Foreign Policy Implications of Climate Change in Focus Regions of European External Action

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Key messages

- In a globalised world, the **effects of climate change** are likely to **cascade across borders**. Climate impacts in one location may have far reaching consequences in other places by affecting trade, migration, investments, and foreign policy objectives.
- Whether such cascading effects are likely to materialise depends in turn on a number of social, economic, and political factors that reinforce or attenuate the effects of climate change on economic development, migration, political stability, etc. These **moderating conditions** are crucial when considering possible challenges in connection with climate change, and opportunities for addressing them.
- In this report, we discuss the possible effects of climate change on issues at the core of **European foreign, security, and development policy** – namely, the impacts of climate change on livelihoods, food security, migration, and political stability in regions with close ties to Europe, where those impacts may affect European foreign policy objectives in a significant way.
- Across regions, we identify a number of **challenges and opportunities** in different **scenarios**, which assume either more or less favourable moderating conditions (i.e., with regard to technology and physical infrastructure; resource and conflict management; economic opportunities; trade and access to markets; governance and state-citizen relations; and social and diplomatic relations).
- Despite important challenges and mounting climatic pressures in all considered regions, our results leave some room for optimism. Depending on their ability to build strong and inclusive institutions, promote sustainable development, and strengthen social and diplomatic ties, affected countries and their partners might be able to **reduce the risk of adverse cascading effects** in connection with a warming world.
- Climate change will become increasingly challenging in the coming years, yet its effects are ultimately determined by social, economic, and political factors. Studying what makes societies susceptible to be adversely affected by climate change and how such conditions evolve over time then gives an indication of where to direct adaptation efforts. The moderating conditions presented in this report offer as many **"levers"** for preparing **against the adverse effects of climate change**.

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1. Introduction

Climate change creates multiple risks for human security and sustainable development. Extreme weather events can lead to volatility in international food prices and thereby compromise the food security of import-dependent countries. Changes in rainfall and runoff can exacerbate rivalry over shared water resources in dry regions, while declining crop yields and fish stocks can compromise the livelihoods of farmers and fisherfolk. Through their impact on social relations, and political stability, all these effects can have knock-on consequences for peace and sustainable development. Many of these risks are likely to materialise in the European neighbourhood and in other countries with close ties to Europe, creating new challenges for the EU and necessitating a reconsideration of its foreign, security, and development policy.

Impacts of climate change may initially manifest as droughts, floods, and other biophysical shocks and pressures, but often have far-reaching social and economic consequences by affecting climate-sensitive livelihoods, communal relations, and politics more broadly. In so doing, they often cross borders between countries and are propagated along human, trade, financial, and political channels that connect these countries (Carter et al. 2021). The food price spikes that struck Middle Eastern and North African countries in 2010 are illustrative of this. Partly driven by extreme weather and production failures in breadbasket regions like Russia and China, soaring food prices became a trigger for political protest in import-dependent countries like Egypt and Tunisia (Albers & Peeters 2011). This in turn had far-reaching geopolitical consequences for the EU and its southern neighbours, including a destabilisation of the MENA region and massive displacements of people (e.g. see Maystadt et al. 2014; Werrell et al. 2015).

In a globalising world, these cascading effects of climate change are increasingly important to consider, yet their impact will differ across contexts. Depending on their economic and political situation, as well as on the precautions they are taking, societies are more or less susceptible to be negatively affected. Under certain conditions, people might even be able to seize new opportunities created by a changing environment or use a common perception of urgency as a catalyst for cooperation. In other words, the geopolitical and human security implications of climate change very much depend on the specific ways people and societies react to shocks and adapt to changing climatic conditions.

Studying what makes societies susceptible to climate change thus gives not only an indication of where to direct adaptation efforts, but also of what specific vulnerabilities to address. There is thus much to gain for European decision makers in trying to understand and anticipate the conditions that moderate the effects of climate change in third countries[1] and that, in some cases, make these countries prone to climate-related social, economic, and political challenges. Countries with close ties and partnerships with the EU are particularly relevant in this context as their ability to manage these challenges has a bearing on the success of European foreign policy.

This report summarises two years of research[2] on climate impacts on human security and development in focus regions of European external action, paying attention to what makes these regions partly vulnerable and partly resilient to the effects of climate change, and to how cooperation with European partners can be improved in this domain. The report begins with an overview of relevant climate security and development challenges, as well as of key moderating influences from a European perspective. This chapter is then followed by an assessment of possible impacts and vulnerabilities in focus regions of European external action. Our assessment is not exhaustive but covers major issues and regions of relevance to European decision-makers. In some parts of the analysis, breadth of coverage is exchanged for a more thorough treatment of causal mechanisms and scope conditions.

The report is based on prior work in the CASCADES project.[3] In addition, it draws on a review of about 140 research articles and working papers that identify the conditions that make societies susceptible to humanitarian, development, and security challenges in connection with slow- and rapid-onset climatic events. A summary of sampling methods and overview of reviewed papers can be found in the Appendix. The report further includes an analysis of how these conditions might evolve over the next 30 years and what this may imply for climate vulnerability (or resilience) in focus regions of European external action. Distinct evolutions are identified along the Shared Socioeconomic Pathways (SSP)[4] to ensure consistency with prior work, drawing on several regional and thematic extensions to the SSP framework.[5]

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[1] "The term 'third country' is used in [European] treaties, where it means a country that is not a member of the [European] Union. This meaning is derived from 'third country' in the sense of one not a party to an agreement between two other countries." (Eurofound, 2021).

[2] This research is part of the CASCADES project funded by the EU and complements other work in the project focusing on the trade, financial, and policy coherence aspects in addressing cascading climate impacts: https://www.cascades.eu.

[3] In particular it draws on Puig et al. (2021), Müller et al. (2021), Lahn et al. (2021), Wolfmaier et al. (2021), Mosello et al. (2021), Elgendy et al. (2021), and Bourekba (2021); which are available on the CASCADES website: https://www.cascades.eu/publications.

[4] The Shared Socioeconomic Pathways (SSP) narratives are a set of five qualitative descriptions of future changes in human development, economy, technology, demographics, technology, institutions, and other relevant factors that shape the capacity of societies to adapt to the impacts of future climate change. The SSP framework is nowadays widely used in climate impacts research (O'Neill et al. 2020).

[5] These were identified from the SSP literature database (Green et al. 2021) and subsequent literature. For the sake of simplicity, we do not explicitly distinguish between different climate scenarios in this report, partly also because our analysis focuses on the next 30 years: a period for which variations in climate projections are more limited (see Carter et al. 2020:41). Yet, it is easy to imagine that possible effects discussed in this report could vary in their intensity when using different climate scenarios.

2. Foreign policy and development implications of climate change

This chapter gives a quick overview of foreign policy, security, and development challenges that can arise in connection with climate change. The focus is on challenges that are either already affecting relevant sectoral policies of the EU and its member states or that will likely do so in the coming years. The section further presents key socioeconomic and political context factors that moderate, i.e. attenuate or amplify, the impacts of climate change on livelihoods, human mobility, social relations, political stability etc. These factors play an important role for the susceptibility of societies to be negatively affected, as well as for their ability to successfully adapt. The concepts introduced in this section form the basis for the discussion of concrete challenges for European external action in Chapter 3.

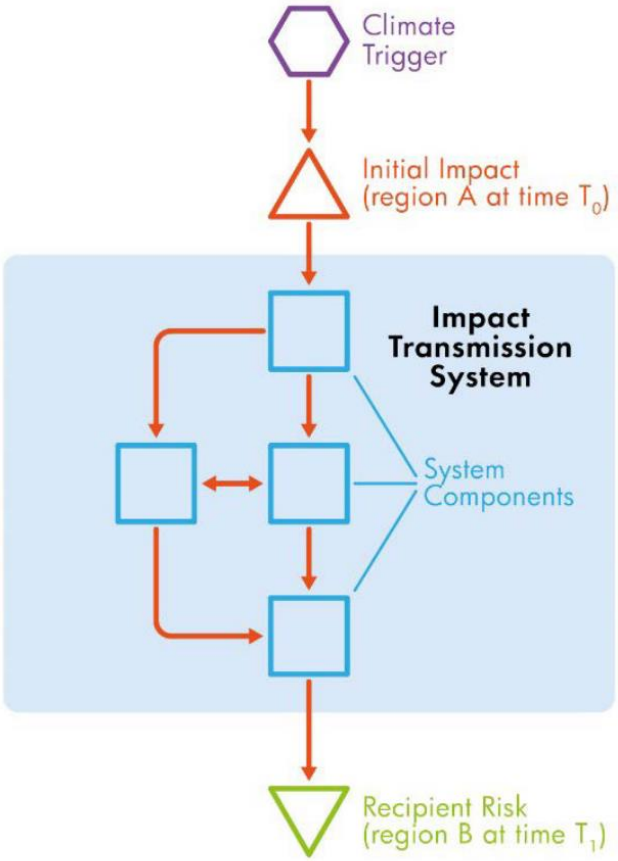
2.1 Social and political effects of climate change

There is little doubt among experts that the effects of climate change can undermine human security and development (see e.g. Adger et al. 2014). As the pressures created by climate change add to and interact with existing challenges for communities and livelihoods, climate impacts on security and development are most pronounced in those regions and for those populations that already face poverty and other obstacles to development. Yet, in an increasingly interconnected world, the ripple effects of these initial impacts (e.g. economic, humanitarian, geopolitical) are likely to also affect people and policies in more distant places.

