negative health impacts
100%
Negative employment impacts
47%
Decrease in fishing catches
100%
Elfao
Decrease in agricultural production
100%
Decrease in herd size
96%
More severe food insecurity
100%
Negative health impacts
92%
Negative employment impacts
70%
Decrease in fishing catches
2%
0 10 20 30 40 50 60 70 80 90 100

Figure 3. Groups identified as most severely affected by environmental changes among survey respondents in ■ Mali and ■ Sudan (multiple choice answers)



of climate-related and environmental change, due to their household responsibilities. Women's income in Mali and Sudan is highly dependent on vegetable cultivation and the agricultural sector, and thus to changes in rainfall and water sources. In addition to their main economic activity, women were also reported as responsible for household work (52% in Sudan), e.g. collecting water, which contributes to their vulnerability to environmental impacts.

In Mali, young people, especially young men, were also perceived as experiencing increased vulnerability to environmental change, due to a lack of economic opportunities. A lack of employment and alternative economic opportunities adds a burden to the responsibility that young men perceive as the heads of their families; this contributes to pressure for them to migrate and thus to their increased exposure and vulnerability to environmental impacts. Some FGD respondents in Mali noted that children are particularly vulnerable to the health impacts of environmental changes. This contrasts with findings from Sudan, where only 9% of respondents considered young people to be most vulnerable, though it is unclear why there was such difference.

Poorer households were identified to be more vulnerable, due to the absence of reserve resources. This was identified by respondents in FGDs in Mali. The lack of land ownership heavily contributed to this vulnerability, whereas reserve resources and land were seen as serving a protective function for wealthier households. As a group of older women in Mali stated,

> **"The situation of the rich and the landowners is different because they will always have something."**

Meanwhile, another group of older men explained that differential vulnerability to the impacts of environmental and climate-related change is inseparable from broader systems of economic inequality:

> **"The impacts are different for the rich and the poor, because the rich get richer on the backs of the poor. The same goes for landowners and landless people, since every day landowners take the good plots [of land]."**

Ethnic minorities in Mali were also identified as having increased vulnerability to environmental change, based on existing systems of marginalisation and inequality. During FGDs, one group of young people in Bamako noted that ethnic groups including the Sonrhaï, Dogons, Peulhs, and Bozos face more negative effects of environmental change, given that they face broader forms of social, economic, and political marginalisation that intensify vulnerability (in terms of precarious livelihoods or barriers to land access, for example).

5. Key findings: coping and adaptation strategies in Mali and Sudan

As discussed in **Section 2.3**, existing research has documented a range of coping and adaptation strategies which people have adopted in response to climate variability and change in the Sahel, which can affect migration pressures. Here, 'coping strategies' refers to people's short-term responses to environmental changes and challenges, while 'adaptation strategies' encompasses the longer-term adjustments people may make to enable them to remain in place in the context of such changes and challenges, as well as supporting their choices about mobility. It should be noted, however, that the strategies described below, while framed as responses to environmental changes and challenges, may also be adopted in responses to other social and economic challenges.

5.1 Strategies to cope with climate-related environmental changes and challenges

Overall, coping and adaptation strategies were reported by more respondents in Mali than in Sudan, likely reflecting differences in the types of changes and hazards they had experienced and the extent of adaptation needed. In Mali, respondents described longer-term environmental changes, which may allow people more time to identify and implement adaptation strategies. In Sudan, the sudden-onset nature of environmental hazards (floods) may limit possibilities for adaptation responses. Floods around the Nile River in South Sudan and Sudan have been increasingly severe and destructive since 2019, linked to changes in rainfall intensity, human impacts on the physical environment, and the poor planning of settlements (Tiitmamer, 2020; Elagib et al., 2021). In addition, adaptation measures such as flood defences, diversion canals and reservoirs, and so on require resources beyond the current capacity of individuals and households (Tiitmamer, 2020, 2021).

Migration was considered a significant adaptation strategy in both Mali and Sudan (see **Figure 4**). Over half of survey respondents in Mali and nearly all survey respondents in Sudan (98%) identified migration as a common adaptation strategy in the face of environmental or climate-related change, as discussed in detail in **Section 6**.

In Mali and Sudan, changes in work and/or subsistence activities and changes to agricultural practices are common strategies people use to adapt to environmental changes while staying in place – reflecting the findings of previous research. These adaptation strategies were identified by about 60% of survey respondents in Mali and 30 to 40% of respondents in Sudan. In Mali, FGD respondents described strategies including the adoption of new agricultural techniques (e.g. new crop varieties, changes to planting seasons such as early seed planting), the construction of small vegetable gardens, lowland/wetland development, and water resource improvement (e.g. small dams, water retaining structures, new water points).

Respondents in Kayes were more likely than those in Bamako to identify changes in work or subsistence activities as adaptation strategies, likely reflecting differences in coping strategies between more rural and more urban settings. In Sudan, respondents described adopting drought-resistant and short-maturing crop varieties during dry periods, and crops that can withstand higher soil moisture during rainy and flood years. Herding practices (such as movement to pasture) are also modified to cope with changing environments and weather

patterns. These echo the in-place coping and adaptation strategies described in previous research, summarised in **Section 3.2**.

Strategies for short-term coping with climate-related hazards and changes include the creation of water and/or food reserves, the sale of assets, and changes in consumption habits. Sale of assets (such as livestock) and changes in consumption habits were each reported by about a quarter of survey respondents in Mali and about one-fifth of respondents in Sudan. In Mali, respondents explained that the sale of assets is most often done during periods of food insecurity, to enable the purchase of food and meet other basic needs (e.g. children's education). In Sudan, respondents reported that the sale of assets was a strategy to raise money to migrate.

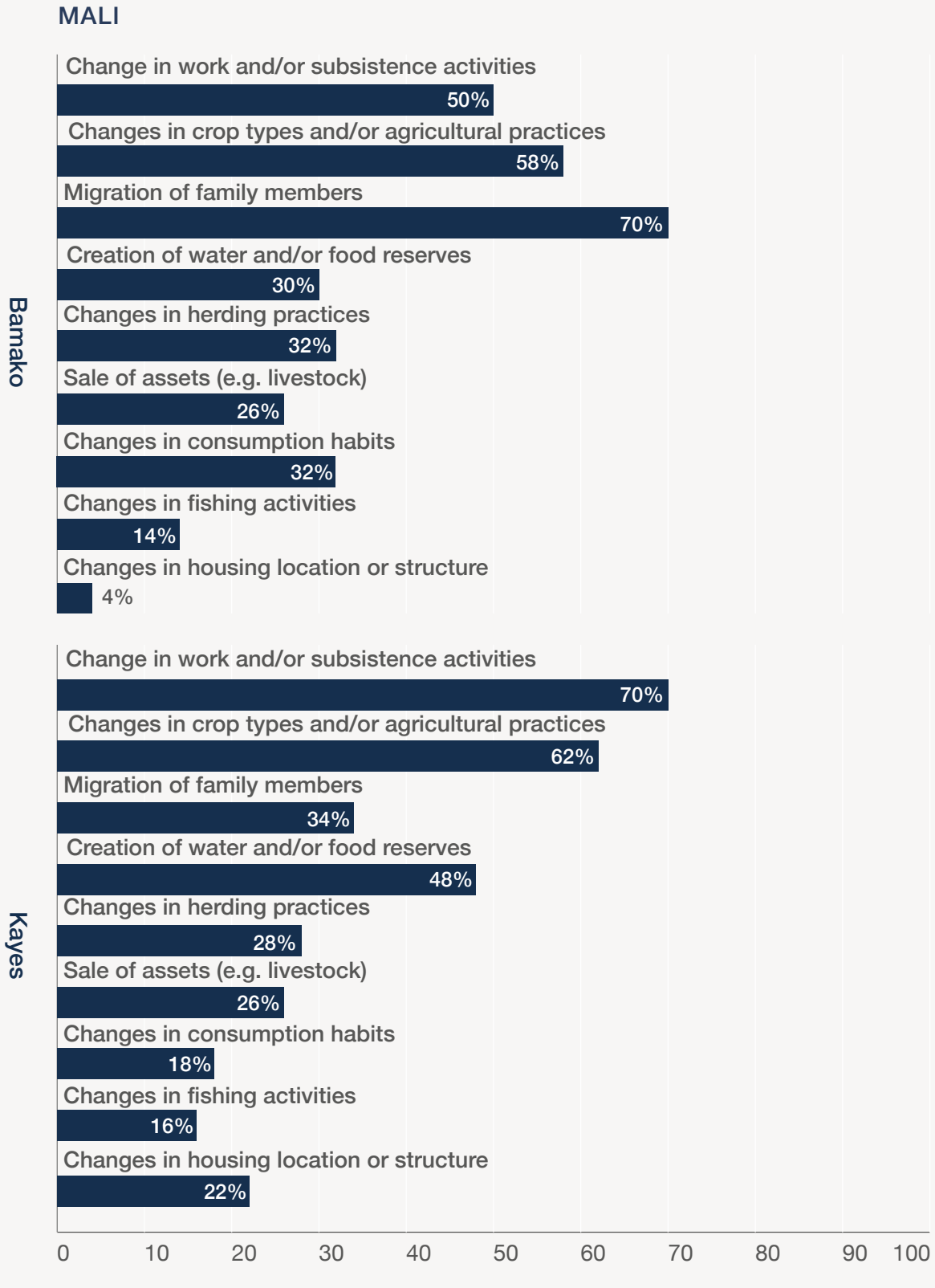
In Mali, respondents in Kayes were more likely to identify the creation of water or food reserves as adaptation strategies, while respondents in Bamako were more likely to identify changes in consumption, likely reflecting differences in possible coping strategies between more rural and more urban settings. In Sudan, respondents in Elfao were more likely than those in other sites to report such coping strategies, potentially because residents of the two other sites in Sudan had been displaced by flooding and may therefore have had fewer options for coping in place.

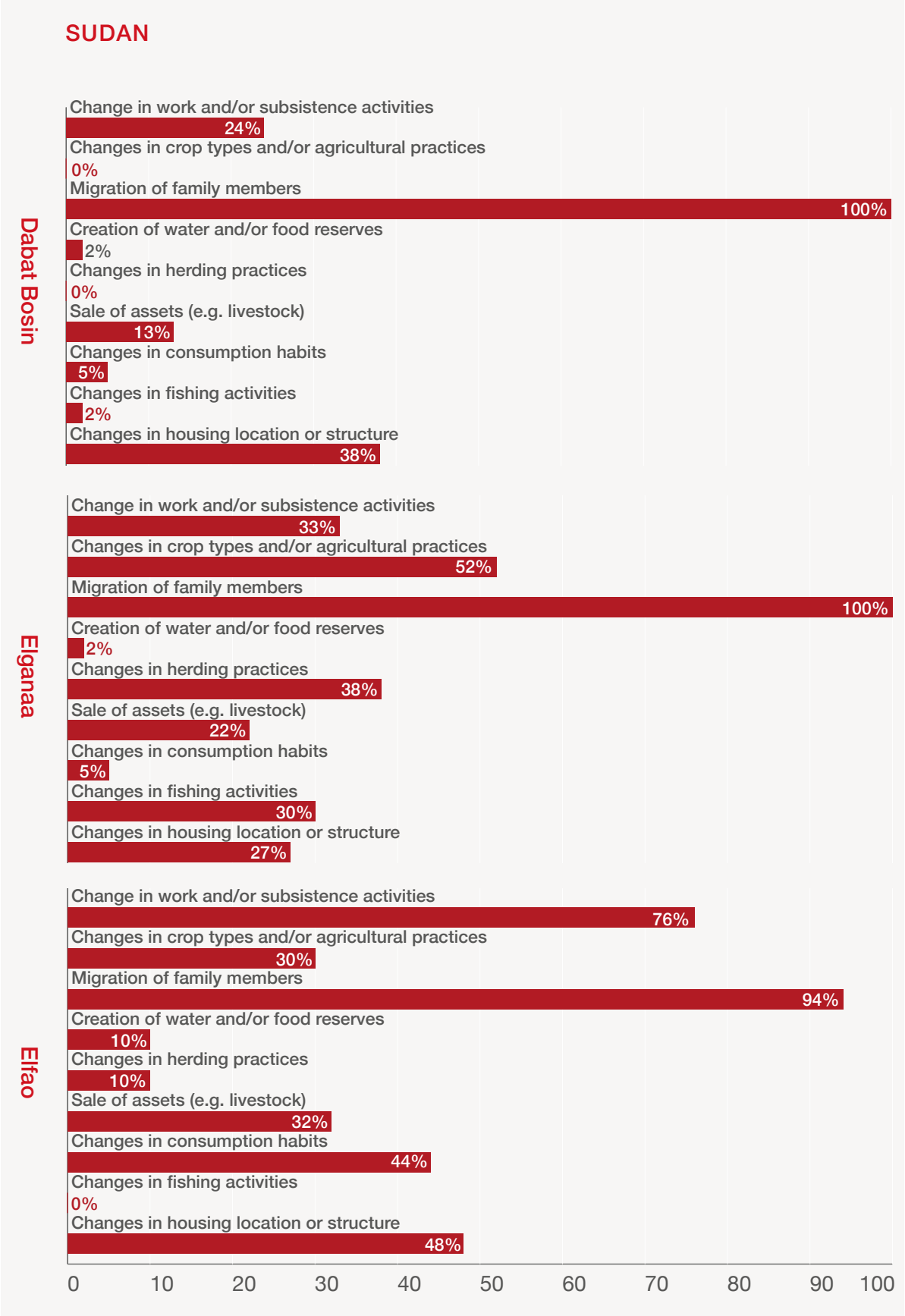
Changes in housing (location of structure) were more commonly reported by respondents in Sudan, reflecting a strategy to adapt to increasing flood risks. This was reported by nearly 40% of respondents in Sudan, compared to just over 10% in Mali. This likely reflects the makeup of respondents in Sudan, where many had been displaced by floods.

Some adaptation strategies can themselves have adverse environmental consequences due to increased pressures on land, water, and forest resources (as reflected in existing research, discussed in **Section 3.2**). For instance, an interviewee in Kayes described how a previous 'green belt' tree-planting initiative supported by the German government had subsequently been cut down for construction purposes and for sale as firewood. Previous studies in Mali and Sudan report that charcoal production can be an important income diversification strategy in response to environmental changes and climate variability, especially for women (Brockhaus et al., 2013; Young and Ismail, 2019) – but can also contribute increased pressures on forest resources and worsen the risk of deforestation. Similarly, alternative economic opportunities such as artisanal gold mining, described by respondents in Sudan, can have very harmful impacts on local environments, including the pollution of water sources, soil erosion, and more (see Holmes et al., 2022).[19]

[19] Representatives of the Red Cross of Chad, Burkinabe Red Cross Society and the Senegalese Red Cross Society also reported that people seeking new economic opportunities in response to the impacts of environmental changes on agriculture are engaging in artisanal gold mining, which has harmful impacts on soil and water, and in the sale of charcoal, which is contributing to deforestation.