Cascading climate change impacts

In this report we build upon the concept of cross-border or "cascading" climate change impacts (see Carter et al. 2021), which describe "consequences of climate change that occur remotely from the location of their initial impact, where both impacts, and potentially also responses to those impacts such as adaptation, are transmitted across one or more borders". The concept implies first, a climate trigger (e.g. an extreme weather event) that induces an initial impact (e.g. crop damages) in a given location. This initial impact can in turn lead to ripple effects (e.g. on livelihoods, migration, or social relations) that reverberate through a so-called impact transmission system, possibly leading to effects that spread beyond borders (see Figure 1).

Figure 1. Transmission of climate impacts across sectors and regions.[6]



It is important to note that we do not necessarily consider the outcome of this impact chain to be negative per se. For instance, migration, such as in the wake of climatic pressures, often has positive social and economic effects and can increase the resources and resilience of sending communities, e.g. via remittances, despite other challenges that it can create (Ionesco et al. 2016). Cross-border climate impacts are nevertheless crucial to consider for a forward-looking foreign and development policy.

In the remainder of this section, we outline key effects of climate change on human security and development that can subsequently cascade across borders and/or affect foreign policy and development objectives of other countries in a significant way. We focus on the pathways and effects we deem most relevant from the perspective of European external action and cooperation with third countries. Our overview is indicative rather than exhaustive and meant to familiarise the reader with the foreign and development policy dimension of climate change impacts.

[6] Source: Carter et al. (2021).

Effects on livelihoods and human security

Livelihoods that are directly and heavily dependent on natural resources, such as those reliant on agriculture, pastoralism, and fisheries, are particularly vulnerable to climate change impacts. Temperature and rainfall shocks, along with extreme weather events, can disrupt these activities, thereby endangering incomes and exacerbating economic hardships (West et al. 2020). Loss of livelihoods can subsequently push individuals to turn to unsustainable and even illegal activities to make ends meet (which in itself can degrade the environment further), while at the same time reducing the affordability of basic foodstuff, thereby contributing to food insecurity (Detges et al. 2020).

Food insecurity is also particularly prominent in places that are highly dependent on food imports. As much of the world's production of staple crops takes place in a few regions, climate shocks in these producing regions can have an impact on global supply chains and international food prices (Detges et al. 2020). Consequently, this is likely to have important economic (as well as political) ramifications for import-dependent countries (Benzie et al. 2016; Ceballos et al. 2016; d'Amour et al. 2016).

There is a rich body of literature covering these so-called 'indirect' pathways in which livelihood and food price shocks connect climate change and political risks. However, some pathways, such as those related to health, have been relatively less studied (Detges et al. 2020), but nonetheless deserve attention. For instance, high temperatures, in combination with floods, can result in outbreaks of communicable diseases such as salmonellosis and cholera (Wu et al. 2016). The impacts of climate change on early childhood development and childhood malnutrition is also noteworthy (see Liu 2011).

All in all, the impacts of climate change on livelihood and human security can hamper the progress of international development cooperation. Specifically, climate impacts pose additional challenges for local, regional, and international actors to improve food security and economic opportunities in affected regions.

Effects on human mobility

Migration has always been an important strategy to cope with environmental changes, and a strategy for individuals to seek alternative sources of income (West et al. 2020). Additionally, migration can help reduce tensions in sending communities, while not necessarily leading to more conflict in receiving areas (Bosetti et al. 2020). Scholars, however, remain divided on how climate change could alter future human mobility patterns (Mosello et al. 2021).

Experts suggest that climate-related shocks in agricultural productivity and livelihood opportunities, as well as slow and rapid onset events (e.g. sea level rise, floods, and storms) are important migration drivers (Ionesco et al. 2016). Contrary to the popular notion that climate change will bring more international migration, the increase in mobility will likely remain internal for most parts, particularly in the form of rural-urban migration (Millock 2015). This, however, could create new challenges in receiving areas: cities with limited infrastructure and resources, for example, may not be able to offer essential services to newcomers and would face additional challenges that risk exceeding their administrative and planning capacities (Mosello et al. 2021).

Another line of argument suggests that extended periods of climate extremes could in fact reduce human mobility. This could happen in two ways: slow onset events may allow communities more time to adapt, therefore reducing the need to move away. On the other hand, the negative impacts of climate change on livelihoods and economic opportunities could make migration less affordable (Call et al. 2017; Koubi et al. 2016; Suckall et al. 2015). This would essentially "trap" populations who are already confronted with the challenges of climate change in a cycle where their livelihoods are put under even greater pressure (Detges et al. 2020). In turn, this could lead to more localised humanitarian crises, while also adding to the challenges faced by development actors in promoting food security and improving livelihood opportunities and well-being.

Effects on social cohesion and state-citizen relations

Together with rising resource demand, climate change could spur local competition over natural resources by altering resource access and availability, which in turn could lead to violence in some cases (Detges et al. 2020). At the same time, climate change could aggravate existing inequalities between social groups, given that some communities are more vulnerable than others to its effects (Burke et al. 2015; Mendelsohn et al. 2006; Narloch & Bangalore 2018; Sedova et al. 2019; Warr & Aung 2019). Deepening inequalities and hardship, in turn, can erode social relations, feed grievances, and fuel communal violence (Cederman et al. 2013; Guariso & Rogall 2017).

Climate shocks can also affect state-citizen relations. If the government is perceived to be unable or uncommitted to protect its citizens from the effects of climate change, public grievances and mistrust towards the state could sour (Detges et al. 2020). Political challenges and tensions can occur even when a government does provide disaster relief, as funds and resources to address an immediate crisis may be diverted from longer-term interventions and policies that are meant for sustainable development or political reforms (Foster & Fozzard 2000). Furthermore, if states end up borrowing large sums of money to cope with a climate-related crisis, and without sufficient international support, they could fall into substantial debt and lose the ability to fulfill essential public functions. This can seriously strain state-citizen relations (Detges et al. 2020).

The breakdown of social and state-citizen relations could in turn provide an opportunity for armed groups to capitalise on grievances and economic hardship (Mercy Corps 2016; Nett & Rüttinger 2016; Nillesen & Verwimp 2009). As armed groups often draw on existing divisions and inequalities, there is a real threat that social cohesion could break down further (Detges et al. 2020). Moreover, armed groups can exploit the government's apparent lack of support to the public and extend their influence by offering people a sense of community and security (Detges et al. 2020). Thus, the rise of armed groups, along with the erosion of state-citizen and inter-group relations, could complicate national and international efforts in promoting regional peace, security, and stability.

It should be noted that the erosion of political orders does not always lead to negative outcomes. On the contrary, it could foster non-armed, peaceful shifts in the balance of power and sharing of responsibilities between different actors. Civil society organisations and members of the private sector, for example, could step in to deliver the very services that state authorities struggle to provide in a moment of crisis (Lahn et al. 2021); even though this can incite authoritarian responses by sitting elites in some cases (see Wood & Wright 2015).

Effects on diplomatic relations between states

Diplomatic relations could be put to the test when two or more countries share a resource and when climate change alters its accessibility or availability. Transboundary rivers exemplify such a situation (see Munia et al. 2020). Economic development and population growth could drive up demand-side pressure on shared water resources, thereby increasing the potential for diplomatic tensions and conflict (Böhmelt et al. 2014). Moreover, upstream states could be tempted to build dams and water retention capacities in anticipation of future climate-related water scarcity, which could in turn raise serious concerns by downstream neighbours and strain relations between riparian states, especially in the absence of agreements and provisions for sharing water resources (Dinar et al. 2015; Tir & Stinnett 2012).

Cross-border water disputes do not necessarily culminate in violence or military action. Indeed, studies have shown that changes in transboundary water resource availability have rarely turned into inter-state wars and that the perception of a common threat such as climate change may, under favourable political conditions, even lead to increased cooperation between riparian states (see Dinar et al. 2015; Link et al. 2016; Tir & Stinnett 2012). Increased cooperation on water issues, in turn, can have spillover effects into other domains of diplomacy and thus improve relations between states overall (see Ide 2018; Ide & Detges 2018). Yet, with growing water demand, climate change, and increasingly erratic hydrological conditions, opportunities for such positive outcomes may dwindle in the future.

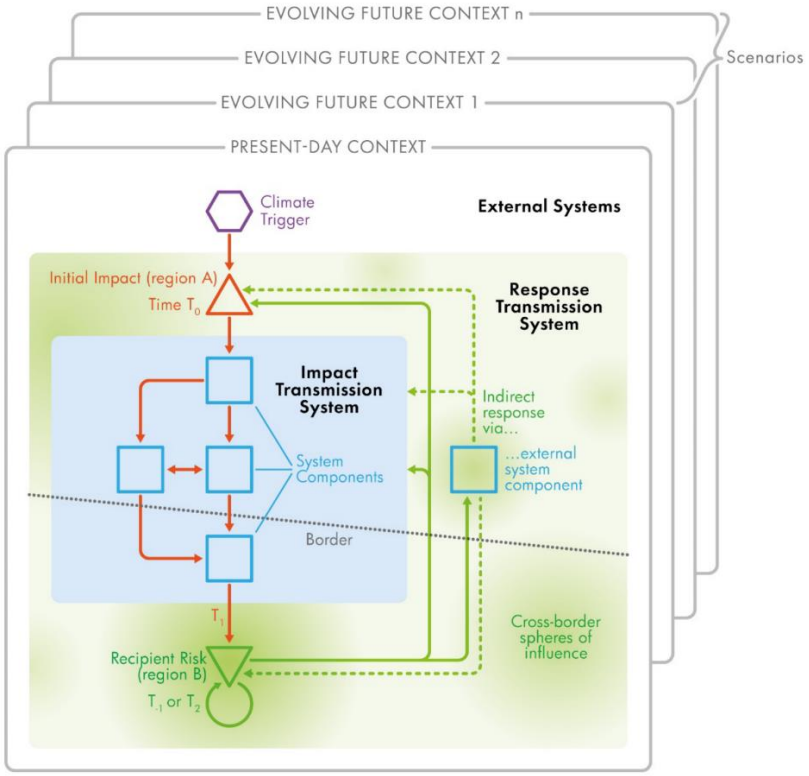
2.2 Social context and moderating factors

The effects and connections described above are possible, yet not bound to happen. “Neither individuals nor societies respond mechanistically to changes in the environment and the grievances they may trigger or aggravate” (Detges et al. 2020:13). What matters ultimately is the vulnerability (or resilience) of affected people, economies, and political systems, which depends on a number of contextual factors. We can expect negative effects of climate change on human security and development where initial impacts interact with other challenges that affect people’s ability to withstand shocks and address climate-related challenges (see Buhaug 2016; Gilmore 2017; Mach et al. 2019; Scheffran et al. 2019).

These factors moderate - i.e. attenuate or amplify - the effects of climate change at all stages of the impact transmission chain and are therefore important to consider in any assessment of cascading risk. For example, the impact of a drought on agricultural production will be moderated by the extent that drought-resistant crops are used, or that alternative water sources are available for irrigation. In turn, drought-induced agricultural production shortfalls will have a different effect

on rural livelihoods, depending on whether alternative income-earning opportunities, social safety nets, or drought relief aid are available for drought-stricken farmers. These moderating factors influence the "permeability" of the transmission system and thus ultimately determine how strongly the system's recipient will be affected. Depending on the future evolution of these moderating influences one can further imagine different scenarios in which cascading impacts are either amplified or attenuated in accordance with scenario-specific conditions (see Figure 2).

Figure 2. Cascading impacts, social context, and future scenarios.[7]



Based on a review of around 140 research articles and working papers,[8] we identify a number of conditions that make people and societies more or less susceptible to the adverse effects of climate change on livelihoods, human mobility, social cohesion, and political stability. These moderating factors, which are important to consider in the context of foreign and security policy and cooperation with climate-vulnerable countries, are summarised in the following pages.

[7] Source: Carter et al. (2021). Please note that Figure 2 also includes key elements of a response transmission system; i.e. the ways in which cross-border risks can be addressed by targeted responses along the impact transmission system. These responses are the focus of future work in CASCADES and are not discussed explicitly in this report.

[8] A summary of sampling methods and an overview of reviewed papers can be found in the Appendix.

Technology and physical infrastructure

Technological progress and the efficient use of resources and farm inputs are crucial to maintain agricultural productivity in the wake of climate change and limit adverse effects on livelihoods and food security. This includes the choice of crop varieties, access to technologies (including traditional knowledge) and services (e.g. agricultural extension and veterinary services for pastoralists), as well as the sustainable use of farm inputs (e.g. seeds, fertilisers).

Similarly, physical infrastructure not only improves water treatment, storage, and irrigation capacity in the face of droughts and dwindling water resources, but also plays a key role in flood prevention and in avoiding waterborne diseases (see e.g. Arouri et al. 2015; Hossain et al. 2019). In turn, this can help attenuate the effects of climate change on human mobility and security. For example, individuals who are protected from floods by embankments are less likely to migrate when faced with excessive rainfall (Call et al. 2017).

Resource and conflict management

Resource scarcity and competition - often aggravated by climatic changes - can lead to tensions and violent disputes between resource users in the absence of mediation channels. In this regard, resource management, regulations, and institutions - both formal and informal - play a critical moderating role, while also ensuring efficient use of resources in the face of climate stress. Indeed, the presence and number of traditional local government rules have been found to reduce people's support for violence in the event of a drought (Linke et al. 2018a).

Related to this is the level of institutional development concerning property rights (McGuirk & Burke 2017). In this regard, land use rights and tenure systems are instrumental moderating factors (Guardado 2018; Hidalgo et al. 2010). Farm households with land certification in Ethiopia, for example, have been found to be less likely to experience land-related disputes when faced with water scarcity than households without such arrangements (Di Falco et al. 2019).

Economic structure, resources, and opportunities

Politics aside, various socioeconomic factors also play a key part in moderating a population's response to climate-related impacts. An important factor in this regard is wealth, the lack of which could make populations more susceptible to climate risks with little financial capacity to adapt. For example, low income countries experiencing temperature fluctuations face a higher risk of civil conflict (Bosetti et al. 2020), but could see a reduction in migration as financial constraints make migration too costly even when there is a high incentive to move (Cattaneo & Peri 2016; Peri & Sasahara 2019). On the other hand, households with greater wealth have a better chance to migrate when confronted with climatic stress (Hirvonen 2016). Moreover, access to credit, remittances, insurances, and alternative financial resources can also help cushion the economic impacts of climate-related disasters and extremes (Arouri et al. 2015; McDermott et al. 2014; Wineman et al. 2017).

Agricultural dependence, whether as a share of gross domestic product (GDP) or land area, also emerges as an important moderating factor, given the sensitivity of the sector to climatic changes (e.g. Aburn & Wesselbaum 2019; Von Uexkull et

al. 2016; Wesselbaum 2020). In particular, areas depending on rainfed agriculture are more vulnerable to droughts, the occurrence of which can increase the risk of violence (Von Uexkull 2014). Wealth, literacy rates, and access to markets and social safety nets also play important roles (Fjelde & Von Uexkull 2012; Peri & Sasahara 2019; Slettebak 2013).

Trade and access to markets

Markets, particularly their size and accessibility, shape people's options for coping with climatic extremes. In Somalia, for example, droughts drive down livestock prices on local markets, as animals risk dying of hunger or thirst before they are sold, and because producers mostly struggle to sell at more distant markets that are not affected by drought. As a consequence, pastoralists' livelihoods deteriorate, which also has an effect on local conflict dynamics (see Maystadt & Ecker 2014). But markets, terms of trade, and the ease of obtaining foreign currency also play a crucial role for the vulnerability of food-importing countries to climate-related price spikes, for example, when food production in major exporting countries is hit by climatic shocks (see Lahn et al. 2021).

Governance and state-citizen relations

Institutions and governance have a huge influence on whether and how climatic pressures can translate into social, political, and economic risks downstream. Regime types, from autocracies to democracies, influence how much political space people are given to express their grievances and to resolve disputes that could arise when climate-related impacts disrupt livelihoods (Eberle et al. 2020; Hendrix & Haggard 2015). Likewise, a high level of political marginalisation, such as those based on ethnic or religious affiliation, could amplify social and political tensions in the wake of climatic shocks (Couttenier & Soubeyran 2014; Detges 2017b; Fjelde & Von Uexkull 2012; Schleussner et al. 2016; Von Uexkull et al. 2016).

How the government is perceived to be providing for its people plays a major role in shaping state-citizen relations, and consequently how the effects of climate shocks and pressures could manifest. In this regard, access to essential services and infrastructure, such as water, electricity, roads, and health care, is widely seen as indicative of the level of involvement or interest by the government in supporting local livelihoods (Cao et al. 2020; Detges 2016). For example, Slettebak (2013) shows that the effect of climatic shocks on the risk of politically motivated violence is higher where access to education is poor. Additionally, corruption and 'rent-seeking' behaviours by government authorities could fuel public distrust and prompt communities to turn away from the state and embrace revolutionary or extremist ideas. In particular, the embezzlement of relief aid by elites in the wake of climatic shocks has been shown to deteriorate state-citizen relations in the Sahel (see Benjaminsen et al. 2012).

Social and diplomatic relations

How the social and political effects of climate change manifest also depends on pre-existing social relations. For instance, climatic shocks may deepen existing inequalities and aggravate a prevailing sense of injustice or grievances felt by certain parts of the population (see Harari & La Ferrara 2018). Likewise,

experience of violence and victimisation in the past makes it more difficult for people to trust each other and cooperate in the wake of climate shocks (Linke et al. 2018b).

A similar logic applies in part to relations between states in the wake of climatic extremes. Pre-existing diplomatic relations and geopolitical competition affect how countries cooperate or clash over shared resources. A high degree of institutionalisation of cooperation, for example, has been found to offset the risk of inter-state conflict in the wake of increased water scarcity (Tir & Stinnett 2012).

Demography

Demographic trends can have significant bearings on the economic and social impacts of climate change. Population densities are an important factor in this regard. On the one hand, climatic shocks may be deadlier and lead to more destruction in densely populated areas (IPCC 2014). On the other hand, resource competition might be fiercer in densely populated areas where higher demand and degradation of resources collide with climate-induced shortages (Döring 2020).