Figure 4. Coping and adaptation strategies identified by survey participants in ■ Mali and ■ Sudan (overleaf)




SUDAN
Dabat Bosin
Change in work and/or subsistence activities
24%
Changes in crop types and/or agricultural practices
0%
Migration of family members
100%
Creation of water and/or food reserves
2%
Changes in herding practices
0%
Sale of assets (e.g. livestock)
13%
Changes in consumption habits
5%
Changes in fishing activities
2%
Changes in housing location or structure
38%
Elganaa
Change in work and/or subsistence activities
33%
Changes in crop types and/or agricultural practices
52%
Migration of family members
100%
Creation of water and/or food reserves
2%
Changes in herding practices
38%
Sale of assets (e.g. livestock)
22%
Changes in consumption habits
5%
Changes in fishing activities
30%
Changes in housing location or structure
27%
Elfao
Change in work and/or subsistence activities
76%
Changes in crop types and/or agricultural practices
30%
Migration of family members
94%
Creation of water and/or food reserves
10%
Changes in herding practices
10%
Sale of assets (e.g. livestock)
32%
Changes in consumption habits
44%
Changes in fishing activities
0%
Changes in housing location or structure
48%
0
10
20
30
40
50
60
70
80
90
100

5.2 Barriers to coping and adaptation

In Mali and Sudan, a lack of financial resources was the most commonly reported barrier to the adoption of coping and adaptation strategies in response to environmental changes. This was identified as a main barrier by 85% of survey respondents in Mali and 97% of those in Sudan, and figures were similar across survey locations within both countries. This may be connected to the impacts of environmental changes on livelihoods. Decreased agricultural production and herd sizes, smaller fish catches, and negative employment impacts (described in **Section 4.2**) lead to lower income, and mean that fewer resources are available for coping and adaptation measures. Furthermore, as discussed in **Section 4.2**, poorer households have fewer reserve resources available to support adaptation. FGD respondents in Mali explained that financial barriers were in part a result of insufficient support from government and international partners, discussed in greater detail in **Section 5.3**.

Differences between Mali and Sudan in responses relating to other barriers to coping and adaptation strategies may be explained by the types of environmental hazards that people experience. In Mali, a lack of training (61%) and information on coping and adaptation strategies (43%) was frequently identified as an obstacle. In contrast, these barriers were identified by only 5% and 25%, respectively, of survey respondents in Sudan. This may be due to the nature and severity of the environmental hazards (floods) underpinning displacement in Sudan, where coping and adaptation are undermined by factors other than insufficient knowledge.

In Mali, respondents in Kayes were more likely than respondents in Bamako to report financial, training, and informational barriers to in-place coping and adaptation. This may reflect people's engagement with different adaptation options in urban settings (e.g. waged employment, rather than adaptations to agricultural practices).

The presence of armed groups and ongoing insecurity also impedes the implementation of adaptation responses. While this was reported mainly by respondents in Mali, the ways in which conflict and insecurity can intensify vulnerabilities to environmental and climate-related changes, while limiting options for in-place coping and adaptation, is an important consideration across the wider Sahel.

In Mali and Sudan, women were identified as facing the greatest barriers to coping and adaptation, due in part to obstacles in accessing financial support. This was reported by similar proportions of survey respondents in both countries (41% in Mali and 36% in Sudan). In Mali, respondents explained that this is due in part to gendered inequalities in access to financial support (e.g. credit, loans) from banks and other sources. Barriers facing women include discriminatory social norms, limited financial literacy, and limited land rights (which in turn limit collateral for loans or credit) (Bizoza, 2019). However, many survey respondents also described women's mobilisation of shared resources (e.g. 'tontines' – shared saving circles among peers) to cope with the effects of environmental changes, highlighting the need to consider both gendered vulnerability and agency in responses to environmental and climate-related change.

Respondents in Sudan were more likely to identify older people as facing barriers to adaptation, due mainly to mobility difficulties, while respondents in Mali were more likely to

identify young people as facing such barriers, due to limited economic opportunities and resources. However, it is unclear why there was such difference. In Sudan, over 80% of respondents identified older people as facing significant barriers to coping and adaptation, which was reported by just over a quarter of those in Mali. As explained by respondents in Mali, this is due to health – and mobility-related difficulties, and difficulties in adopting 'modern' agricultural and livelihood techniques.

In Mali, 40% of respondents identified young people as facing significant barriers to coping and adaptation (compared to just 2% in Sudan). In Mali, reasons for these barriers echo those identified in **Section 5.3** as underpinning young peoples' vulnerability to environmental changes. For example, a lack of employment and economic opportunities for young people means that they may be less likely to have sufficient financial resources to support coping and adaptation strategies, and may have fewer opportunities to cope and adapt through changes to work or subsistence activities.

People with disabilities also face barriers to coping and adaptation, due to physical mobility difficulties. One-fifth of survey respondents in Mali identified 'other' groups as facing the greatest barriers to coping and adaptation, and FGD respondents highlighted people with disabilities as a group facing particular barriers.

5.3 Assistance for coping and adaptation

In both Mali and Sudan, the most commonly reported forms of assistance received by people facing the impacts of climate-related and environmental hazards and changes were types of short-term humanitarian support for immediate needs that did not directly address key challenges to coping and adaptation (**Figure 5**). Common forms of assistance received included food assistance (reported by 56% of survey respondents in Mali and 87% in Sudan), cash and voucher assistance (51% in Mali and 61% in Sudan), and non-food items for basic needs such as shelter and sanitation (38% in Mali and 46% in Sudan). These forms of assistance enable households to cope by 'replacing' food, non-food items, and resources lost through events such as floods, or by mitigating the loss of harvests and agricultural (and other) income due to environmental changes (as described in **Section 4.2**). While these types of support address urgent immediate and short-term needs, and may potentially free up some resources for investments in longer-term adaptative strategies, they do not directly or sufficiently address the key challenges to coping and adaptation strategies described in **Section 5.2**. In particular, they do not mitigate the lack of financial resources to support adaptive innovations (as opposed to simply meeting basic needs via cash assistance), or meet the need for training and information on adaptation strategies and climate-related hazards.

In Mali, this support was provided by government and by NGOs, while in Sudan, most if not all assistance comes from national and international NGOs. In Mali, for example, FGD respondents described the provision of assistance in the form of grain storage and distribution by both government and NGOs. In Sudan, respondents in Dabat Bosin and Elganaa reported receiving no support from the national government or from local authorities – although this represents the experiences of study respondents and is not necessarily reflective of overall

patterns of support provision. Respondents in IDP camps in Elfao mentioned the state-level government's coordination of NGOs providing post-disaster support. Government responses to disasters, including environment-related displacement, are discussed in detail in **Section 7**. While people can seek out other sources of support to longer-term adaptation, this can entail risks. For example, in Mali, some respondents noted that it was possible to obtain credit from banks – but this presents the risk of contributing to indebtedness and further vulnerability.

The wide differences in access to short-term government and NGO assistance across research locations may result from geographic differences in the impacts of climate-related and environmental hazards, as well as the uneven allocation of assistance across locations within countries. In Mali, more respondents in Kayes reported receiving food assistance, while other forms of assistance (e.g. financial assistance, non-food items) were more frequently identified by respondents in Bamako. In Sudan, food assistance was reported by all or nearly all survey respondents in Dabat Bosin and Elfao and 65% of those in Elganaa; non-food items were reported by all respondents in Elfao but none in Dabat Bosin; and financial assistance was reported by 80 to 100% of respondents in Dabat Bosin and Elfao but under 10% in Elganaa. This may reflect the types of humanitarian assistance provided by different national and international NGOs across different displacement sites and camps.

Access to short-term support (e.g. food assistance, financial assistance, non-food items) was reported by a higher proportion of respondents in Sudan, while access to longer-term support (e.g. skills and livelihood training, agricultural inputs), though still relatively uncommon, was reported by a slightly higher proportion of respondents in Mali. This likely reflects the types of environmental changes experienced by respondents in the two countries: acute hazards such as flooding in Sudan, where humanitarian aid is more likely to be provided, and slower-onset environmental changes in Mali, where there is greater scope for focusing on longer-term adaptation.

Training support and agricultural inputs were identified as important for adaptation to environmental changes and challenges, but few respondents reported benefiting from these forms of assistance. FGD respondents and interviewees in Mali emphasised the importance of support such as training on agricultural and herding strategies, subsidies of agricultural inputs, and material support for tree planting initiatives and the construction of firebreaks to protect against brushfires. However, only a quarter of survey respondents in Mali and under one-fifth in Sudan reported receiving training, while only one-fifth of respondents in Mali and just over 10% in Sudan reported benefiting from agricultural and farming inputs, suggesting that these are not widely available. Among the research sites in Sudan, people in Elganaa received a short training course on income generation activities, but the other two communities had not received similar training.

Respondents highlighted the need to increase material support for longer-term adaptation efforts. According to an interviewee in Kayes, *'All the State does is sensitisation [against migration], which is not listened to by these young people,'* suggesting that efforts to support coping and adaptation ought to involve more concrete material support and assistance (e.g. funds and equipment to support livelihood diversification, agricultural

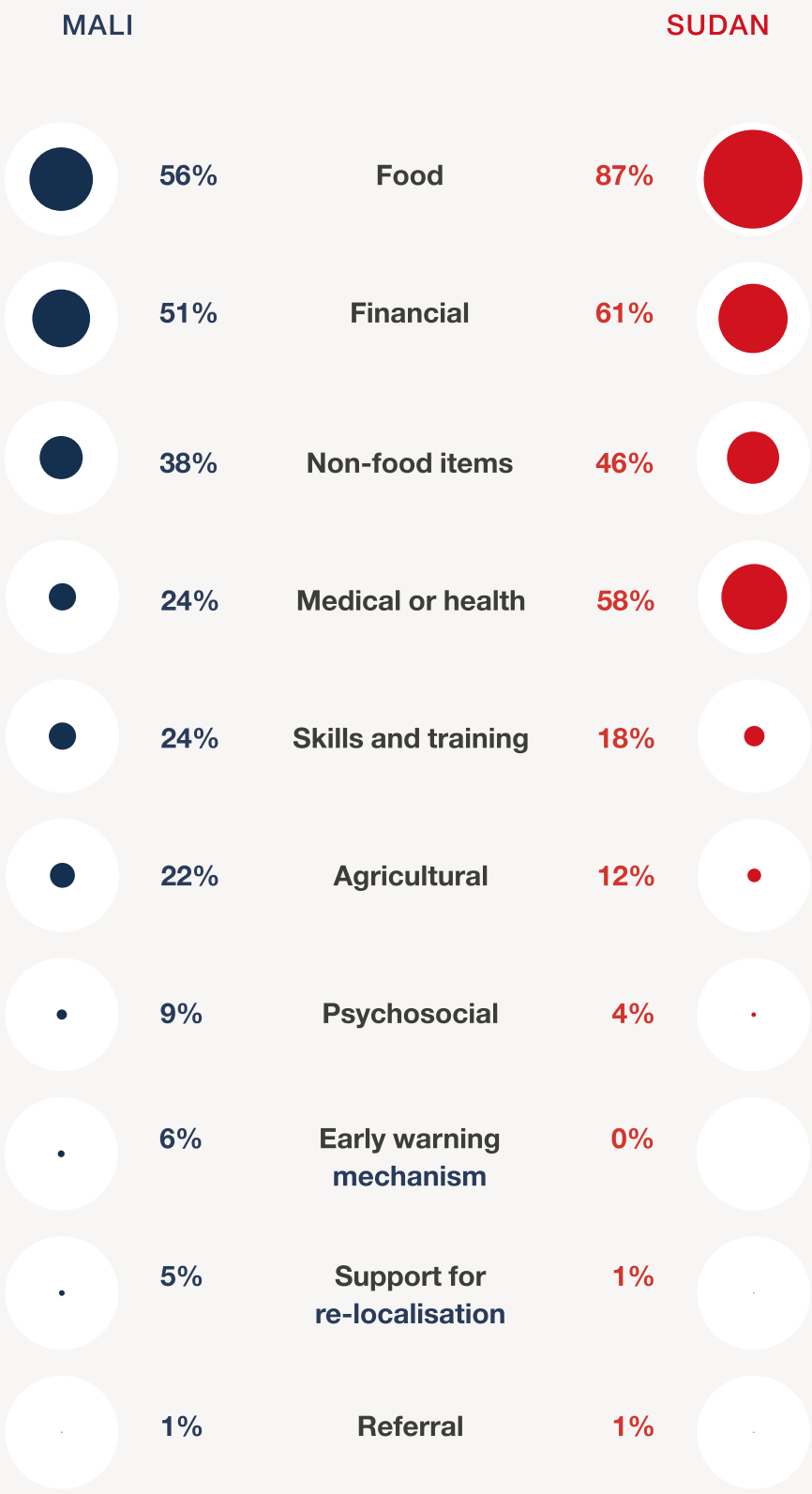
innovations, etc.). Similarly, as another interviewee in Kayes explained,

> **"The government sensitises the population, especially young people, against migration, but the lack of financial resources to take care of the needs of families… pushes them towards migration."**

Furthermore, respondents highlighted a need to expand support for coping and adaptation initiatives beyond the agricultural sector, to respond to the varied aspirations of young people. In Mali, FGD participants and government and NGO representatives emphasised the need for strategies focusing on youth, including professional training and employment creation and support, financial support to youth-led projects, integration support for young migrants, and monitoring of outcomes and follow-up support. Previous research on migration in response to environmental changes in Mali and Niger notes that young people, especially those with higher levels of formal education, may not find farming attractive and instead aspire to occupations outside the agriculture sector (Hummel, 2016; Liehr et al., 2016) that provide higher earnings and enable young people to meet life goals (McCullough et al., 2019).

Finally, responses in both countries indicated a need to expand knowledge of and access to early warning systems to support preparedness for climate-related hazards. Representatives of the Mali Red Cross and IOM highlighted the importance of early warning systems and meteorological information to inform preparedness and decision-making in response to climate-related risks – to enable communities to put in place measures to cope with environmental and climate-related hazards and changes, and to mitigate associated risks. However, only 6% of survey respondents in Mali reported benefiting from early warning mechanisms, suggesting that this is not necessarily a widely available or widely known service. A lack of timely weather information was also identified as a barrier to coping and adaptation in Sudan, likely reflecting experiences of flood-related displacement. All communities in Sudan reported that they had only heard about impending floods from neighbouring communities, and no survey respondents reported benefiting from early warning mechanisms. For example, in Elganaa, the community only heard about flood risk two days before impact – too late to adopt risk management and coping measures. These findings indicate the need for more systematic efforts to ensure access to these systems at the community level, potentially building on existing volunteer networks to share alerts and carry out initial assessments after environmental events.