Urbanisation levels are another important moderating factor. Studies have shown that urban areas, in comparison to more remote locations, are more likely to experience severe welfare loss and social turmoil when exposed to climatic shocks or consumer price spikes (see McGuirk & Burke 2017; Thomas et al. 2010). Other demographic factors such as age and gender also influence how the effects of climate change might ultimately manifest. For instance, age and gender play significant roles in influencing an individual's decision to migrate in the wake of climatic shocks (Gray & Mueller 2012; Mueller et al. 2020; Thiede et al. 2016).

Natural physical environment

Furthermore, the very features of a population's environment (e.g. country size, topography, soil type) could also be important moderating influences (see e.g. Carter & Lybbert 2012; Couttenier & Soubeyran 2014; Gröschl 2012). Rough terrains such as mountains, for example, have been found to be correlated with the incidence of climate-related conflicts (Couttenier & Soubeyran 2014), due to the tactical advantages they offer for armed groups (Fearon & Laitin 2003). In a similar fashion, communities residing close to rivers are technically less reliant on direct rainfall for their day-to-day needs and are hence less vulnerable to erratic rainfall patterns, as compared to those living further away (Landis et al. 2017).

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This chapter has shown that climate change can have multiple and significant impacts on the security and development of climate-vulnerable countries and, by extension, on their international partners and allies. It has also shown that context matters and that future risks will not only depend on climatic trends and challenges but also on the ability of societies to overcome these challenges. The following chapter discusses what this means for EU foreign and development policy and explores possible challenges in focus regions of European external action.

3. Challenges in focus regions of European external action

European countries are, in global comparison, relatively well equipped to deal with climatic shocks and knock-on economic consequences within their borders (see ND-GAIN 2019). Yet, when considering that a great number of the EU's partner countries are much more vulnerable to the immediate effects of climate change and also considering how closely the EU is connected to these partners, e.g. through trade, investments, migration, and foreign policy links, a different picture emerges. It is easier then to appreciate the indirect effect that adverse climatic change in other regions can have on European economic and geo-political interests.

What particular challenges should EU policymakers prepare for then? In this chapter, we try to answer this question by focusing on countries and regions outside the EU that are a) particularly exposed and vulnerable to climatic hazards, that b) have close ties with European partners, and that c) are emblematic of the kind of climate-related challenges that (potentially) also affect other partners of the EU. In particular, we focus on cases in Europe's southern neighbourhood but extend our analysis also to the Western Balkans and to more remote regions in the final section of this chapter (see Table 1 below).

Table 1. Regions covered in the analysis.

Region	Selection criteria
North Africa	Particularly vulnerable to climatic hazards; close ties with European countries; prone to climate-related challenges (livelihoods and human security, migration and urbanisation, political instability, violent extremism, transboundary water resources).
Middle East	
Central Sahel	Particularly exposed and vulnerable to climatic hazards; close ties with European countries; prone to climate-related challenges (livelihoods and food security, human mobility, social tensions and opportunities for armed groups).
Western Balkan	Very close ties with European countries (in particular trade, investments and partial political integration); Very relevant from the perspective of migration to the EU; extends geographical coverage of the analysis.
South Asia	Particularly vulnerable to climatic hazards; figures very prominently in research on climate and migration links; extends geographical coverage of the analysis.
Central Asia	Vulnerable to climatic hazards; strong climate-migration links that are potentially relevant for the EU; extends geographical coverage of the analysis.

3.1 North Africa

As one of the world's driest regions, North Africa[9] is highly susceptible to the impacts of climate change. Rising temperatures, increasingly erratic rainfall, and prolonged droughts threaten the region's agricultural and water sectors (Desmidt 2021) - North Africa is expected to see an increase in agricultural and ecological droughts under a 2°C warming scenario (IPCC 2021b). On the other hand, sea level rise presents a major risk to coastal areas and cities such as Alexandria, Algiers, and Benghazi (World Bank 2014).

Water scarcity is of particular concern, especially as inefficient irrigation systems have overexploited groundwater resources, resulting in a significant decline in aquifer levels (Froebich et al. 2020). The most recent climate projections indicate that the decrease in rainfall levels will be especially pronounced in the Mediterranean parts of North Africa, although much of the Saharan parts will see an increase in heavy precipitation and pluvial flooding (IPCC 2021b), which also present a number of challenges.

North Africa is a vital partner region for the EU in terms of development, trade, migration, and security. For instance, Europe was the MENA region's most important trading partner, with the value of trade averaging USD 637 billion per year between 2014 and 2017 (ECFR 2019). Compared to other OECD countries, the EU has taken in the largest share of migrants from North Africa and is also the main destination of refugees from Libya and the Maghreb countries, underscoring the importance of the EU as a destination and safe haven for people in the region (West et al. 2020).

North Africa is also an important focal point of EU external action through frameworks such as the EU Neighbourhood Policy and Union for the Mediterranean. Through these frameworks, the EU has become a prominent contributor to climate resilience projects in the region, with an emphasis on renewable energy, energy efficiency, and water security (European Commission 2015; Lahn et al. 2021; UfM 2019). However, diplomatic relations between the EU and North Africa still depend heavily on a bilateral framework that pursues "political cooperation based on mutual interests" (De Groof et al. 2019). There is also a general lack of regional cooperation focusing specifically on the connection between climate and security issues (Desmidt 2021).

[9] For the purposes of this report, "North Africa" designates the northern African countries bordering the Mediterranean Sea. This section draws heavily on Lahn et al. (2021), which covers both North Africa and the Middle East.

Livelihoods and human security

Agriculture is a key sector for the economies of North Africa. Much of the sector is export-driven and targeted to the EU market - over 70% of the EU's olive oil imports, for example, come from the region (West et al., 2020, Table 4). Likewise, the region is highly dependent on imports of staple food items. Egypt is the world's largest importer of wheat, and several other North African countries have relatively low self-sufficiencies in wheat production (FAO et al. 2021). This leaves much of North Africa sensitive to fluctuations in international food prices, with potential consequences for regional food security.

Moreover, many North African economies are highly dependent on oil and gas exports, further exposing them to the risks associated with international market dynamics, particularly possible shifts in demand for fossil fuels, driven by political efforts to curb greenhouse gas emissions worldwide. Algeria and Libya are particularly exposed to these risks, given that over 90% of their respective total merchandise exports are derived from hydrocarbon exports (Lahn et al. 2021).

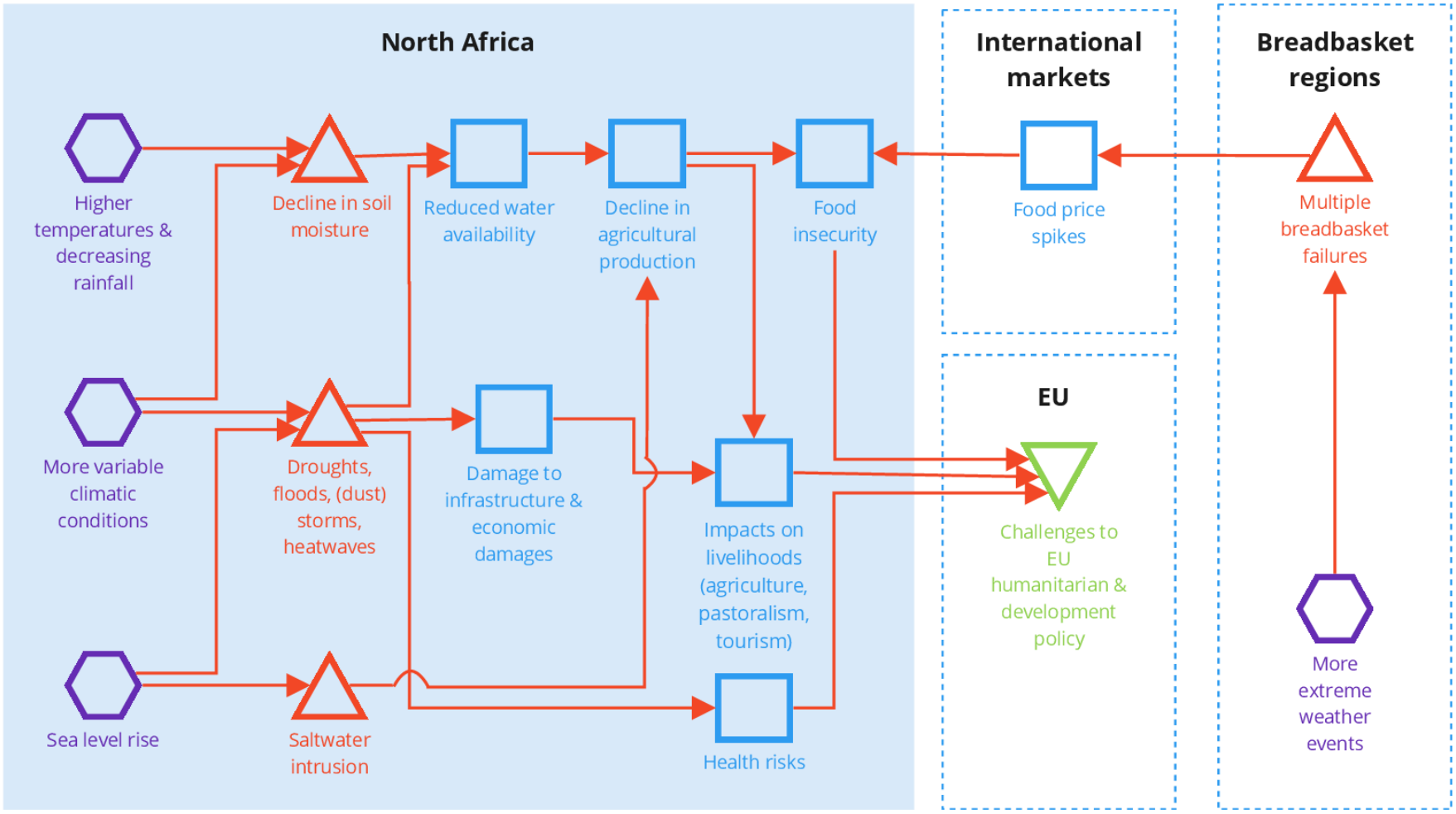
As much of North Africa's agriculture is rainfed (70%), the sector itself is at high risk from climate change impacts, particularly from declining rainfalls and increased rainfall variability and occurrence of extreme weather events like heatwaves and droughts (Desmidt 2021; Knaepen 2021; Radhouane 2013; Verner et al. 2018). These risks are compounded by the fact that crop production methods are not always suited to changing environmental conditions. In Tunisia, for example, the majority of wheat cultivation still depends directly on rainfall, and farmers have responded to drought-induced harvest losses by exploiting scarce groundwater supplies (Knaepen 2021).

Ultimately, the resulting decline in agricultural production and consequently agriculture's contribution to GDP could be substantial for certain North African countries such as Morocco and Egypt (Lahn et al. 2021). Furthermore, sea level rise could disrupt agricultural livelihoods along the Nile Delta by exacerbating problems of land subsidence, saltwater intrusion, and poor drainage (Jobbins & Henley 2015).

Sea level rise is also a major risk for the coastal parts of North Africa, especially those along the Mediterranean, many of which are highly dependent on tourism (Verner 2012). Both Morocco and Tunisia stand out as some of the most successful tourism industries in the whole MENA region, with Tunisia's beach resorts being a popular destination for European tourists (Timothy 2018). Along with sea level rise, more frequent and intense storms in coastal areas could therefore damage infrastructure, with devastating impacts on businesses and tourism economies (Lahn et al. 2021).

Moreover, the health of populations across North Africa could also be at stake as a consequence of climate change. Warmer temperatures and longer heatwaves - exacerbated by climate change - could lead to more health problems in a region that already registers high summer temperatures, particularly in the form of heat stress (Ranasinghe et al. 2021:33; Zittis et al. 2021). Dust storms also present a health hazard (Querol et al. 2013), with potential effects on the transmission of infectious diseases (Agier et al. 2013; Wu et al. 2016). However, dust storm projections in North Africa are less certain due to uncertainties in future wind and precipitation patterns as well as land use changes (Ranasinghe et al. 2021:36).

Figure 3. Climate change, livelihoods, and human security in North Africa.



Breadbasket regions include major food-producing regions such as Brazil, the United States' Midwest, and eastern China.

Box 1: COVID-19 in North Africa.

Climate change not only exposes populations across North Africa to various health hazards, as mentioned above - conversely, health hazards themselves could intensify the impacts of climate change on livelihoods and human security. Such is the case with the COVID-19 pandemic. In particular, health measures such as mobility restrictions have severely disrupted food supply chains across the region: transport was restricted, agricultural labour and inputs were limited, and overall agricultural productivity declined, resulting in a loss of agricultural income and a spike in domestic food prices (FAO 2021b; IMF 2020). Moreover, the pandemic's mobility restrictions impacted key tourist destinations in the region - Morocco, for example, saw a 2% loss in GDP from tourism alone (Strauss 2020).

COVID-19's economic impacts have thus exacerbated the precarious conditions of many agriculture- and tourism-dependent communities. What is more, the loss in income and savings could also reduce the adaptive capacity of these communities to the growing challenges presented by climate change. The effects of COVID-19, as well as government responses, may also contribute to the erosion of state-citizen relations and make North African countries more susceptible to social unrest, should climate change put further stress on communities and disclose further government neglect or failures. Despite the initial successes of North African governments in managing the pandemic, their less coherent responses in subsequent waves of the pandemic, coupled with prevailing economic hardships, have made the region's security situation ripe for protest. Such was the case, for example, in Tunisia where protests over the country's dire economic situation erupted in early 2021 (Financial Times 2021).

Finally, crises like COVID-19 could make EU external action on promoting regional development and climate resilience more challenging. The economic impacts of the COVID-19 pandemic could, for example, redirect resources away from climate-related measures towards addressing more visible short-term economic and health concerns in the region.

Source: Wolfmaier et al. (2021).

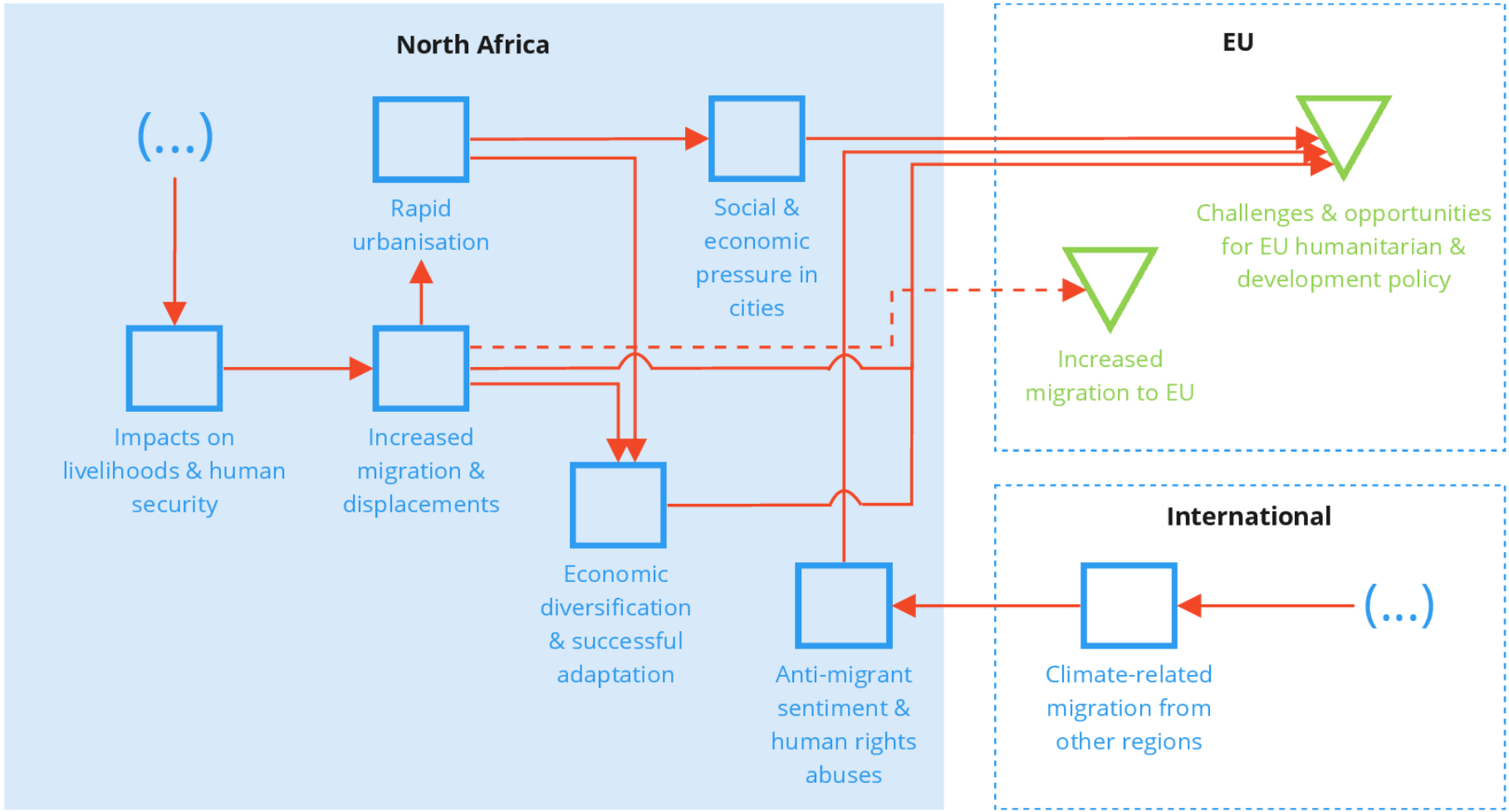
Migration and urbanisation

North Africa has historically been an important destination, transit, and departure point for migration (Desmidt 2021). At the same time, North Africa stands out as one of the most urbanised regions on the African continent, with urbanisation levels in Egypt and Libya reaching 93% and 81% respectively in 2015 (Kanos & Heitzig 2020). Urbanisation trends in the region are expected to continue, driven in part by rural-urban migration; Cairo's population, for example, is projected to rise from around 20 million in 2018 to more than 25 million by 2030 (UN DESA 2019).