Figure 5. Forms of assistance from government and NGOs reported by survey respondents in ■ Mali and ■ Sudan



	Mali			Sudan			
Forms of assistance	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Food assistance	**56%**	50%	62%	**87%**	100%	65%	98%
Financial assistance (e.g. cash and vouchers, credit)	**51%**	68%	34%	**61%**	100%	8%	80%
Non-food items for basic needs (e.g. shelter, sanitation)	**38%**	46%	30%	**46%**	0	43%	100%
Medical or health services	**24%**	28%	20%	**58%**	22%	62%	92%
Skills and livelihoods training	**24%**	42%	6%	**18%**	0	50%	0
Agricultural inputs (e.g. seeds, tools)	**22%**	32%	12%	**12%**	0	32%	2%
Psychosocial services	**9%**	0	18%	**4%**	0	0	14%
Early warning mechanisms	**6%**	8%	4%	**0**	0	0	0
Support for re-localisation	**5%**	6%	4%	**1%**	0	0	4%
Referral to other agencies or services	**1%**	0	2%	**1%**	0	0	2%
No assistance	**19%**	14%	24%	—	—	—	—

In Mali, community support initiatives play important roles in facilitating coping and adaptation efforts, alongside or in the absence of sufficient government and NGO assistance. This echoes previous studies in Mali that describe the importance of community-based coping and adaptation strategies through mutual support and assistance (Hummel, 2016; Liehr et al., 2016). Roughly one-fifth of survey respondents in Mali (and roughly a quarter of those in Kayes) reported receiving no assistance from government or NGOs, echoing findings from previous research on migration in response to environmental changes in Mali (Hummel, 2016). Similarly, some FGD respondents and interviewees reported the support provided by government authorities was minimal at best and that most support came from within communities. According to a focus group respondent,

> **"The state does not protect migrants. It does not support migrants. The state does not improve people's living conditions to prevent them from leaving."**

As a national NGO representative stated,

> **"The government has done nothing about climate change and human mobility [in our community]. Only neighbours have contributed to supplying the village with drinking water by installing a water tower, developing a garden area… building three classrooms… and three latrines."**

Community-based initiatives described by FGD respondents and interviewees include lending money that would be reimbursed after harvest, the establishment of cereal banks, and income-generating activities involving the development of small irrigated areas in villages, enabling people to meet their basic needs. Respondents in Sudan did not specifically discuss community support initiatives, potentially reflecting their precarious conditions and limited resources resulting from displacement.

6. Key findings: migration trends and decisions in Mali and Sudan

Respondents in Mali and Sudan were asked to describe the overall trends and notable changes they have noticed in migration into and out of their communities, including trends and changes in the regions of origin and destination of migrants; the duration of migration; and drivers of and barriers to migration.[20] They were also asked about the relationships between environmental factors and migration, and how migration compares to other coping strategies in response to environmental changes and challenges. Respondents were asked to reflect on general patterns of migration, as well as their own experiences of migration and the experiences of family members. These changing patterns of migration took place not only in contexts of environmental change but also in contexts of wider economic, political, and social change.

6.1 Overall trends in migration patterns

Most respondents in Mali and Sudan observed that most in-migration (i.e. migration into respondents' localities, from elsewhere in the country or from other countries) involves people from neighbouring countries or from within the same country (**Table 3**). Most survey respondents in Mali (83%, including 92% in Kayes) observed that in-migrants arrived from other localities in the country, while nearly half (and over three-quarters of those from Kayes) reported in-migration from the same part of the country. Significant numbers of respondents (44%) also reported in-migration from neighbouring countries (such as Senegal, Burkina Faso, Guinea, Côte d'Ivoire, Algeria, according to interviewees). In Sudan, almost all respondents (97%) in Elganaa pointed to in-migration from a neighbouring country, reflecting patterns of in-migration from South Sudan. Nearly half overall in Sudan reported in-migration from another locality in the same region. In Dabat Bosin, before the major flood in 2021, young South Sudanese men used to move to Sudan to work as agricultural seasonal labourers or in construction work, whereas some young women used to work in border markets as tea makers.

In Sudan, most out-migration (i.e. migration out of respondents' localities, toward other parts of the country or to other countries) is also perceived as being towards another location within the country or to a neighbouring country, building on long histories of mobility between Sudan and South Sudan. In Elganaa, out-migration to a different locality or region within the same country or to a neighbouring country was described by half of survey respondents or more, while in Elfao all respondents observed that out-migration is mainly toward a different region in the same country. All respondents in Dabat Bosin reported that out-migration is mainly toward a neighbouring country (i.e. between Sudan and South Sudan). They explained that people from Dabat Bosin have been moving for a long time between Sudan and South Sudan, including after South Sudan's independence from Sudan in 2011,

[20] This section examines respondents' perceptions of migration patterns, trends, and changes, and does not entail an analysis of specific migration figures within the research locations.

due to insecurity, transhumance livelihoods, and cross-border trade.

Patterns of out-migration appear more varied in Mali, with cross-border migration toward neighbouring countries and other world regions described more frequently. While most survey respondents in Mali (71%) observed that most out-migrants head to other regions of the country, large numbers of respondents (between 55 and 66%) pointed to migration destinations further afield, including neighbouring countries, other African countries, or countries outside Africa. Survey respondents in Bamako were more likely than those in Kayes to highlight out-migration to a neighbouring country, while those in Kayes were more likely to identify another African country or a country outside Africa (e.g. in Europe or Gulf states) as the main out-migration destination, reflecting its position as a hub of longer-distance international migration.

Table 3. Trends in migrant sources and destinations reported by survey respondents in Mali and Sudan

	Mali			Sudan			
Source or destination region	Total	Bamako (N=50)	Kayes (N=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Origins of in-migrants							
Different locality in the same region of the country	**48%**	20%	76%	**n/a**	n/a	48%	n/a
Different region in the same country	**83%**	74%	92%	**n/a**	n/a	3%	n/a
Neighbouring country	**44%**	40%	48%	**n/a**	n/a	97%	n/a
Another African country	**9%**	8%	10%	**n/a**	n/a	0	n/a
Country outside Africa	**5%**	4%	6%	**n/a**	n/a	0	n/a
Destinations of out-migrants							
Different locality in the same region of the country	**18%**	22%	14%	**29%**	0	78%	2%
Different region in the same country	**71%**	94%	48%	**52%**	0	60%	100%
Neighbouring country	**66%**	92%	60%	**52%**	100%	50%	0%
Another African country	**61%**	48%	74%	**0**	0	0	0
Country outside Africa	**55%**	22%	88%	**1%**	0	0	2%

Migration from rural to urban areas is seen as a key trend in internal mobility in Mali and Sudan, likely due to anticipated economic opportunities – although respondents in Sudan also highlighted trends in rural-to-rural migration (linked to mining and agricultural opportunities).[21] Rural-to-urban migration (especially toward national capitals) was reported by roughly 40% of survey respondents in both Mali and Sudan – potentially driven by a search for economic opportunities (as discussed in **Section 6.2**).

However, responses varied widely across research sites. In Mali, nearly 90% of respondents in Bamako identified rural-to-urban migration as the most common (likely drawing upon their own migration trajectories), but no respondents in Kayes reported the same (focusing instead on cross-border migration). In Sudan, nearly 90% of survey respondents in Elfao focused on rural-to-urban migration, compared to roughly two-thirds in Elganaa and just 2% in Dabat Bosin. Conversely, over half of respondents in Elganaa identified rural-to-rural migration as the most common type of internal mobility. These trends may reflect the different types of economic opportunities available to migrants in different parts of Sudan: work opportunities in urban centres, as well as artisanal gold mining areas and large-scale mechanised farming schemes in rural areas.

Respondents in both Mali and Sudan observed that migration is mainly temporary or seasonal, rather than permanent – although this varied across locations within countries, reflecting more localised patterns of mobility. At least half of survey respondents in Mali and Sudan reported that migration is mainly temporary, while over a quarter of those in Mali and one-fifth in Sudan observed that migration is mainly seasonal. However, clear differences emerged within both countries. In Mali, respondents in Bamako (62%) were more likely than those in Kayes (38%) to identify migration as temporary, while those in Kayes were more likely to report permanent migration (30%, compared to just 6% in Bamako), potentially reflecting the prominence of international migration there.

In Sudan, respondents in Elganaa and Elfao described migration mainly as temporary (82% in Elganaa, 48% in Elfao) or seasonal (50% in Elfao). In Elfao, for example, respondents explained that most internal migration occurs on a seasonal basis toward agricultural schemes to work in labour. In Dabat Bosin, migration was described as temporary or of unknown duration (likely due to the uncertainty characterising flood-related displacement).

In Mali, a large proportion of survey respondents reported that return migration is increasing, due to economic, political, and sanitary/health crises (notably the COVID-19 pandemic) and more restrictive residence and migration policies. FGD respondents and interviewees identified the return (often forced) of migrants from countries such as Libya or France as an important migration trend in Mali. This is reflective of Mali having become a receiving country for deported and returned African migrants from northern

[21] It has been observed that this also occurs in Mali, in the dry season and on a lesser scale.

African countries (e.g. Libya, Algeria) and Europe (Trauner and Deimel, 2013).

In Mali and Sudan, adult men were identified as the most likely to migrate. Overall 65% of respondents in Mali and 53% of those in Sudan shared this perception, while younger men specifically were identified as most likely to migrate by 50% and 64%, respectively, of respondents in Mali and Sudan. However, over half of respondents in Bamako identified young women as likely to migrate, potentially reflecting a greater propensity among young women for migration toward urban centres. In Sudan, all survey respondents in Dabat Bosin reported that both men and women (adults and young people) are likely to migrate, likely reflecting their experiences of flood-related displacement of whole communities.

6.2 Drivers of migration

Respondents in Mali and Sudan were asked to reflect on drivers of migration in two ways, first by reflecting on the factors that they perceived as underpinning general patterns of migration, and second by reflecting on their own migration decisions (or those of their family members). Overall, reasons for moving, or considering moving, were multiple and intersecting, encompassing political, economic, social, and environmental factors.

In both perceptions of overall trends and respondents' own migration experiences, economic factors were identified as the primary motivation for migration in Mali and Sudan (except among those displaced by sudden-onset events such as floods) (**Table 4**). As discussed in **Section 3.3**, this reflects findings in the wider literature. In Mali, economic motivations (e.g. seeking better working and living conditions) were identified as underpinning general migration patterns by nearly all survey respondents (98%), while all respondents in Bamako and Kayes reported that economic factors drove their own migration decisions. FGD participants, especially younger men, shared similar motivations. In Sudan, nearly all survey respondents in Elfao (94%) and Elganaa (nearly 80%) identified economic factors as the main reason for their own migration (though in Dabat Bosin, all respondents identified sudden-onset environmental hazards as driving displacement).

Environmental factors – especially rainfall changes and lack of access to natural resources (and with the exception of sudden-onset events such as floods) – were typically identified as secondary to economic factors, although there is significant overlap with economic motivations given the impacts of environmental change on livelihoods and food insecurity. In Mali, precipitation changes affecting livelihood activities, lack of access to natural resources, and food insecurity were each identified as primary drivers of general migration patterns, and as drivers of respondents' own migration decisions, by about a third of survey respondents. As noted above, environmental changes and challenges may be linked to economic factors through their impacts on individual and household socioeconomic status and in turn increased pressures for migration. In relation to both general migration patterns and respondents' own migration decisions, precipitation changes, resource access, and food insecurity were all identified by more respondents in Bamako than in Kayes. This may reflect challenges faced previously by respondents in Bamako, i.e. prior to their own migration.

In Sudan, all respondents in Dabat Bosin identified sudden-onset environmental hazards (floods) as the reasons for their

displacement, as did 90% of those in Elfao and nearly 70% of those in Elganaa. However, respondents in Elganaa and Elfao also identified other environmental factors as reasons for their own migration, though in both cases these were secondary to economic motivations. Rainfall changes affecting livelihoods were reported by a third of respondents in Elganaa and over half of those in Elfao, and food insecurity was identified by nearly two-thirds of respondents in both sites.

This suggests that even before the floods, slower-onset environmental changes were contributing to migration pressures.

Table 4. Primary reasons for survey respondents' own migration decisions in Mali and Sudan

	Mali			Sudan			
Main reasons for migration	Total (N=72)	Bamako (n=34)	Kayes (n=38)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Economic (search for better working and living conditions)	**100%**	100%	100%	**57%**	0%	78%	94%
Rainfall changes affect livelihood activities	**36%**	65%	11%	**28%**	0%	33%	54%
Lack of access to natural resources	**32%**	62%	5%	**16%**	0%	10%	42%
Food insecurity	**31%**	41%	21%	**42%**	0%	62%	66%
Security (e.g. conflict)	**18%**	21%	16%	**2%**	0%	0%	6%
Environmental shocks (e.g. flooding)	**13%**	18%	8%	**85%**	100%	67%	90%
Temperature changes affecting subsistence activities	**6%**	9%	3%	**5%**	0%	0%	18%

6.3 Perceived changes to migration patterns

Most respondents in Mali and Sudan report that migration patterns are changing in their localities, in particular reporting increases in both in – and out – migration. Increases in in-migration and out-migration were frequently reported in Mali, each identified by nearly three-quarters of survey respondents. However, respondents in Bamako were more likely than those in Kayes to report such increases. Nearly 90% of respondents in Bamako reported an increase in out-migration, compared to just over 50% in Kayes. This may reflect the Bamako respondents' own experiences of mobility, as well as changes in mobility patterns within and through Bamako, as both a destination and increasing transit point. For example, research on youth migration in Mali reports that migrants from other parts of the country pass through Bamako on their way to Europe or when returning from Europe to their home communities (Daum, 2014).

In Sudan, an increase in out-migration was reported by most survey respondents (90%, ranging from 75% in Elganaa to 100% in Dabat Bosin), while an increase in in-migration was reported only by respondents in Elganaa (although all respondents there noted such an increase). In Elganaa, patterns of increasing in – and out-migration exist simultaneously, as respondents described out-migration to urban centres and seasonally to agricultural farms, alongside in-migration from South Sudanese refugees that recently crossed the border into Sudan.

In Mali, respondents in Kayes were more likely than those in Bamako to report declines in both in – and out-migration, potentially due to changes in patterns of cross-border mobility. Declines in in- and out-migration were observed by 25% and 41%, respectively, of survey respondents in Kayes compared to just 2% of those in Bamako. Given Kayes' position as a hub of cross-border mobility, this may reflect the impacts of migration restrictions (spanning both more restrictive migration policies and COVID-related restrictions) and other factors on patterns of cross-border movement.

In Sudan, respondents described changes in gendered patterns of migration, with young married and unmarried women moving further away for months at a time to work in the agricultural sector. This change, described by close to half of respondents, stands in contrast to 'traditional' norms and customs, and was described as resulting from recent environmental changes. However, these findings are based only on respondents' perceptions of migration patterns; it is unclear whether they are reflected in existing migration data. Normally, active-age women work as casual wage labourers in farming activities, such as hand weeding and harvesting in nearby fields. Now, respondents relayed that women are almost equally as likely as men to move for distant agricultural opportunities. Women who move take their babies and must manage the dual burden of agricultural labour and childcare, in contexts of harsh agricultural labour conditions not suitable for children. The long-term implications of this vary and include child malnutrition and the weakened health of mothers.