Although the links between environmental hazards and migration are weak for the MENA region (Hoffmann et al. 2020), climate change could continue to have an influence on migration through its impacts on livelihoods and rural economies. This could present a major challenge for current and future EU-North African migration policies in the long run, particularly as the larger share of irregular migration across the Mediterranean to the EU has recently shifted towards the central and western routes, which pass through Libya and Algeria-Morocco respectively (Council of the European Union 2021). In addition, reports of human rights abuses faced by migrants being trafficked across North Africa have also surfaced more frequently in recent years, demonstrating the rising challenges faced by migrants in the region (Nissling & Murphy-Teixidor 2020).

While climate-induced water stress and lower agricultural productivity may increase rural-urban migration, likewise, climate change could also drive urban-urban migration, especially from coastal cities that are at risk from sea level rise (Lahn et al. 2021). These movements could be beneficial in terms of economic diversification and adaptation, if cities are able to provide for in-coming migrants. However, cities in North Africa are at present vulnerable to the cascading effects of climate change, as they often lack administrative capacities, regulations, and the necessary infrastructure for more climate-resilient urban development (Lahn et al. 2021). This leaves the populations of both city residents and migrants highly exposed to a range of social, economic, and ecological challenges. It may also thwart EU efforts to support urban resilience in North Africa, especially in the food, water, and energy sectors (see Elgendy et al. 2021).

Figure 4. Climate change, migration, and urbanisation in North Africa.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 3.

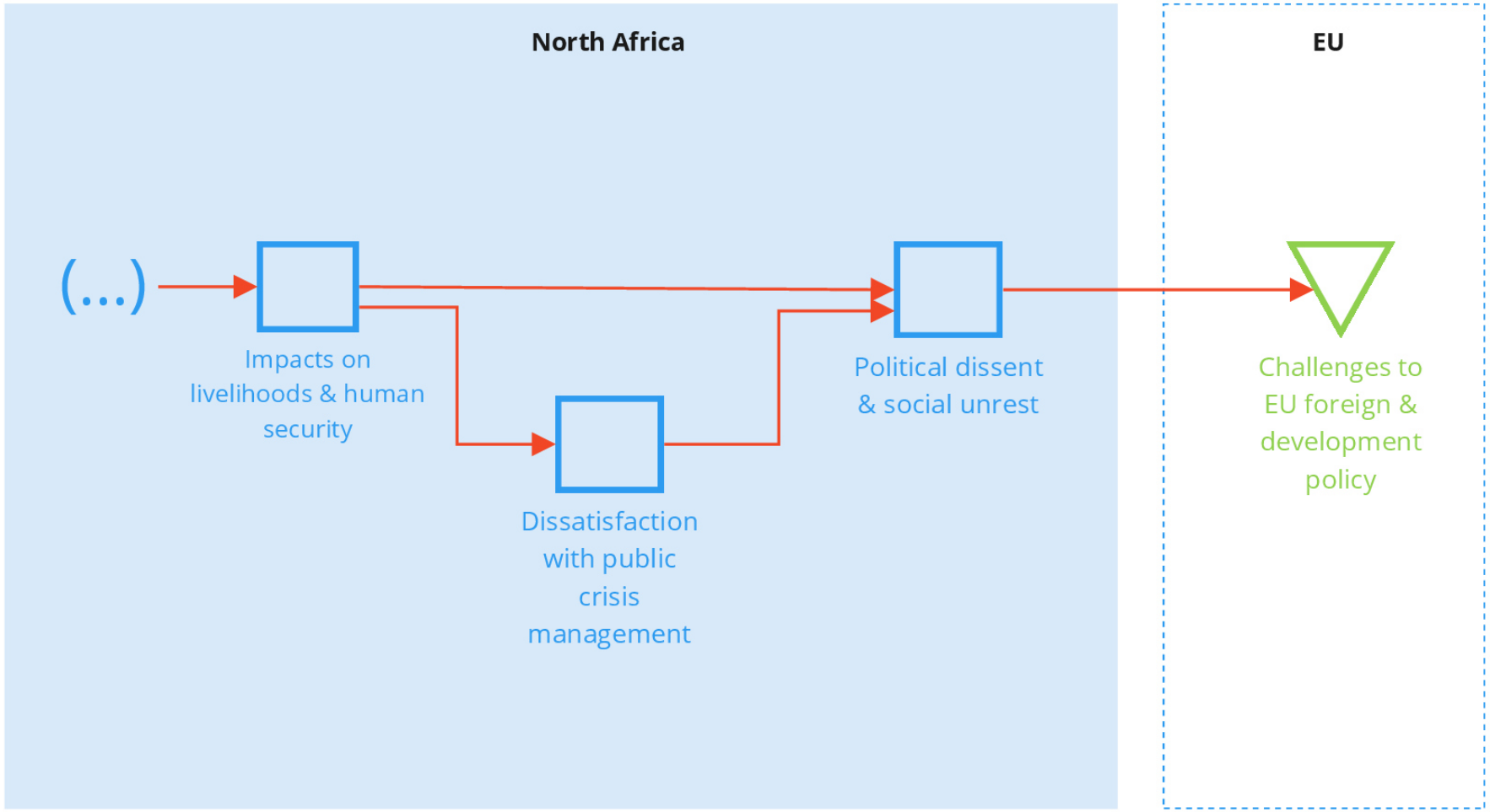
Political dissent and repression

A combination of authoritarianism, public discontent, and struggling economies have left North Africa's political situation in a fragile state - made worse by the COVID-19 pandemic (Wolfmaier et al. 2021). Inequality within North Africa's export-oriented agricultural sector could also aggravate social tensions: in Tunisia's olive sector, for example, smallholder farmers face limited opportunities to access credits and loans in comparison to large-scale agri-businesses (Knaepen 2021). These are of particular concern to the EU whose economy and security are closely interlinked with the region's political stability (West et al. 2020).

Climate change further compounds these challenges, although the extent to which this happens also depends on other factors. Key factors are the pre-existing levels of distrust and frustration that the public has towards political elites and the way those respond to climate-related crises. If not handled well, such crises, in combination with other underlying factors such as unemployment, high food prices, and absence of political freedom, can fuel discontent and possibly unrest (Lahn et al. 2021; Müller et al. 2021). Conflict data collected by ACLED shows that since 2011, popular protests have been on the rise, with a steeper increase since 2014, and again since 2018/2019. In several cases, these protests have been fueled by a mix of socioeconomic and environmental concerns, and a sense of political marginalisation by central governments. This includes for example the protests against (drinking) water scarcity in Tunisia and Morocco, and protests against shale fracking in Algeria (Desmidt 2021).

Furthermore, political instability can just as well result from insensitive responses to climate change by North African governments. If authorities decide to securitise climate change and use it as a pretext for heavy-handed measures, such as hard border closures, mobility restrictions, and land seizures, this can further stoke public dissent (see Lahn et al. 2021).

Figure 5. Climate change, political dissent, and repression in North Africa.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 3.

Violent extremism

North African countries, specifically those in the Maghreb, are characterised by their robust state structures and strong security apparatus which have largely kept armed opposition and terrorist groups at bay - with the exception of Libya (Bourekba 2021). However, the recent crackdowns on public protests over grievances could, along with climate change impacts, fuel more public distrust and provide more opportunities for violent extremism to thrive (Bourekba 2021). Consequently, this could pose a major challenge to the EU's counter-terrorism support measures in the region.

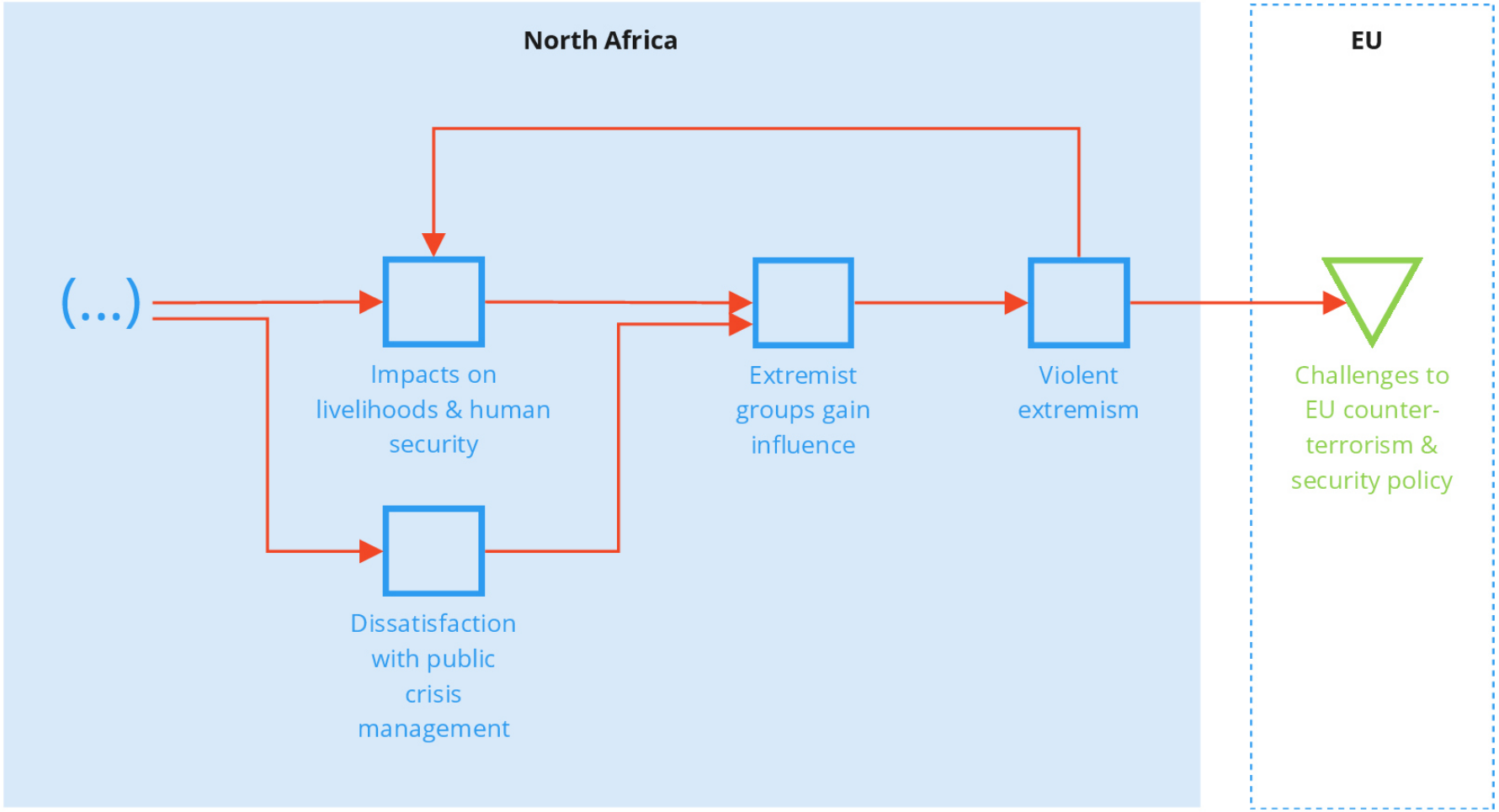
A multitude of factors can lead to radicalisation in North Africa, including political and economic exclusion as well as state repression, and these, in turn, are often exploited by extremist groups for recruitment (see Alonso & Rey 2007; Marks 2013; Torelli et al. 2012). Climate change has the potential to aggravate these risks. Climate-induced loss of livelihoods in the agricultural and tourism sectors could feed into existing grievances as well as food and water insecurity (Bourekba 2021), thereby drawing individuals closer towards extremist ideologies.

Climate change could also add pressure for governments and institutions to effectively protect their citizens - failure to do so could damage the social contract - which has already been under huge strain since 2011. Climate-related water shortages and disasters, for example, could increase public demand for the government to provide drinking water and other services, failure of which could erode people's trust and confidence towards the state. Extremist groups may capitalise on this by presenting themselves as alternative providers and saviours, thereby strengthening their position among the public (Nett & Rüttinger 2016).

Meanwhile, violent extremism and military responses by North African governments could increase the vulnerability of communities to climate hazards. A case in point are the counter-terrorism measures in border regions between Morocco, Algeria, and Tunisia which have disrupted informal cross-border trade, thus depriving border communities of an important adaptation strategy (Santini & Cimini 2019). Under such circumstances, deprived communities may become more drawn towards violent extremism (Roussellier 2018), especially when climate-related impacts disrupt their livelihoods.

Past evidence for a link between climate change and violent extremism in North Africa is scant (Bourekba 2021). Yet, given the prevailing state of fragility in Libya and in southern neighbouring countries like Mali, as well as mounting climatic pressures, the region could experience more climate-related extremist violence in years to come.

Figure 6. Climate change and violent extremism in North Africa.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 3.

Conflict and cooperation in transboundary river basins

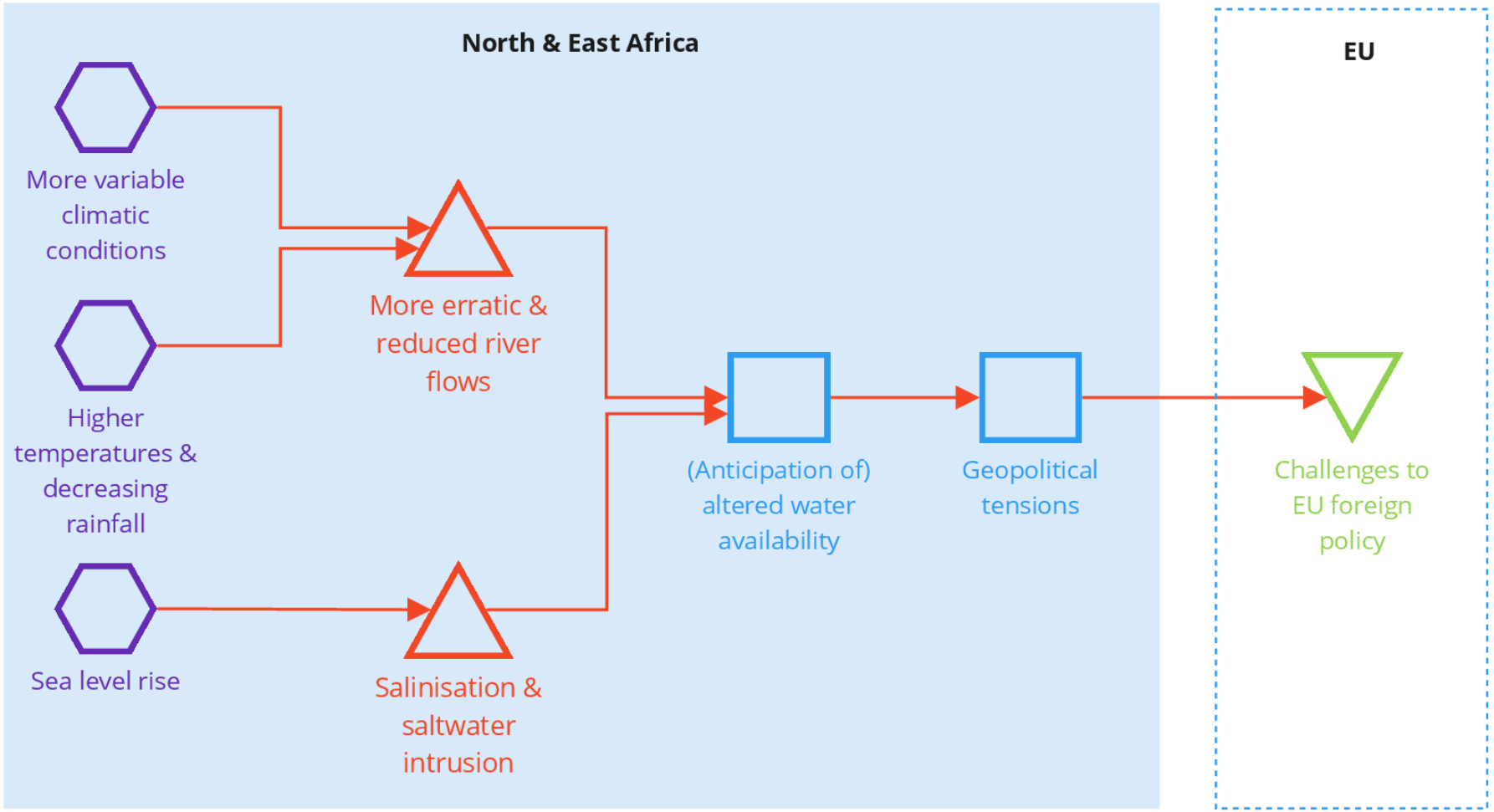
Water stress is a major concern for populations across North Africa, especially so for those along the Nile River Basin. Egypt in particular stands out – internal factors such as rapid population growth, high domestic water consumption, and expanding (and inefficient) irrigation water use contribute to the country's water stress (Dakkak 2020).

However, some factors are beyond Egypt's boundaries (and control) – the Grand Ethiopian Renaissance Dam (GERD) in upstream Ethiopia is a case in point, as downstream Egypt fears that the filling and operation of the dam would affect its water security (Climate Diplomacy n.d.b). This has led to disputes between the Nile's riparian countries, including Sudan, which could have major ramifications for the region's stability and EU foreign policy interests.

While different climate models provide varying accounts of the future of the Nile river flows, there is a general consensus that temperatures will rise in the Blue Nile region (on which the GERD is located), leading to higher evaporation rates and runoff deficits (Coffel et al. 2019; Lahn et al. 2021). Sea level rise could also add more pressure on the agricultural and water sectors in the Nile delta, through salinisation and saltwater intrusion (Stanley & Clemente 2017).

These climate impacts could compel Egypt to become more hostile towards development projects upstream of the Nile, such as the GERD, thereby complicating efforts to maintain friendly relations and cooperation in the basin (Climate Diplomacy n.d.b).

Figure 7. Climate change, conflict, and cooperation in transboundary river basins in North and East Africa.



Salinisation and saltwater intrusion are more localised effects in the case of North Africa, specifically in the Nile delta.

Social context and future vulnerability

The risks presented in the previous pages could very well intensify in the near future, but do not have to. A downward spiral of increasingly difficult climatic, economic and political conditions in North Africa could for instance be counteracted by efficient and inclusive institutions, improved economic opportunities, and other factors that augment the resilience of the region to the adverse effects of climate change. The future evolution of socioeconomic and political conditions will thus be key.