In Mali, changes in migration patterns were observed to have occurred mainly over the past four to 10 years, reflecting more gradual changes in migration trends (as well as slower-onset environmental changes). Most survey respondents (62%) reported that these changes have occurred over the past four to 10 years – although respondents in

Bamako were more likely than those in Kayes to report that changes have occurred in the past four to 10 years while respondents in Kayes were more likely to report that changes have occurred over a period of more than 10 years. This may reflect Kayes' long history as a migration transit hub, where early indicators of changing migration patterns may be more observable given the scale of migration flows.

In Sudan, changes in migration patterns were observed to have occurred mainly in the past one to three years, reflecting the impacts of more recent patterns of sudden-onset environmental hazards (i.e. flooding). Most survey respondents (nearly 70%) reported that these changes have occurred in the past one to three years. This was reported by nearly all (95%) of respondents in Dabat Bosin, likely due to experiences of flooding and associated displacement. This echoes previous reports that floods in South Sudan and Sudan have been increasingly severe and destructive in the past three years (Tiitmamer, 2020; Elagib et al., 2021). Respondents in Elganaa and Elfao were more likely than those in Dabat Bosin to report that these changes have been happening for longer (20% of respondents in Elganaa and nearly 40% of those in Elfao observed changes over the past four to 10 years).

6.4 Mobility and adaptation

More respondents in Sudan than in Mali observed that environmental changes are contributing to a general increase in mobility, likely reflecting differences in the type of environmental changes and challenges observed by respondents. In Sudan, nearly all respondents overall (93%), including all respondents in Elganaa, observed that environmental changes are contributing to a general increase in mobility – likely reflecting the impacts of intensified flooding on displacement in recent years. In Mali, just over a quarter of survey respondents (27%) reported that environmental changes are contributing to increased mobility. This was observed by more respondents in Bamako (45%) than in Kayes (9%), which may reflect respondent demographics, with a greater proportion of those in Bamako having migrated.

In Mali, 15% of survey respondents – and nearly one-fifth of those in Bamako – observed that environmental changes are contributing to a decrease in mobility. While less commonly reported than increasing mobility, this is nonetheless important: it may reflect how economic impacts of environmental change can reduce household income and in turn reduce options for mobility, echoing previous research described in **Section 3.3**.

As outlined in **Section 5.1**, migration is considered a common adaptation strategy in both Mali and Sudan (see **Figure 4**, in **Section 5.1**). Over half of survey respondents in Mali identified migration as a common adaptation strategy in the face of environmental or climate-related changes – ranging from 70% in Bamako to just a third in Kayes. This likely reflects respondent demographics, with a greater proportion of those in Bamako having themselves migrated (see **Section 2.4**). In Sudan, nearly all survey respondents (98%) identified migration as an adaptation strategy. This large majority included all respondents in Dabat Bosin and Elganaa – reflecting their own experiences of displacement due to flooding.

For respondents identifying migration as an adaptation strategy in response to environmental changes and challenges,

the destinations and duration of migration may vary widely, reflecting findings discussed in **Section 6.1**. However, the impacts of environmental changes on livelihoods and income (as discussed in **Section 4.2**) may limit possibilities for more expensive long-distance and international migration.

In Mali, migration was described as a 'last resort' in response to environmental changes, only occurring when no other alternatives exist because people prefer to stay in their own communities – and young people often shoulder the burden of having to migrate. This was frequently highlighted by FGD participants and interviewees, while a desire to stay in place was identified as a key barrier to migration by survey respondents, as discussed in **Section 6.5**. As one FGD respondent explained,

> **"If we manage to have a strategy that can help us stay, so much the better. If necessary, if we have the possibility through migration to manage and send [money] to our parents, we'll do that. We have no other strategy but migration."**

Young people often shoulder the burden of 'last resort' migration in order to support their parents and families. As a FGD participant in Kayes (Mali) explained, discussing his own experience,

> **"Given the poverty we were going through, my age and the energy I had allowed me to do certain things. [We had] no source of income except land, but this hardly produced anything… The decision is made to leave even if there's the risk of death."**

Similarly, according to an interviewee in Kayes,

> **"Young people with no [opportunities] prefer to migrate even if they have to die at sea. There is no alternative solution to their problems as long as the problem of money is not addressed. Europeans should understand that no one wants to leave their locality for somewhere else in order to die in the water. Young people prefer to stay but they don't have a solution."**

'Tipping points', where coping in place was no longer possible, were mainly associated with acute environmental hazards, such as flooding or crop failure. In Mali, FGD participants described continued shocks such as flooding, acute lack of food, and poor crop production (or failed crops) after harvest as underpinning migration decisions. In Sudan, almost all survey respondents (98%) reported that migration became the main coping option as a result of large-scale sudden flooding events, which rendered their areas uninhabitable. For example, in Elganaa, when farms were totally submerged by floods, local communities changed their work and livelihood activities from farming and herding to wage labouring, or adapted by moving away from the area.

While such 'external' tipping points were discussed most frequently, some respondents described more gradual decisions about migration. In such cases, the decision to move was made earlier, and migration occurred once the necessary resources became available – once (for younger people) parents were persuaded to allow migration to take place, lodging was arranged, and money for the costs of travel secured.

As well as being an adaptation itself, migration can also provide the means to support other in-place adaptation initiatives through remittances – but this connection risks being overstated, and not all migrants are able to support such initiatives. Echoing findings from previous research (discussed in **Section 3.2**), interviewees in Mali described how migration and wider adaptation are interconnected, as remittances sent by migrants can support adaptation-focused developments in their home communities, such as hydro-agricultural infrastructure, irrigation systems, small dams, or fish farming initiatives. A Mali Red Cross representative described initiatives in Kayes that are supported by migrants and diaspora members:

> **"The contribution that [migrants] bring to the community in terms of investments… the health centre, water points or reforestation, support for agriculture and market gardening… The communities who are there, they see migration as really a positive… There are projects where we should support the community on the basis of an expression of needs – create an area with plantations for market gardening and others – but the means for the project were limited… It was the diaspora from this village who was in France who set up a borehole to allow the [garden] to be watered."**

However, these migration-adaptation connections are not guaranteed, and risk being overstated. For example, a local official in Kayes explained that while migrants contribute considerably to the development of their home communities, resources provided by migrants are often invested in infrastructure that doesn't directly address environmental risks and vulnerabilities. Additionally, as discussed in **Section 6.7**, not all migrants are able to support such projects given that many migrants are unable to regularly send money to their families – with just 3% of survey respondents in both Mali and Sudan in reporting contributions to development projects in communities of origin. In many cases, remittances are only sufficient to meet families' basic needs, and are not able to contribute to larger adaptation efforts.

6.5 Barriers to migration

Older people were identified as the group least likely to migrate, and women and people with disabilities were also described as facing barriers to migration – highlighting the intersecting and compounding effects of vulnerabilities to the impacts of environmental change, general barriers to coping and adaption, and specific barriers to mobility along lines of gender, age, and (dis)ability (as discussed in **Section 4.2** and **Section 5.2**, respectively). Older people were identified as the least likely to migrate by the majority of survey respondents in Mali (76%) and Sudan (96%), due to physical mobility challenges and difficulties finding employment. Similar challenges face people with disabilities. In Mali, nearly three-quarters of respondents reported that women are least likely to migrate, due to marriage and family restrictions. In Sudan, despite changes to gendered migration patterns described in **Section 6.3**, social restrictions on women were still considered a barrier to mobility.

Family reasons and a desire to stay in place were the most frequently identified

barriers to migration reported in Mali and were also reported in Sudan, reflecting strong attachments to community as well as potential losses associated with migration (**Table 5**). In Mali family reasons were identified as a key barrier to migration by over 90% of survey respondents and nearly 60% of those in Sudan (and roughly 70 to 80% of those in Elganaa and Elfao). Although FGD respondents in Mali described family pressures in relation to young people shouldering the burden for migration (as discussed in **Section 6.4**), these survey responses suggest that the impacts of family relations on mobility across the Sahel are more complex. While some migrants may experience pressures from family members to move, others may be prevented from moving due to familial restrictions (especially for women), responsibility for supporting family members through in-place work or care labour, lack of financial support from family members for migration, or a desire to remain with family. This echoes previous research in Mali, which describes the importance of family ties and responsibilities and attachment to place as reasons for non-migration (Sauvain-Dugerdil, 2013; Kirwin and Anderson, 2018).

Over half of survey respondents in Mali (53%) identified a desire to stay in place as the main barrier to mobility. This highlights the importance not only of family but of people's attachment to their locality (based on elements of personal, communal, cultural, spiritual, and historical significance). A desire to stay in place was reported by under a fifth of those in Sudan, potentially reflecting the impacts of increasingly severe flooding.

In Sudan, financial barriers were identified as the main barrier to migration, but were reported less frequently in Mali. Nearly all respondents in Sudan (83%), especially in Dabat Bosin, described a lack of financial resources as a barrier to migration. This may be linked to respondents' own financial status in the aftermath of flood-related displacement and current conditions in IDP or refugee camps. In Mali, just a third of survey respondents described financial barriers to migration, although these were identified by more respondents in Kayes than in Bamako (potentially due to the profiles of respondents, with most respondents in Bamako having already migrated). FGD respondents in both Bamako and Kayes described financial limitations as a key barrier, though it is unclear why there was such difference compared to survey respondents.

In Mali, respondents also highlighted logistical barriers to international migration, specifically documentation requirements (e.g. residence permits) for destination countries and more restrictive migration policies. This was identified by some as an important change limiting possibilities for mobility, as one FGD participant in Kayes explained:

> **"Before, traveling to France was easy. Things have now changed. Before, it was enough to have the passport… Now, having a passport and transportation are not enough to reach France."**

Table 5. Barriers to migration identified by survey respondents in Mali and Sudan

	Mali			Sudan			
Main barriers	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Family reasons	**91%**	90%	92%	**59%**	33%	68%	78%
A desire to stay in place	**53%**	62%	44%	**16%**	16%	20%	10%
Lack of financial resources	**33%**	18%	48%	**83%**	93%	70%	88%
Use of in-place coping strategies	**18%**	10%	26%	**2%**	0	5%	0
Lack of information	**4%**	0	8%	**13%**	20%	17%	2%

6.6 Migration outcomes

In Mali, most respondents felt their social and economic conditions had improved after migration, due to new employment or business opportunities, an ability to meet their basic needs, and the ability to send funds to support their parents and families in their home communities. However, they also described migration as being associated with numerous social and economic challenges. More respondents in Kayes (72%) than in Bamako (56%) reported that their social and economic conditions had improved after migration, while those in Bamako (20%) were slightly more likely than those in Kayes (12%) to report that their conditions had declined, potentially reflecting challenges associated with migration to urban centres. Reflecting previous literature on the challenges faced by migrants (discussed in **Section 3.5**), FGD respondents also described difficulties associated with migration, notably challenges in finding work, housing, and food; financial difficulties; health concerns in urban settings (including illness and accidents, and likely also barriers to accessing health services); and pressures associated with responsibility for supporting families in their home communities.

Involuntary displacement due to sudden-onset environmental hazards and conflict is associated with particular challenges, including loss of social status, resources, and property. In Sudan, for instance, where most respondents had experienced forced displacement due to flooding, an overwhelming majority of respondents (88%) reported that their socio-economic conditions declined after migrating. They explained they are currently living under the challenges of being refugees in a foreign country, as well as coping with widespread losses due flooding, including loss of life, assets, houses, livestock, and livelihood activities, lack of access to schooling, and separation from household members and from home.

In Mali, FGD respondents who had been displaced due to conflict described challenges associated with the experience of displacement and the loss of resources needed to navigate social and economic processes. These included the loss of identification documents, mobile phones, means of transportation (e.g. motorcycles), and property, making it difficult to settle and adapt after moving. Similar challenges may also affect people displaced by rapid-onset environmental events such as floods. As one man in Bamako explained,

> **"We did not settle here for pleasure. That we leave our locality for another is a difficulty in itself."**

6.7 Ties between migrants and their families and communities of origin

Family and community members sometimes provide material, logistical, and emotional support before and during migration journeys – but many migrants do not receive any material support. Over one-fifth of survey respondents in Mali reported that family and community provide assistance, advice, or guidance to facilitate migration. FGD respondents who were themselves migrants explained that family and peer networks provided them with financial support (e.g. funds for transport) or logistical support such as helping to obtain administrative documents (e.g. identity cards). Just under a quarter of all survey respondents (not only migrants) in Mali regularly received food or material objects from family and community members, and roughly one-fifth were regularly sent money. In Sudan, about one-third of survey respondents reported regularly receiving money from family or community members – though this was reported by roughly half of respondents in Elganaa and Elfao compared to just 5% in Dabat Bosin, likely due to experiences of forced displacement of entire households and communities.

In Mali, over a quarter of survey respondents reported receiving no support from family and community members. As FGD respondents in Mali explained, provision of financial support is clearly not possible for all families (due to economic constraints). Furthermore, support from family varies according to the nature of displacement or migration. For instance, when movement occurs due to insecurity or to rapid-onset events such as floods, families are often unable to provide financial support.

Migrants provide support to their families and communities of origin by regularly sending money, food, or other goods, although this was reported by more respondents in Mali than in Sudan, and for some migrants an inability to provide such assistance may be a source of shame. Over half of survey respondents in Mali (54%) reported that migrants regularly send money to family and community members, while over a third (37%) reported that migrants regularly send food or other goods (e.g. medication). FGD participants who were migrants described the maintenance of close ties with family members and communities of origins, mainly through sending money as well as clothing, medication, and provisions. One group noted that remittances to families accounted for between 70 and 90% of some migrants' income.

In Sudan, a third of survey respondents (and 45 to 50% of those in Elganaa and Elfao) reported regularly sending money to family and community members, although

very few (4%) reported sending food or other goods. According to some FGD respondents, for some migrants an inability to provide such assistance may be a source of shame. Referring to their own migrant family members, they explained that when they left, they intended to send money back to their families. However, not all of them have managed to do so. They may feel shame when they are unable to meet these obligations.

Most migrant respondents in Mali and Sudan return to their localities of origin only occasionally or rarely, and return mainly to visit family. Occasional or rare return visits were reported by nearly 90% of survey respondents in Mali and nearly 60% of those in Sudan. However, in Sudan, very few respondents in Dabat Bosin (7%) reported making return visits, given the impacts of flooding in their localities of origin. The main reason given by respondents for returning is to visit family, reported by over three-quarters of survey respondents in Mali and between about 60 and 70% of respondents in Sudan. As FGD respondents in Mali explained, some younger women and men may return to their home communities to help their parents with agricultural work. Return visits for special (e.g. religious) occasions and professional or business activities were each reported more frequently by survey respondents in Sudan than in Mali.

Most migrant respondents in Mali plan to return to live in their locality of origin (i.e. long-term or permanent return), while most migrant respondents in Sudan either wish to return but are not able to do so, or have no plans to return, for financial and environmental reasons. Over three-quarters of survey respondents in Mali (77%) reported that they plan to return to their locality of origin, although this was reported by more respondents in Kayes (86%) than in Bamako (68%) – potentially because over half of respondents in Bamako had migrated over six years ago (see **Section 2.4**) and were more likely to be settled in their 'new' location. Similarly, only respondents in Bamako (20%) reported that they do not plan to return.

Between a quarter and a third of survey respondents in Sudan reported being unable to return or having no plans to return, although responses varied across research sites. Most respondents in Dabat Bosin (76%) wanted to return but were unable to – for financial reasons and because the area is still flooded – whereas those in Elfao (80%) did not intend to return due to increasing flood events in their locality of origin.

7. Policy frameworks and responses

People's migration options and trajectories in response to environmental and climate-related changes in the Sahel are influenced by intersecting national, regional, and international migration, climate and development policies and legal frameworks (see e.g. Hummel, 2016; Liehr et al., 2016). This section explores how the governments in Mali and Sudan are responding to climate and environment-linked migration and situates them within the wider country and regional frameworks that relate to human mobility in the region.

7.1 Regional and national responses

Migration policies in Sudan and Mali are influenced by wider regional mobility frameworks in the Sahel. The regional frameworks reviewed tend to give little acknowledgement of or attention to the role that migration might play as part of coping and adaptation strategies in response to environmental and climate change.[22] These include the African Union Migration Policy Framework, which identifies climate change as a 'major push factor' underpinning migration and which aims to address its root causes to 'better manage' migration and displacement (AU, 2018a). The AU's Protocol to the Treaty Establishing the African Economic Community Relating to Free Movement of Persons, Right of Residence and Right of Establishment sets out rights to mobility, but with no specific reference to environmental or climatic drivers of migration (AU, 2018b). IGAD's Regional Migration Policy Framework suggests that 'migration-environment interrelated policies are inevitable' for Member states but does not present detailed responses beyond references to environmental protection and adaptation to address sources of displacement (IGAD, 2012). However, more recently a 2020 IGAD Protocol on Free Movement of Persons allows entry and stay in the context of disasters and recognises the positive contribution of free movement in mitigating impacts associated with disasters, climate change and environmental degradation. This was adopted in 2020 and is not yet ratified at the time of writing. Last, while ECOWAS' Common Approach on Migration recognises the rights of ECOWAS citizens to enter, reside, and settle in member states (ECOWAS, 2008), it includes no specific reference to the environment or climate. Moreover, its implementation has been hindered by a lack of standardised legislation, weak institutional frameworks, and restrictive national policies (Hummel, 2016; Liehr et al., 2016).

Regional climate policies tend to frame migration mainly as a problem to be controlled (Chazalnoël et al., 2016). The AU's Draft Climate Change Strategy frames climate-related forced displacement and internal and international migration as an 'additional burden' of climate change, and discusses efforts to 'stem and even reverse'

[22] See also disasterdisplacement.org/portfolio-item/implementing-the-commitments (Mokhnacheva, 2022)

rural-to-urban migration. (AU, 2020).[23] IGAD's Drought Disaster Resilience and Sustainability Initiative Strategy identifies environmental change and climatic variations as contributors to population displacement and 'climate refugees' and identifies both displacement and rural-to-urban migration as socioeconomic risks (IDDRSI, 2013). Many NAPAs and other policies across the Sahel frame cross-border migration, including transhumance, as a potential problem, linked to competition over land and water, conflict and instability, and environmental damage (Opitz-Stapleton et al., 2021).

Mali

Reflecting regional trends, Mali's climate and development policies frame environmental migration primarily as a problem to be controlled or prevented, or do not mention the issue altogether:

- Despite Mali's 2007 National Adaptation Plan of Action (NAPA) recognising migration as an adaptation strategy in the face of environmental risks and new climatic conditions, especially droughts in the Inner Niger Delta, it identifies as core aims the 'sedentarisation' of populations and the reduction of migration (Ministère de l'Equipement et des Transport, 2007).
- Mali's 2011 National Policy on Climate Change includes no explicit mention of migration or mobility, apart from the fact that climatic variability has strongly affected herding livelihoods, driving movements toward Mali's south and resulting in conflicts between herders and farmers (Ministère de l'Environnement, 2011).
- Mali's 2013 Agricultural Development Policy identifies as an axis of intervention the development of climate change adaptation mechanisms, including through strengthening capacities of vulnerable rural populations, and highlights the need for sustainable natural and environmental resource management in a context of climate change (République du Mali, 2013). However, it does not mention migration as an adaptation strategy.
- Poverty Reduction Strategy Papers (PRSPs) in Mali have integrated environmental issues as cross-cutting themes, suggesting that rural development initiatives constitute important means to prevent rural-to-urban migration (Hummel, 2016; Liehr et al., 2016).
- Mali's 2015 Intended Nationally Determined Contribution (INDC) plan includes no mention of migration (République du Mali, 2015), nor does its Revised NDC (Ministère de l'Environnement, 2021).
- Mali's 2018 third National Communication to the UN Framework Convention on Climate Change (UNFCCC) only mentions transhumance in relation to migration, pointing out that the country receives transhumance herders from Niger, Burkina Faso and Mauritania.

[23] The African Union Climate Change and Resilient Development Strategy and Action Plan was adopted by AU Heads of State and government in February 2022.

Sudan

Climate- and environment-related migration is not prominent in national policies, in the context of recent political changes. Even before the political crisis in 2021, migration policies were focused on displacement caused by conflict and violence, especially in Darfur and from Ethiopia and South Sudan. The National Council for Strategic Planning General Secretariat's Twenty-Five-Year National Strategy 2007—2031 makes this explicit, including migration and internal movement as a security and defence threat together with ethnic and regional violence and conflict, and mentioning the need to 'settle nomads.'

The current government approach to migration focuses on border control and developing the capacity of law enforcement, as well as the health and social sectors to some extent. In White Nile, Red Sea, Kassala and Northern states, a migration technical committee is working on migration, focusing on displacement and on the law enforcement perspective.

Sudan's climate and development policies also frame migration (both internal and cross-border) in response to climate-related pressures as problematic and something to be controlled (Chazalnoël et al., 2016):

- The 2016 NAPA identifies migration as a significant 'adverse impact' of climate change, referring to movement due to flooding, desertification, and resource degradation as well as potential climate-induced displacement toward areas less vulnerable to droughts. The document also mentions that decreasing agricultural productivity in other regions may also lead to an influx of climate refugees and the out-migration of pastoralists, and in turn to the need to develop institutional and infrastructure capacity to accommodate this (Ministry of Environment, 2016).
- The National Plan for the implementation of the Great Green Wall for the Sahel and Sahara recognises the interaction of human activities and climate drivers in affecting mobility. It acknowledges that large-scale mechanised farming is blocking transhumant nomadic routes by decreasing grazing areas, and that climatic conditions are exacerbating this.
- Sudan's 2015 Intended Nationally Determined Contribution (INDC) plan identifies human displacement as a 'key vulnerability' linked to climate change and proposes water-related developments to discourage migration from vulnerable areas (Republic of Sudan, 2015). Sudan's updated NDC submission includes no mention of migration (High Council for Environment, 2021).
- Sudan's 2021 Poverty Reduction Strategy Paper describes adverse consequences of environmental degradation and climate change as contributing to or compounding poverty, especially in rural areas, and identifies as a priority strengthening resilience of communities in the face of climate change. While no mention is made of migration specifically in relation to climate, an aim of the Strategy's agricultural development component is to 'discourage migration' (Ministry of Finance, 2021).

8. Recommendations

These recommendations emerge from the findings and include suggestions from FGD participants and interviewees in Mali and Sudan, as well as interviewees in the wider Sahel, who were asked to identify the types of assistance that would be necessary to support coping and adaptation responses, including in relation to mobility.

8.1 Recommendations for national and international humanitarian actors (including National Red Cross and Red Crescent Societies)

Ensure that programmatic action, organisational narratives and (through humanitarian diplomacy) policy frameworks acknowledge and reflect the complex relationship between climate change and mobility:

- **Strengthen engagement with existing evidence on climate change and migration.** Many of the key findings presented in this report challenge common organisational or policy narratives that often present a simplistic relationship between climate change and migration (although the reasons for such narratives, including in relation to advocacy, must be acknowledged). This highlights the importance of drawing on existing academic and expert research findings on climate change-migration relationships to inform communications and advocacy strategies, and strategic plans on climate change and migration, to ensure these reflect and are adjusting to emerging evidence.
- **Given the transborder nature of climate change and its impacts, there is a need for more systematic dialogue and coordination between actors working in different countries**, for example between different National Red Cross and Red Crescent Societies, and between regions of the same country, to inform understanding of the vulnerabilities and needs associated with climate-related migration in its localised and transborder dimensions as well as informing the development of regional strategies and capacities.

Address vulnerabilities associated with climate change and mobility:

- **Target and strengthen route-based humanitarian assistance and (re) integration support to people who migrate internally and regionally in response to climate-related and environmental hazards and changes.** To increase wellbeing and socio-economic outcomes in transit and in destination localities, forms of assistance might include assistance in securing food and housing, access to healthcare and other basic services, information on accessing required documentation (e.g. work permits), job training, psychosocial and psychological support, and facilitating communication with family members. This should be embedded in wider work to address existing vulnerabilities among migrant populations, and ought to involve a range of actors, from NGOs to governments to host communities.
- **Ensure that support for adaptation and to meet needs among vulnerable migrants takes into account the differential effects of environmental and climate change on vulnerability and mobility, along lines of gender, age, disability, livelihood type, and income.** Responses should explicitly consider

the needs of groups that are particularly vulnerable to the adverse effects of climate change, and those who face barriers to mobility. Given the uneven impacts of environmental change, associated migration pressures and uneven access to adaptation options (including mobility), support for in-place coping and adaptation strategies should be targeted to (and informed by the priorities of) groups such as older adults, young people, women, people with disabilities, farmers, herders, or fishers.

Support governments to strengthen the development and implementation of laws and policies addressing climate-related mobility (see **Section 8.2**), through policy engagement and humanitarian diplomacy. For example, National Red Cross and Red Crescent Societies can increase engagement with national governments on this, building on their role as humanitarian auxiliaries to national authorities, as well as global efforts by the International Red Cross and Red Crescent Movement to address wider assistance and protection needs of people on the move.

- **Advance partnerships to address gaps in the evidence base in order to better meet needs for support.** In this respect, National Red Cross and Red Crescent Societies have a unique role to play in assessing conditions on the ground. This research points to aspects of patterns of climate-related mobility on which there is currently a dearth of information. For example: internal migrants working in artisanal gold mines in Sudan and the wider Sahel; people who migrate as an adaptive strategy but wish to return to live in their locality of origin; or people who are displaced multiple times due to the same climate-related hazard. Each of these groups have different vulnerabilities, needs and aspirations that will require specific support. In this respect, collaborative working across different humanitarian and development organisations, including National Red Cross and Red Crescent Societies, is critical to increase the specificity of support.

Support adaptation and community resilience strategies within climate-vulnerable communities, so that mobility remains a choice but is not the only option:

- **Expand community knowledge of and access to early warning systems and climate information**, to support preparedness and early and anticipatory action in response to climate-related hazards, building on government partnerships and existing mechanisms (e.g. radio broadcasts, volunteer networks) to share information and alerts and to inform people's anticipatory, adaptative, and mobility decisions.
- **Ensure that support goes beyond short-term needs by strengthening material support for longer-term coping and locally-led adaptation initiatives, guided by locally-determined needs and strategies.** For example, through skills training and provision of material resources (e.g. funds and equipment to support livelihood diversification, agricultural innovations, etc.), targeting all those in need of support regardless of their intentions or ability to migrate.
- **Ensure that support is provided based on an understanding of the key barriers to adaptation in specific**

communities and the needs of different groups. For example, ensuring that support goes beyond coping strategies and adaptation interventions in the agricultural sector to respond to the varied aspirations of young people, who may not wish to work in agriculture.

8.2 Recommendations for national governments and regional organisations

- **Promote the consistent integration of climate-related mobility, including displacement and migration, into relevant national and regional policy and legal frameworks and strategies**, including climate adaptation plans, disaster risk reduction and response plans, poverty reduction and other development plans, and migration and settlement policies. Responses should be based on existing evidence, should draw on the needs and priorities of affected communities, and should involve the participation of National Red Cross and Red Crescent Society representatives alongside civil society and government actors.
- **Recognise migration in response to climate vulnerabilities as a form of adaptation and as involving risks and losses, rather than as a problem to be managed and prevented**. At the same time, migration should not be considered as a feasible solution or panacea to climate-related challenges under all circumstances, given the challenges and social and material losses that may be associated with mobility. Furthermore, non-migration should not be equated with adaptation, given that many people may be 'trapped' in situations of extreme vulnerability.
- **Avoid looking at climate-related mobility in isolation, but rather situate it within the context of the broader dynamics of environmental change that underpin climate-related vulnerabilities and migration pressures.** This involves explicitly considering the socioeconomic and political barriers (and inequalities in access) to financial support, water and agricultural inputs; restrictions on access to land and water sources; and a lack of clear land tenure and legal rights; all of which contribute to existing socioeconomic vulnerabilities and may intensify the impacts of climate change and associated migration pressures while limiting possibilities for coping and adaptation.
- **Expand knowledge of and access to early warning systems and climate information to support preparedness and early and anticipatory action in response to climate-related hazards** through regional and national meteorological agencies.
- **Address elements of policy frameworks that create or exacerbate vulnerabilities among people on the move in general, that may impact individuals moving in response to climate-related and environmental changes.** This involves addressing barriers to obtaining resident and work permits, healthcare and education services, housing, and employment.

8.3 Recommendations for international donors

- **Invest in building an evidence base to improve understanding of how climate change interacts with existing and future patterns and drivers of mobility in specific contexts**, in order to anticipate future impacts and to support resilience and adaptation strategies within climate-vulnerable communities.
- **Address vulnerabilities associated with climate change and mobility, including through investment in addressing the impacts of climate change on humanitarian needs both for migrants and for people remaining in place.** In terms of addressing humanitarian needs in the context of migration, this should involve consideration of climate-related migration, as part of wider flexible, needs-based and sustainable funding for international humanitarian assistance and protection to migrants in situations of vulnerability. Support for people who wish to remain in place might involve the provision of flexible and accessible climate adaptation finance for national and international organisations to address immediate humanitarian vulnerabilities linked to climate-related mobility alongside preparedness measures such as early warning systems and in-place coping, adaptation, and resilience measures.
- **Ensure that funding to address vulnerabilities associated with climate-related migration, as well as funding that targets wider vulnerabilities among migrants, focuses on all migrants in situations of vulnerability.** This includes attention to internal and intra-regional movement, rather than an emphasis on preventing 'irregular' migration towards Europe.
- **Support international acknowledgement and consensus that mobility can be an important adaptation strategy** to be enabled among a range of choices for people in climate-vulnerable communities.

9. References

Abdi, O. A., Glover, E. K., and Luukkanen, O. (2013) Causes and impacts of land degradation and desertification: case study of the Sudan. *International Journal of Agriculture and Forestry*, **3**(2), 40–51.

Advisory Group on Climate Change and Human Mobility. (2015) *Human mobility in the context of climate change: elements for the UNFCCC Paris Agreement.* Advisory Group on Climate Change and Human Mobility.

Afifi, T., Govil, R., Sakdapolrak, P. and Warner, K. (2012) *Climate change, vulnerability and human mobility: perspectives of refugees from the East and Horn of Africa.* Bonn: UNU-EHS.

African Union (AU) (2009) *African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa (Kampala Convention).* Addis Ababa: African Union.

African Union (2010) *Policy Framework for Pastoralism in Africa: Securing, Protecting and Improving the Lives, Livelihoods and Rights of Pastoralist Communities.* Addis Ababa: Department of Rural Economy and Agriculture, African Union.

African Union (2018a) *Migration Policy Framework for Africa and Plan of Action (2018–2030).* Addis Ababa: African Union.

African Union (2018b) *Protocol to the Treaty Establishing the African Economic Community Relating to Free Movement of Persons, Right of Residence and Right of Establishment.* Addis Ababa: African Union.

African Union (2020) *Draft Africa Climate Change Strategy 2020–2030.* Addis Ababa: African Union.

Alou, M. T., Maïga, I. M. and Hainikoye, A. D. (2015) Au coeur de la marginalisation des femmes en milieu rural Nigérien: l'accès à l'eau agricole. *Les Cahiers d'Outre-Mer*, **68**(270), 163–188.

Anderson, K., Golovko, E. and Hargrave, K. (2021) *Risks and resilience: exploring migrants' and host communities' experiences during the COVID-19 pandemic in West Africa.* Geneva: International Federation of Red Cross and Red Crescent Societies.

Barros, D. D. (2010) Liens ville-village et changements sociaux face à la migration saisonnière: le mouvement de personnes entre Songho (région dogon) et Bamako Mali. *Anthropos*, 471–488.

Bello, I. M. (2016) Les stratégies de gestion de risques agricoles au Niger: évidence empirique et implication pour les ménages agricoles. *Économie Rurale: Agricultures, Alimentations, Territoires*, **351**, 67–78

Benjaminsen, T. A., Aune, J. B. and Sidibé, D. (2010) A critical political ecology of cotton and soil fertility in Mali. *Geoforum*, **41**, 647–656.

Bertoli, S., Docquier, F., Rapoport, H. and Ruyssen, I. (2020) *Weather shocks and migration intentions in Western Africa: insights from a multilevel analysis.* Munich: Center for Economic Studies and Ifo Institute.

Bizoza, A. R. (2019) Land rights and economic resilience of rural women in the G5-Sahel countries, West Africa. *African Journal on Land Policy and Geospatial Sciences*, **2**(1), 46–59.

Bleck, J. and Lodermeier, A. (2020) Migration aspirations from a youth perspective: focus groups with returnees and youth in Mali. *The Journal of Modern African Studies*, **58**(4), 551–577.

Bluett, K. and Davy, D. (2020) *Access to essential services for people on the move in the ECOWAS region*. Study commissioned by the International Federation of Red Cross and Red Crescent Societies and the United Nations High Commissioner for Refugees.

Bonnet, B, and Guibert, B. (2014) Stratégies d'adaptation aux vulnérabilités du pastoralisme: trajectoires de familles de pasteurs (1972–2010). *Afrique Contemporaine*, **1**(249), 37–51.

Borderon, M., Sakdapolrak, P., Muttarak, R., et al. (2019) Migration influenced by environmental change in Africa: a systematic review of empirical evidence. *Demographic Research*, **41**, 491–544.

Bouaré-Trianneau, K. N. (2013) Le riz et le bœuf, agro-pastoralisme et partage de l'espace dans le Delta intérieur du Niger (Mali). *Les Cahiers d'Outre-Mer*, **66**(264), 423–444.

British Red Cross (2022) *From commitments to reality: British Red Cross humanitarian priorities for the International Migration Review Forum.* London: British Red Cross.

Brockhaus, M., Djoudi, H. and Locatelli, B. (2013) Envisioning the future and learning from the past: adapting to a changing environment in northern Mali. *Environmental Science and Policy*, **25**, 94–106.

Chazalnoël, M., Mach, E. and Ionesco, D. (2016) *Migration in the Intended Nationally Determined Contributions (INDCs) and Nationally Determined Contributions (NDCs).* Geneva: IOM.

Corner, A., Shaw, C. and Clarke, J., (2018) *Principles for effective communication and public engagement on climate change: A Handbook for IPCC authors.* [online] Oxford: Climate Outreach. Available at: ipcc.ch/site/assets/uploads/2017/08/Climate-Outreach-IPCC-communications-handbook.pdf [Accessed 13 May 2022].

Daouda, Y. H. (2015) Les politiques publiques agricoles au Niger face aux défis alimentaires et environnementaux: entre échecs répétitifs et nouvelles espérances. *Les Cahiers d'Outre-Mer*, **68**(270), 115–136.

Daum, C. (2014) *Entre individualisation et responsabilités familiales: les mobilités des jeunes de la région de Kayes au Mali*

Defrance, D., Delasalle, E. and Gubert, F. (2020) *Is migration drought-induced in Mali? An empirical analysis using panel data on Malian localities over the 1987–2009 period. Paris: UMR LEDa.*

De Longueville, F., Ozer, P., Gemenne, F., et al. (2020) Comparing climate change perceptions and meteorological data in rural West Africa to improve the understanding of household decisions to migrate. *Climatic Change*, **160**(1), 123–141.

De Longueville, F., Zhu, Y. and Henry, S. (2019) *Direct and indirect impacts of environmental factors on migration in Burkina Faso: application of structural equation modelling. Population and Environment*, **40**(4), 456–479.

Deubel, T. and Boyer, M. (2017) *Gender, markets and women's empowerment in the Sahel region: a comparative analysis of Mali, Niger, and Chad.* Dakar: World Food Programme.

Diallo, A., Donkor, E., and Owusu, V. (2020) Climate change adaptation strategies, productivity and sustainable food security in southern Mali. *Climatic Change*, **159**(3), 309–327.

Dillon, A., Mueller, V. and Salau, S. (2011) Migratory responses to agricultural risk in Northern Nigeria. *American Journal of Agricultural Economics*, **93**(4), 1048–1061.

Djoudi, H. and Brockhaus, M. (2011) Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in northern Mali. *International Forestry Review*, **13**(2), 123–135.

Djoudi, H., Brockhaus, M. and Locatelli, B. (2013) Once there was a lake: vulnerability to environmental changes in northern Mali. *Regional Environmental Change*, **13**(3), 493–508.

Doka, M. D., Magoudou, D. and Diouf, A. (2014) *Food crisis, gender, and resilience in the Sahel: lessons from the 2012 crisis in Burkina Faso, Mali, and Niger.* Oxford: Oxfam GB.

Doso, S. (2014) Land degradation and agriculture in the Sahel of Africa: causes, impacts and recommendations. *Journal of Agricultural Science and Applications*, **3**(3), 67–73.

Drees, L., and Liehr, S. (2015) Using Bayesian belief networks to analyse social-ecological conditions for migration in the Sahel. *Global Environmental Change*, **35**, 323–339.

Ebi, K. L., Padgham, J., Doumbia, M., et al. (2011) Smallholders adaptation to climate change in Mali. *Climatic Change*, **108**(3), 423–436.

ECOWAS (2003) *Regulation C/REG.3/01/03 relating to the implementation of the regulations on transhumance between the ECOWAS member states*. Dakar: ECOWAS.

ECOWAS (2008) *ECOWAS Common Approach on Migration.* Ouagadougou: ECOWAS Commission.

Eizenga, D. (2019) *Long term trends across security and development in the Sahel.* Paris: OECD Publishing.

Elagib, N. A. (2011) Changing rainfall, seasonality and erosivity in the hyper-arid zone of Sudan. *Land Degradation and Development*, **22**(6), 505–512.

Elagib, N. A., Al Zayed, I. S., Saad, S. A. G., et al. (2021) Debilitating floods in the Sahel are becoming frequent. *Journal of Hydrology*, **599**, 126362.

El Tahir, B. A., Mohammed Fadl, K. E., and Fadlalmula, A. G. D. (2010) Forest biodiversity in Kordofan Region, Sudan: Effects of climate change, pests, disease and human activity. *Biodiversity*, **11**(3–4), 34–44.

Epule, T. E., Ford, J. D., Lwasa, S. and Lepage, L. (2017) Climate change adaptation in the Sahel. *Environmental Science and Policy*, **75**, 121–137.

Etana, D., Snelder, D., Wesenbeeck, C. and Buning, T. (2020) Climate change, in-situ adaptation, and migration decisions of smallholder farmers in central Ethiopia. *Migration and Development.*

Food and Agriculture Organization (FAO) (2019) *Sahel regional overview: December 2019.* Rome: FAO.

Generoso, R. (2015) How do rainfall variability, food security and remittances interact? The case of rural Mali. *Ecological Economics*, **114**, 188–198

Grace, K., Hertrich, V., Singare, D., and Husak, G. (2018) Examining rural Sahelian out-migration in the context of climate change: an analysis of the linkages between rainfall and out-migration in two Malian villages from 1981 to 2009. *World Development*, **109**, 187–196.

Gray, C. and Mueller, V. (2012) Drought and population mobility in rural Ethiopia. *World Development*, **40**(1), 134–45.

Gray, C. and Wise, E. (2016) Country-specific effects of climate variability on human migration, *Climatic Change*, **135**(3–4), 555–568.

Groth, J., Ide, T., Sakdapolrak, P., et al. (2020) Deciphering interwoven drivers of environment-related migration: a multisite case study from the Ethiopian highlands. *Global Environmental Change*, **63**, 102094.

Gubert, F., Lassourd, T. and Mesplé-Somps, S. (2010) *Do remittances affect poverty and inequality? Evidence from Mali.* Paris: IRD and Paris School of Economics.

Halimatou, A. T., Kalifa, T., and Kyei-Baffour, N. (2017) Assessment of changing trends of daily precipitation and temperature extremes in Bamako and Ségou in Mali from 1961–2014. *Weather and Climate Extremes*, **18**, 8–16.

Hamadalnel, M., Zhu, Z., Lu, R., et al. (2021) Spatio-temporal investigations of monsoon precipitation and its historical and future trend over Sudan. *Earth Systems and Environment,* **5**(3), 519–529.

Hermans, K. and Garbe, L. (2019) Droughts, livelihoods, and human migration in northern Ethiopia. *Regional Environmental Change*, **19**(4), 1101–11.

Hiernaux, P., Diawara, M. and Gangneron, F. (2014) Quelle accessibilité aux ressources pastorales du Sahel? L'élevage face aux variations climatiques et aux évolutions des sociétés sahéliennes. *Afrique Contemporaine*, **249**, 21–35.

Hiernaux, P., Mougin, E., Diarra, L., et al. (2009) Sahelian rangeland response to changes in rainfall over two decades in the Gourma region, Mali. *Journal of Hydrology*, **375**(1–2), 114–127.

Hoffmann, R., Dimitrova, A., Muttarak, R., et al. (2020) A meta-analysis of country-level studies on environmental change and migration. *Nature Climate Change*, **10**(10), 904–912.

Holmes, S., Brooks, N., Daoust, G., et al. (2022) *Climate risk report for the Sahel region.* London: Met Office, ODI, and FCDO.

Hoogeveen, J. G., Rossi, M. and Sansone, D. (2019) Leaving, staying or coming back? Migration decisions during the northern Mali conflict. *The Journal of Development Studies*, **55**(10), 2089–2105.

Hummel, D. (2016) Climate change, land degradation and migration in Mali and Senegal: some policy implications. *Migration and Development*, **5**(2), 211–233.

Ibnouf, F. O. (2011) Challenges and possibilities for achieving household food security in the western Sudan region: the role of female farmers. *Food Security*, **3**(2), 215–231.

Ickowicz, A., Ancey, V., Corniaux, C., et al. (2012) Crop-livestock production systems in the Sahel: increasing resilience for adaptation to climate change and preserving food security. In A. Meybeck et al. (eds) *Building Resilience for Adaptation to Climate Change in the Agriculture Sector* (261–294). Rome: FAO.

International Federation of Red Cross and Red Crescent Societies (IFRC) (2021a) *Displacement in a changing climate: localized humanitarian action at the forefront of the climate crisis.* Geneva: IFRC.

IFRC, (2017) *IFRC Global Strategy on Migration 2018 – 2022 – Reducing Vulnerability, Enhancing Resilience.* [online] Geneva, Switzerland: International Federation of Red Cross and Red Crescent Societies. Available at: https://www.ifrc.org/document/ifrc-strategy-migration-1 [Accessed 7 Jun. 2022].

IFRC (2021b) *Humanitarian assistance and protection for people on the move: a route-based approach spanning Africa, Middle East and Europe.* Geneva: IFRC.

Ihring, D. and Meskers, J. (2021) *The impact of the Sahel conflict on cross-border movements from Burkina Faso and Mali towards Côte d'Ivoire and Ghana.* Mixed Migration Centre.

Inter-Governmental Authority on Development (IGAD) (2012) *IGAD Regional Migration Policy Framework.* Addis Ababa: Inter-Governmental Authority on Development.

IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI) (2013) The IDDRSI Strategy. Djibouti: IGAD.

Internal Displacement Monitoring Centre (IDMC) (2021) *Global Report on Internal Displacement 2021: internal displacement in a changing climate.* Geneva: IDMC.

International Organization for Migration (IOM) (2022a) 'Key migration terms', iom.int/key-migration-terms

IOM (2022b) 'Migration data portal', migrationdataportal.org/international-data

Intergovernmental Panel on Climate Change (IPCC) (2022) Summary for policymakers. In H.-O. Pörtner, D. C. Roberts, M. Tignor, et al. (eds.), *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press.

Kiema, A., Tontibomma, G. and Zampaligré, N. (2014) Transhumance et gestion des ressources naturelles au Sahel: contraintes et perspectives face aux mutations des systèmes de productions pastorales. *VertigO*, **14**(3).

Kirwin, M. and Anderson, J. (2018) *Identifying the factors driving West African migration.* Paris: OECD.

Konaté, F. O. (2010) La migration féminine dans la ville de Kayes au Mali. *Hommes et Migrations*, **4**(1286–1287), 62–73.

Koutou, M., Sangaré, M., Havard, M., et al. (2016) Adaptation des pratiques d'élevage des producteurs de l'Ouest du Burkina Faso face aux contraintes foncières et sanitaires. *Agronomie Africaine*, **28**(2), 13–24.

Liehr, S., Drees, L. and Hummel, D. (2016) Migration as societal response to climate change and land degradation in Mali and Senegal. In J. A. Yaro and J. Hesselberg (eds.), *Adaptation to Climate Change and Variability in Rural West Africa* (147–169). Cham: Springer.

Lind, J., Sabates-Wheeler, R., Caravani, M., et al. (2020) Newly evolving pastoral and agro-pastoral rangelands of Eastern Africa. *Pastoralism: Research, Policy and Practice*, **10**, 24.

Lombard, J. (2008) Kayes, ville ouverte: migrations internationales et transports dans l'ouest du Mali. *Autrepart*, 3(47), 91–107.

Marega, O. and Mering, C. (2018) Les agropasteurs sahéliens face aux changements socio-environnementaux: nouveaux enjeux, nouveaux risques, nouveaux axes de transhumance. *L'Espace Géographique*, 47(3), 235–260.

McCullough, A., Mayhew, L., Opitz-Stapleton, S. et al. (2019) *When rising temperatures don't lead to rising tempers: climate and insecurity in Niger.* London: ODI.

Ministère de l'Environnement et de l'Assainissement (2011) *Politique Nationale sur les Changements Climatiques.* Bamako: Ministère de l'Environnement et de l'Assainissement, République du Mali.

Ministère de l'Environnement, de l'Assainissement et du Développement Durable (2021) *Contribution Déterminée au Niveau National Révisée*. Bamako: Ministère de l'Environnement, de l'Assainissement et du Développement Durable, République du Mali.

Ministère de l'Equipement et des Transports (2007) *Programme d'Action National d'Adaptation aux Changements Climatiques.* Bamako: Ministère de l'Equipement et des Transports, République du Mali.

Ministry of Environment, Natural Resources and Physical Development (2016) *National Adaptation Plan.* Khartoum: Ministry of Environment, Natural Resources and Physical Development, Republic of the Sudan.

Ministry of Finance and Economic Planning (2021) *Sudan Poverty Reduction Strategy Paper 2021–2023.* Khartoum: Ministry of Finance and Economic Planning, Republic of Sudan.

Mokhnacheva, D. (2022) *Baseline Mapping of the Implementation of Commitments related to Addressing Human Mobility Challenges in the Context of Disasters, Climate Change and Environmental Degradation under the Global Compact for Safe, Orderly and Regular Migration (GCM).* Geneva: Platform on Disaster Displacement.

Morrissey, J. W. (2013) Understanding the relationship between environmental change and migration: the development of an effects framework based on the case of northern Ethiopia. *Global Environmental Change*, **23**(6), 1501–10.

Mueller, V., Gray, C. and Hopping, D. (2020a) Climate-induced migration and unemployment in middle-income Africa. *Global Environmental Change*, **65**, 102183.

Mueller, V., Sheriff, G., Dou, X. and Gray, C. (2020b) Temporary migration and climate variation in eastern Africa. *World Development*, 126.

Naess, L. O., Selby, J. and Daoust, G. (2022) *Climate resilience and social assistance in fragile and conflict-affected settings. BASIC Research Working Paper 2.* Brighton: Institute of Development Studies.

Nawrotzki, R. J. and Bakhtsiyarava, M. (2017) International climate migration: evidence for the climate inhibitor mechanism and the agricultural pathway. *Population, Space and Place*, **23**(4).

Nawrotzki, R. J., Schlak, A. M. and Kugler, T. A. (2016) Climate, migration, and the local food security context: introducing Terra Populus. *Population and Environment*, **38**(2), 164–184.

Ng'ang'a, S. K., Bulte, E. H., Giller, K. E., et al. (2016) Migration and self-protection against climate change: a case study of Samburu County, Kenya. *World Development*, **84**, 55–68.

Nilsson, E., Becker, P. and Uvo, C. B. (2020) Drivers of abrupt and gradual changes in agricultural systems in Chad. *Regional Environmental Change*, **20**(3), 1–17.

OECD/SWAC (2014) *An Atlas of the Sahara-Sahel: geography, economics and security.* Paris: OECD/Sahel and West Africa Club.

OECD/SWAC (2020) *Africa's urbanisation dynamics 2020: Africapolis, mapping a new urban geography.* Paris: OECD/Sahel and West Africa Club.

Office of the UN High Commissioner for Human Rights (OHCHR) (2021) *Human rights, climate change and migration in the Sahel.* Geneva: OHCHR.

Opitz-Stapleton, S., Cramer, L., Kaba, F., et al. (2021) *Transboundary climate and adaptation risks in Africa: perceptions from 2021.* Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises (SPARC).

Opitz-Stapleton, S., Nadin, R., Watson, C. and Kellet, J. (2017) *Climate change, migration and displacement: The need for a risk-informed and coherent approach.* ODI and UNDP.

Opondo, D. O. (2013) Erosive coping after the 2011 floods in Kenya. *International Journal of Global Warming*, **5**(4), 452–66.

Ouallet, A. (2008) La question migratoire et les dynamiques transsahariennes à travers l'exemple malien. *Annales de Géographie*, **5**(663), 82–103.

Owain, E. L. and Maslin, M. A. (2018) Assessing the relative contribution of economic, political and environmental factors on past conflict and the displacement of people in East Africa. *Palgrave Communications*, **4**(1), 1–9.

Peters, K., Dupar, M., Opitz-Stapleton, S., et al. (2020) *Climate change, conflict and fragility: an evidence review and recommendations for research and action.* London: ODI.

Piguet, E. (2022). Linking climate change, environmental degradation, and migration: an update after 10 years. *Wiley Interdisciplinary Reviews: Climate Change*, **13**(1), e746.

Republic of Sudan (2015) *Intended Nationally Determined Contributions (INDCs).* Khartoum: Republic of Sudan.

République du Mali (2013) *Politique de Développement Agricole du Mali.* Bamako: République du Mali.

République du Mali (2015) *Contribution Prévue Déterminée au Niveau National.* Bamako: République du Mali.

Richardson, K., Calow, R., Pichon, F., et al. (2022) *Climate risk report for the East Africa region.* London: Met Office, ODI, and FCDO.

Sauvain-Dugerdil, C. (2013) Youth mobility in an isolated Sahelian population of Mali. T*he Annals of The American Academy of Political and Social Science*, 648(1), 160–174.

Scheffran, J., Marmer, E., and Sow, P. (2012) Migration as a contribution to resilience and innovation in climate adaptation: social networks and co-development in Northwest Africa. *Applied Geography*, 33, 119–127.

Schwerdtle, P. N., Stockemer, J., Bowen, K. J., et al (2020) *A meta-synthesis of policy recommendations regarding human mobility in the context of climate change. International Journal of Environmental Research and Public Health,* 17(24), 9342.

Selby, J. and Daoust, G. (2021) *Rapid evidence assessment on the impacts of climate change on migration patterns.* London: Foreign, Commonwealth and Development Office.

Streiff-Fénart, J. and Poutignat, P. (2014) *Vivre sur, vivre de la frontière: l'après transit en Mauritanie et au Mali*

Sulieman, H. M. (2013) *Land grabbing along livestock migration routes in Gadarif State, Sudan: impacts on pastoralism and the environment.* The Land Deal Politics Initiative.

Sulieman, H. M. and Elagib, N. A. (2012) Implications of climate, land-use and land-cover changes for pastoralism in eastern Sudan. *Journal of Arid Environments*, 85, 132–141.

Tarif, K. and Grand, A. O. (2021) 'Climate change and violent conflict in Mali', accord.org.za/analysis/climate-change-and-violent-conflict-in-mali

Tiitmamer, N. (2020) *South Sudan's devastating floods: why there is a need for urgent resilience measures.* Juba: Sudd Institute.

Tiitmamer, N. (2021) A climate crisis in Africa: the case of South Sudan. *The Cairo Review of Global Affairs*, thecairoreview.com/essays/a-climate-crisis-in-africa-the-case-of-south-sudan

Traore, B., Corbeels, M., Van Wijk, M. T., et al. (2013) Effects of climate variability and climate change on crop production in southern Mali. European Journal of Agronomy, 49, 115–125.

Traore, B., Van Wijk, M. T., Descheemaeker, K., et al. (2015) Climate variability and change in southern Mali: learning from farmer perceptions and on-farm trials. *Experimental Agriculture*, 51(4), 615–634.

Trauner, F. and Deimel, S. (2013) The impact of EU migration policies on African countries: the case of Mali. *International Migration*, 51(4), 20–32.

UN Convention to Combat Desertification (UNCCD) (2020) *The Great Green Wall implementation status and way ahead to 2030.* Bonn: UNCCD.

van der Land, V. and Hummel, D. (2013) Vulnerability and the role of education in environmentally induced migration in Mali and Senegal. *Ecology and Society*, 18(4).

World Bank (2021) 'World Development Indicators DataBank'. databank.worldbank.org/source/world-development-indicators

Young, H. and Ismail, M. A. (2019) Complexity, continuity and change: livelihood resilience in the Darfur region of Sudan. *Disasters*, 43, S318–S344.

Zickgraf, C. (2021). Climate change, slow onset events and human mobility: reviewing the evidence. *Current Opinion in Environmental Sustainability*, *50*, 21–30.

Zoma-Traoré, B., Soudré, A., Ouédraogo-Koné, S., et al. (2020) From farmers to livestock keepers: a typology of cattle production systems in south-western Burkina Faso. *Tropical Animal Health and Production*, 52(4), 2179–2

Appendix 1. Data collection methods

In-country research

The research in Mali and in Sudan was led by in-country research partners. In Mali, the research was led by Kéné Conseils, based in Bamako, and in Sudan, the research was led by the Director of the Centre for Remote Sensing and GIS at the University of Gadarif and his team. Virtual planning meetings were held with the researchers in Mali and in Sudan to clarify and refine the aims of the study, the methodology, and key questions. In Mali, data collection was carried out by a team of 10 field researchers, who received training by the lead in-country researchers on the aims of the study, on the data collection tools, and on data collection techniques and ethics. Similar training was provided by the director of the Centre for Remote Sensing and GIS at the University of Gadarif to the research team in Sudan.

Data collection methods

In Mali and Sudan, data was collected through quantitative surveys and qualitative focus groups discussions (FGDs) and individual interviews. The survey, FGD, and interview tools were developed with input from the in-country research partners. While common tools were used in both Mali and Sudan, in-country researchers adapted questions in response to contextual circumstances. The quantitative and qualitative data collection components were conducted simultaneously.

Quantitative surveys. Quantitative data was collected via individual surveys. Purposive sampling for the surveys targeted both migrants and members of sending, transit and receiving communities, women and men, and younger and older adults. In Mali, 100 respondents took part in the survey, including 50 in Bamako and 50 in Kayes. In Bamako, survey data was collected in five communes: Communes 1, 2, 4, 5, and 6. In Kayes, survey data was collected in nine localities: Hawa Dembaya, Liberté Dembaya, Kayes, Khouloum, Somankidi, Samé Diomgoma, Gouméra, Gory Gopela, and Bangassi.

In Sudan, 165 respondents took part in the survey, including 50 in Elfao village in Gadarif, 60 in Elganaa village in White Nile and 55 in Dabat Bosin refugee camp in White Nile. In Mali, the survey was implemented in French, English, and in Bamanankan, the language used by the majority of the population in Bamako district and Kayes. In Sudan, the survey was implemented in English and Arabic. Informed consent was verbally obtained from all research participants.

Focus group discussions. Qualitative FGDs were carried out to add context and depth to quantitative findings. In Mali, 11 FGDs were conducted with a total of 88 participants, including five FGDs in Bamako and six in Kayes. Separate focus groups were held with women and with men of different ages (women over age 40, men over age 40, women under age 40, men under age 40) and with people with disabilities (both women and men), representing migrants, members of host communities, and returned migrants.

In Sudan, FGDs were held with a total of 118 participants, including community leaders (e.g. camp leaders), community members (women and men of different ages), and youth (young women and young men) from internally displaced and refugee communities. Where possible, separate focus groups were held with women and with men, although mixed-gender focus groups were also held, with equal numbers of women and men. FGD locations were the same as those for the quantitative survey.

Research sites

Data collection sites (for surveys, focus groups, and interviews) in Mali and Sudan were determined in collaboration with in-country research partners. Sites were selected to represent both migrant sending communities and migration destination communities, accounting for research partners' existing capacities and security and access concerns.

Appendix 2. Survey data tables

Key findings: perceptions of environmental change in Mali and Sudan

Table A1. Negative and positive environmental changes observed by survey respondents in Mali and Sudan

	Mali			Sudan			
Observed changes	Total (N=91)	Bamako (n=47)	Kayes (n=44)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Negative changes							
Deforestation	**64%**	49%	80%	**63%**	67%	63%	58%
Reduction, pollution and/or changes in water sources	**57%**	60%	55%	**76%**	98%	42%	92%
Decrease in rainfall	**56%**	36%	77%	**8%**	0	12%	12%
Changes in rainfall timing	**34%**	51%	16%	**48%**	53%	37%	58%
Soil degradation or erosion	**32%**	43%	20%	**41%**	58%	25%	42%
Longer or more frequent droughts	**30%**	17%	43%	**16%**	0	15%	36%
Increase in temperature	**24%**	26%	23%	**12%**	16%	7%	12%
Changes in temperature timing	**21%**	36%	5%	**10%**	16%	12%	2%
Decrease in temperature	**17%**	0	34%	**9%**	2%	17%	8%
Loss of access to land	**15%**	17%	14%	**52%**	84%	20%	56%
More frequent or severe flooding	**11%**	13%	9%	**52%**	58%	42%	56%
More frequent or severe storms	**10%**	4%	16%	**38%**	53%	28%	32%
Increase in rainfall	**8%**	11%	5%	**61%**	82%	43%	60%

	Mali			Sudan			
Observed changes	Total (N=91)	Bamako (n=47)	Kayes (n=44)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Positive changes							
Improved forestation	**52%**	45%	59%	**17%**	36%	10%	4%
Increased quantity and/or quality of water sources	**50%**	51%	48%	**19%**	29%	7%	22%
Decrease in temperature	**17%**	0	34%	**8%**	13%	8%	2%
Increase in rainfall	**14%**	11%	18%	**54%**	65%	62%	32%
Less frequent or severe flooding	**13%**	11%	16%	**1%**	0	0	2%
Shorter or less frequent droughts	**12%**	6%	18%	**0**	0	0	0
Soil improvement	**11%**	9%	14%	**5%**	0	13%	0
Less frequent or severe storms	**11%**	4%	18%	**0**	0	0	0
Better access to land	**7%**	0	14%	**0**	0	0	0
Increase in temperature	**6%**	0	11%	**1%**	0	2%	0
Changes in temperature timing	**6%**	4%	7%	**1%**	2%	0	0
Changes in rainfall timing	**6%**	9%	2%	**1%**	0	2%	2%

Table A2. Timescale of environmental changes observed by survey respondents in Mali and Sudan

	Mali			Sudan			
Timescale of changes	Total (N=91)	Bamako (n=47)	Kayes (n=44)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Less than 1 year	**1%**	0	2%	**1%**	2%	0%	0%
1 to 3 years	**12%**	15%	9%	**78%**	85%	92%	52%
4 to 6 years	**26%**	38%	14%	**12%**	11%	5%	20%
7 to 10 years	**29%**	32%	25%	**8%**	2%	5%	18%
More than 10 years	**32%**	15%	50%	**3%**	0%	2%	8%

Table A3. Human activities identified as causes of environmental changes by survey participants in Mali and Sudan

	Mali			Sudan			
Perceived causes	Total (N=80)	Bamako (n=42)	Kayes (n=38)	Total (N=32)	Dabat Bosin (n=22)	Elganaa (n=4)	Elfao (n=6)
Agricultural practices	**69%**	64%	74%	**11%**	7%	13%	12%
Energy demands	**61%**	48%	76%	**5%**	4%	3%	8%
Mining	**53%**	64%	39%	**1%**	0%	0%	2%
Industrial activities	**49%**	52%	45%	**0%**	0%	0%	0%
Herding practices	**43%**	50%	34%	**5%**	4%	10%	2%
Fishing practices	**19%**	14%	24%	**0%**	0%	0%	0%
Actions of security forces or armed groups	**19%**	14%	24%	**0%**	0%	0%	0%
Changes to land rights/ tenure	**13%**	0	26%	**3%**	4%	3%	2%
Other	**8%**	7%	8%	**1%**	0%	2%	2%

Table A4. Effects of environmental changes reported by survey respondents in Mali and Sudan

	Mali			Sudan			
Reported effects	Total (N=91)	Bamako (n=47)	Kayes (n=44)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Negative impacts							
Decrease in agricultural production	**76%**	74%	77%	**95%**	85%	100%	100%
Decrease in herd size	**36%**	40%	32%	**95%**	87%	100%	96%
More severe food insecurity	**32%**	38%	25%	**99%**	98%	100%	100%
Negative health impacts	**31%**	32%	30%	**98%**	100%	100%	92%
Negative employment impacts	**29%**	34%	23%	**71%**	98%	47%	70%
Decrease in fishing catches	**18%**	15%	20%	**65%**	85%	100%	2%
Positive impacts							
Less severe food insecurity	**13%**	11%	16%	**1%**	0	0	2%
Increase in agricultural production	**8%**	0	16%	**0**	0	0	0
Increase in fishing catches	**7%**	0	14%	**3%**	9%	0	0
Increase in herd size	**5%**	2%	9%	**1%**	2%	0	2%
Positive employment impacts	**3%**	0	7%	**0**	0	0	0
Positive health impacts	**1%**	0	2%	**0**	0	0	0
Impacts on mobility							
Increase in mobility	**27%**	45%	9%	**93%**	95%	100%	84%
Decrease in mobility	**15%**	19%	11%	**3%**	2%	0	8%

Table A5. Groups identified as most severely affected by environmental changes among survey respondents in Mali and Sudan

	Mali			Sudan			
Most vulnerable groups	Total (N=91)	Bamako (n=47)	Kayes (n=44)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Women	**27%**	36%	18%	**58%**	71%	37%	70%
Young people	**31%**	34%	27%	**9%**	4%	18%	4%
Older people	**22%**	19%	25%	**70%**	55%	72%	86%
Herders	**31%**	34%	27%	**50%**	84%	35%	32%
Farmers	**69%**	89%	48%	**78%**	80%	88%	64%
Fishers	**15%**	15%	16%	**9%**	22%	5%	0
Other vulnerable groups	**4%**	4%	5%	**4%**	0	5%	6%

Key findings: coping and adaptation strategies in Mali and Sudan

Table A6. Coping and adaptation strategies identified by survey participants

	Mali			Sudan			
Strategies	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Change in work and/or subsistence activities	**60%**	50%	70%	**43%**	24%	33%	76%
Changes in crop types and/or agricultural practices	**60%**	58%	62%	**28%**	0	52%	30%
Migration of family members	**52%**	70%	34%	**98%**	100%	100%	94%
Creation of water and/or food reserves	**39%**	30%	48%	**4%**	2%	2%	10%
Changes in herding practices	**30%**	32%	28%	**17%**	0	38%	10%
Sale of assets (e.g. livestock)	**26%**	26%	26%	**22%**	13%	22%	32%
Changes in consumption habits	**25%**	32%	18%	**17%**	5%	5%	44%
Changes in fishing activities	**15%**	14%	16%	**12%**	2%	30%	0
Changes in housing location or structure	**13%**	4%	22%	**37%**	38%	27%	48%

Table A7. Barriers to coping and adaptation reported by survey respondents in Mali and Sudan

	Mali			Sudan			
Barriers	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Lack of financial resources	**85%**	80%	90%	**97%**	96%	95%	100%
Lack of training	**61%**	56%	66%	**5%**	4%	5%	8%
Lack of information	**43%**	34%	52%	**22%**	24%	17%	28%

Table A8. Groups facing the greatest barriers to coping and adaptation identified by survey respondents in Mali and Sudan

	Mali			Sudan			
Vulnerable groups	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Young people	**44%**	38%	50%	**2%**	0	0	6%
Women	**41%**	48%	34%	**36%**	44%	13%	54%
Older people	**27%**	18%	36%	**84%**	82%	80%	90%
Other vulnerable groups	**20%**	32%	8%	**36%**	35%	43%	30%

Table A9. Forms of assistance from government and NGOs reported by survey respondents in Mali and Sudan

	Mali			Sudan			
Forms of assistance	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Food assistance	**56%**	50%	62%	**87%**	100%	65%	98%
Financial assistance (e.g. cash and vouchers, access to credit)	**51%**	68%	34%	**61%**	100%	8%	80%
Non-food items for basic needs (e.g. shelter, sanitation)	**38%**	46%	30%	**46%**	0	43%	100%
Medical or health services	**24%**	28%	20%	**58%**	22%	62%	92%
Skills and livelihoods training	**24%**	42%	6%	**18%**	0	50%	0%
Agricultural or farming inputs (e.g. seeds, tools)	**22%**	32%	12%	**12%**	0	32%	2%
Psychosocial services	**9%**	0	18%	**4%**	0	0	14%
Early warning mechanisms	**6%**	8%	4%	**0%**	0	0	0%
Support for re-localisation	**5%**	6%	4%	**1%**	0	0	4%
Referral to other agencies or specialist services	**1%**	0	2%	**1%**	0	0	2%
No assistance	**19%**	14%	24%	—	—	—	—

Key findings: migration decisions and trajectories in Mali and Sudan

Table A10. Perceived changes in migration trends among survey respondents in Mali and Sudan

	Mali			Sudan			
Migration trend	Total (N=92)	Bamako (n=46)	Kayes (n=46)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Increase in in-migration	**73%**	78%	67%	**36%**	0	100%	0
Decreased in in-migration	**14%**	2%	26%	**0**	0	0	0
Increase in out-migration	**71%**	87%	54%	**90%**	100%	75%	98%
Decrease in out-migration	**22%**	2%	41%	**1%**	0	0	2%

Table A11. Trends in migrant sources and destinations reported by survey respondents in Mali and Sudan

Source or destination region	Mali			Sudan			
	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Origins of in-migrants							
Different locality in the same region of the country	**48%**	20%	76%	**n/a**	n/a	48%	n/a
Different region in the same country	**83%**	74%	92%	**n/a**	n/a	3%	n/a
Neighbouring country	**44%**	40%	48%	**n/a**	n/a	97%	n/a
Another African country	**9%**	8%	10%	**n/a**	n/a	0	n/a
Country outside Africa	**5%**	4%	6%	**n/a**	n/a	0	n/a
Destinations of out-migrants							
Different locality in the same region of the country	**18%**	22%	14%	**29%**	0	78%	2%
Different region in the same country	**71%**	94%	48%	**52%**	0	60%	100%
Neighbouring country	**66%**	92%	60%	**52%**	100%	50%	0%
Another African country	**61%**	48%	74%	**0**	0	0	0
Country outside Africa	**55%**	22%	88%	**1%**	0	0	2%

Table A12. Trends in migration-destination type reported by survey respondents in Mali and Sudan

Migration type and destination	Mali			Sudan			
	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Rural-to-rural	**2%**	2%	2%	**27%**	5%	52%	22%
Rural-to-urban	**44%**	88%	0	**39%**	2%	35%	86%
Urban-to-rural	**2%**	4%	0	**2%**	0	0	8%
Toward neighbouring countries	**4%**	2%	6%	**50%**	100%	43%	2%
Toward African countries outside of the region	**8%**	2%	14%	**0**	0	0	0
Toward international regions (e.g. Europe, Gulf states)	**40%**	2%	78%	**2%**	0	3%	2%

Table A13. Trends in duration of migration reported by survey respondents in Mali and Sudan

Migration duration	Mali			Sudan			
	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Permanent	**18%**	6%	30%	**9%**	4%	18%	4%
Temporary	**50%**	62%	38%	**53%**	25%	82%	48%
Seasonal	**28%**	30%	26%	**21%**	0	17%	50%
Don't know	**—**	—	—	**24%**	71%	0	0

Table A14. Groups identified as most likely to migrate by survey respondents in Mali and Sudan

	Mali			Sudan			
Most likely to migrate	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Men	**65%**	48%	82%	**53%**	100%	22%	40%
Women	**6%**	10%	2%	**36%**	100%	3%	4%
Both men and women	**6%**	12%	0	**46%**	100%	25%	12%
Young men	**50%**	68%	32%	**64%**	18%	100%	70%
Young women	**29%**	56%	2%	**45%**	100%	0%	40%
Young people and adults	**31%**	38%	24%	**39%**	0	100%	8%
Elderly people	**1%**	0	2%	**33%**	100%	0	0

Table A15. Primary reasons for general migration patterns according to survey respondents in Mali and Sudan

	Mali		
Main reasons for migration	Total (N=100)	Bamako (n=50)	Kayes (n=50)
Economic (search for better working and living conditions)	**98%**	96%	100%
Food insecurity	**35%**	54%	16%
Precipitation changes affecting subsistence activities	**32%**	52%	12%
Lack of access to natural resources	**31%**	50%	12%
Security (e.g. conflict)	**21%**	26%	16%
Temperature changes affecting subsistence activities	**12%**	10%	14%
Environmental shocks (e.g. flooding)	**11%**	16%	6%

Table A16. Primary reasons for survey respondents' own migration decisions in Mali and Sudan

Main reasons for migration	Mali			Sudan			
	Total (N=72)	Bamako (n=34)	Kayes (n=38)	Total (N=165)	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Economic (search for better working and living conditions)	**100%**	100%	100%	**57%**	0%	78%	94%
Rainfall changes affecting livelihood activities	**36%**	65%	11%	**28%**	0%	33%	54%
Lack of access to natural resources	**32%**	62%	5%	**16%**	0%	10%	42%
Food insecurity	**31%**	41%	21%	**42%**	0%	62%	66%
Security (e.g. conflict)	**18%**	21%	16%	**2%**	0%	0%	6%
Environmental shocks (e.g. flooding)	**13%**	18%	8%	**85%**	100%	67%	90%
Temperature changes affecting subsistence activities	**6%**	9%	3%	**5%**	0%	0%	18%

Table A17. Perceived timescale of changes in migration trends among survey respondents in Mali and Sudan

Timescale	Mali			Sudan			
	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Less than one year	**1%**	2%	0	**5%**	0	10%	4%
1 to 3 years	**9%**	7%	11%	**69%**	95%	68%	42%
4 to 6 years	**39%**	50%	28%	**11%**	2%	2%	32%
7 to 10 years	**23%**	30%	15%	**8%**	0	18%	6%
More than 10 years	**28%**	11%	46%	**5%**	0	2%	16%

Table A18. Groups identified as least likely to migrate by survey respondents in Mali and Sudan

	Mali			Sudan			
Least likely to migrate	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Older people	**76%**	98%	54%	**96%**	100%	90%	100%
Women	**71%**	66%	76%	**13%**	7%	20%	12%
Young women	**27%**	16%	38%	**8%**	0	12%	12%
Young men	**26%**	10%	42%	**0**	0	0	0
Men	**8%**	14%	2%	**8%**	7%	13%	2%

Table A19. Barriers to migration identified by survey respondents in Mali and Sudan

	Mali			Sudan			
Main barriers	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Family reasons	**91%**	90%	92%	**59%**	33%	68%	78%
A desire to stay in place	**53%**	62%	44%	**16%**	16%	20%	10%
Lack of financial resources	**33%**	18%	48%	**83%**	93%	70%	88%
Use of in-place coping strategies	**18%**	10%	26%	**2%**	0	5%	0
Lack of information	**4%**	0	8%	**13%**	20%	17%	2%

Table A20. Socioeconomic outcomes of migration reported by survey respondents in Mali and Sudan

	Mali			Sudan			
Outcomes	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Improved	**64%**	56%	72%	**8%**	9%	2%	14%
Declined	**16%**	20%	12%	**88%**	87%	95%	80%
Neither improved nor declined	**4%**	8%	0	**2%**	2%	2%	2%
Improved and declined in different ways	**16%**	16%	16%	**1%**	2%	0	2%

Table A21. Assistance provided by family or community members to migrants, identified by survey respondents in Mali and Sudan

	Mali			Sudan			
Forms of assistance	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
None	**27%**	32%	22%	—	—	—	—
Regularly send food or material objects	**23%**	6%	40%	5%	2%	12%	0
Advice and guidance	**22%**	44%	0	—	—	—	—
Facilitating migration of others	**21%**	4%	38%	10%	25%	3%	0
Regularly send money	**19%**	16%	22%	34%	5%	47%	50%
Contributions to community development projects	**11%**	6%	16%	3%	0	8%	0

Table A22. Assistance provided to family and community members by survey respondents in Mali and Sudan

	Mali			Sudan			
Forms of assistance	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Regularly send money	**54%**	48%	60%	**33%**	4%	45%	50%
Regularly send food or material objects	**37%**	44%	30%	**4%**	0	10%	0
Contributions to community development projects	**3%**	2%	4%	**3%**	0	8%	0
Facilitating migration of others	**3%**	0	6%	**2%**	5%	2%	0
None	**3%**	6%	0				
Other	**—**	—	—	**36%**	36%	32%	42%

Table A23. Frequency of return visits and reasons for return among survey respondents in Mali and Sudan

	Mali			Sudan			
Patterns of return visits	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Average frequency of return to locality of origin							
Several times a year	**3%**	4%	2%	**0**	0	0	0
Occasionally	**42%**	48%	36%	**56%**	5%	98%	62%
Rarely	**45%**	40%	50%	**2%**	2%	0	4%
Never	**10%**	8%	12%	**41%**	91%	2%	32%
Reasons for return visits							
To visit family	**77%**	72%	82%	**42%**	0	58%	68%
For special or religious occasions	**12%**	14%	10%	**25%**	0	48%	26%
Professional or business activities	**5%**	4%	6%	**25%**	5%	62%	2%

Table A24. Plans for long-term or permanent return to locality of origin among survey respondents in Mali and Sudan

	Mali			Sudan			
Plans for return	Total	Bamako (n=50)	Kayes (n=50)	Total	Dabat Bosin (n=55)	Elganaa (n=60)	Elfao (n=50)
Yes, and plan to return	**77%**	68%	86%	**6%**	9%	n/a	10%
Yes, but not able to return	**10%**	8%	12%	**27%**	76%	n/a	6%
No	**10%**	20%	0	**29%**	15%	n/a	80%
Don't know	**3%**	4%	2%	**1%**	0	n/a	4%