For example, North Africa's reliance on rainfed agriculture and cereal imports is currently a factor of vulnerability in the face of local drought risks and possible volatility in international food prices if major grain exporting regions of the world are hit by climatic shocks. But we may very well imagine a scenario, in which the region's agriculture becomes more resilient and dependence from food imports is reduced. Likewise, the region's resilience to climate change will depend on the success of reforms that improve access to education and to other services for a rapidly growing population. It will also depend on reforms that promote economic opportunities in sectors less directly affected by climate change. Physical infrastructure and future urban planning are other important factors to consider, given rising sea levels that threaten coastal cities in the region (Lahn et al. 2021).

State-citizen relations in North Africa have been tense in the past due to a combination of authoritarianism, lack of political freedom, political marginalisation, public discontent with political elites, and social inequities. In Tunisia for example, coastal areas and large agri-businesses are often major recipients of economic and infrastructural support, as opposed to interior, rural, and smallholder agricultural communities. Moreover, institutional reform has been hampered by conflict and political instability. In particular, the development of local-level institutions and decentralised governance systems has been difficult. These factors currently undermine the ability of communities to withstand shocks and avoid conflicts in the face of adverse environmental conditions (Lahn et al. 2021). This situation could worsen or improve in the future, depending on the ability of North African countries to reform, as well as on the economic and political conditions they will face internationally.

Future climate vulnerability (or resilience) in North Africa is yet to be determined. Depending on the evolution of the region's economies, institutions and overall social relations, it might be able to avert the worst impacts of climate change and embark on a resilient pathway. Table 2 summarises our assumptions about possible socioeconomic and political scenarios for North Africa and of their implied vulnerability (or resilience) to the cascading impacts of climate change along the key dimensions discussed in Section 2.2. The scenarios follow the five Shared Socioeconomic Pathways (SSPs) over the period 2020-2050. A more detailed analysis and discussion of underlying factors of vulnerability and resilience can be found in the appendix (Table 5).

Table 2. Future resilience and vulnerability to cascading climate impacts in North Africa.[10]

Context Factor	SSP1 – Sustainability (2050)	SSP2 – Middle of the road (2050)
Technology and physical infrastructure	Adopting more sustainable technologies and using resources more efficiently, people in the region are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Yet, productivity levels remain slightly lower than in SSP5 due to limited fertiliser use.	Slow diffusion of new technologies and progress towards sustainability means that North African countries are susceptible to some extent to experiencing adverse effects of climate change on water availability and agricultural production.
Resource governance and conservation	Cooperative and sustainable approaches to cross-border resource management limit the adverse economic effects of climate change and discourage conflicts over climate-sensitive resources.	Conflicts over access to water and land are possible in the wake of climate change, due to imperfect institutions and cooperation mechanisms. Population growth and increasing water demand make it somewhat more challenging to withstand climatic shocks and pressures.
Economic structure and opportunities	More equitable access to education facilitates income diversification and makes it easier to prepare for- and to recover from climatic shocks.	Moderate opportunities outside the agricultural sector and intermediate access to education make climate adaptation somewhat challenging.
Trade and access to markets	Good access to global and European markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes, due to food import dependence.	Obstacles to international and inter-regional trade somewhat reduce the ability to cope with climate change. Global food price spikes remain a challenge, due to food import dependence.
Governance and state-citizen relations	Improved governance and decentralisation of institutions, more equitable access to services and improved state-citizen relations and civil society empowerment increase adaptive capacity and reduce the prospects of climate-induced grievances and social turmoil. Yet, political reforms in rentier states bring some governance challenges and uncertainty.	To some extent, climatic pressures can lead to or aggravate public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges. Institutions remain somewhat centralised, which hampers effective climate adaptation.
Social relations	Greater social equity and cohesion facilitate climate adaptation and reduce the risk of grievances in the wake of climate change. More harmonious and cooperative relations between communities discourage conflicts over access to resources.	To some extent, climatic pressures can aggravate social tensions as North African countries come to grips with a legacy of inequality and tensions among and within countries, which also complicates climate adaptation.

[10] Sources: Abdelkader et al. (2018); Andrijevic et al. (2020); Borgomeo et al. (2018); Burek et al. (2016); Carter et al. (2020); Dellink et al. (2017); Jiang & O'Neill (2017); KC & Lutz (2017); Lahn et al. (2021); Mazzoni et al. (2018); Nechifor & Winning (2016); O'Neill et al. (2017); Rao et al. (2019); Riahi et al. (2017); Wada et al. (2016).

Table 2. Continued.

Context Factor	SSP3 – Regional rivalry (2050)	SSP4 – Inequality (2050)	SSP5 – Fossil-fuelled development (2050)
Technology and physical infrastructure	Overexploitation of natural resources and disregard for sustainability and climate resilience make North African countries much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Resurgent nationalism and antagonisms hamper the diffusion of resilient technologies.	Deepening inequalities in the access to technologies and resources make low income countries and marginalised communities in the region much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. They are thus also more vulnerable to knock-on effects on livelihoods, food, water, and energy security, health, and political stability.	Due to rapid technological change, infrastructure development, and efficiency gains, North African countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Yet, heavy reliance on hydrocarbons raises notable environmental risks that hamper climate adaptation.
Resource governance and conservation	Rapid population growth and rising water demand paired with inefficient resource governance increase climate-related risks for livelihoods and human security.	Unequal power and access to resources create tensions that risk to be aggravated by climate change but are unlikely to spawn full blown war. Disadvantaged groups remain highly vulnerable to climate impacts on livelihoods and human security, in particular in rural and peri-urban areas. Violent protest can ensue when political responses to climate change are inadequate.	Pragmatic and mostly cooperative approaches to resource governance limit the adverse effects of climate change, as well as potential conflicts over climate-sensitive resources. Yet, potentials for more sustainable and equitable resource use are not fully realised, leaving some communities vulnerable to the effects of climate change.
Economic structure and opportunities	Poor access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change.	Unequal access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and susceptible to social turmoil.	Rapid economic development and opportunities outside the agricultural sector make it easier to adapt to a changing climate.
Trade and access to markets	Trade restrictions hamper effective climate adaptation. Protectionist policies in food producing countries increase the risk of global food price spikes in the event of multiple breadbasket failures.	Limited access to global markets hampers effective climate adaptation by low income countries and small producers, which also remain vulnerable to global food price spikes.	Good access to international markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes.
Governance and state-citizen relations	Ineffective governance, poor service delivery for a rapidly growing population, and divisive rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. Institutional reforms are stalling and heavily centralised governance systems make it difficult to address climate-related challenges locally.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. In particular in structurally neglected areas. Yet, aggrieved groups will rarely have the means to challenge political regimes in a significant way.	Improved governance and access to services lead to more harmonious state-citizen relations and higher resilience against climate-induced social and economic pressures.
Social relations	Social inequalities and polarisation increase the prospect of grievances and communal conflict in the wake of climate change.	Social inequalities and the concentration of power among a small elite reduce adaptive capacity and increase the prospect of social tensions in the wake of climate change.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) in the wake of climate change.

3.2 Middle East

Similar to North Africa, the Middle East[11] is subject to a wide range of climate change impacts. Along with rising temperatures and more severe droughts, heavy precipitation is expected to increase in frequency and intensity, although there are strong seasonal differences - precipitation is expected to decrease in summer, while the opposite trend holds in winter (IPCC 2021c).

Furthermore, parts of the Middle East are highly exposed to sea level rise and the risks associated with it, namely saltwater intrusion and storm surges (Şen 2019). The Shatt al-Arab River in Iraq, for example, is among the world's deltas most at risk in terms of sea level rise and flooding (Tessler et al. 2015).

Relations between the EU and the Middle East run deep on many fronts. Besides migration and security - topics that often connect both regions in the international spotlight - the EU is also an important trading partner of the region. As an example, the EU is the largest import partner of Gulf countries, with 17.8% of the region's imports coming from the EU in 2020 (European Commission 2021).

The EU is also a major contributor of overseas development assistance (ODA) to many countries in the region. Specifically, some Middle Eastern countries (e.g. Iraq and Syria) are major recipients of the EU's ODA disbursements on peacebuilding and conflict prevention (West et al. 2020).

Livelihoods and human security

The economic structure of the Middle Eastern countries varies widely, ranging from high income, predominantly urban hydrocarbon-exporting states in the Gulf (Qatar, UAE, Kuwait, Bahrain) to countries where agriculture plays a larger role in both the formal and informal economies (including Iran, Syria, and Yemen). The region also includes fuel importers that are highly dependent on foreign aid (e.g. Palestine, Lebanon, and Jordan) (Lahn et al. 2021).

Agriculture has widely been regarded as the sector that is "likely to be affected most severely by climate change" in the region (Lahn et al. 2021). Consequently, the deleterious impacts of climate change on crop production could severely affect food security and livelihoods in the region (Voss et al. 2013). However, the transition to decarbonised energy systems - globally advocated in response to global warming - also indicates declining markets for oil and gas, and thus a squeeze on the key revenue streams and spending power for exporter governments.[12]

Major disruptive climate factors in the region include rising temperatures, higher evapo-transpiration rates, water shortages, as well as sea level rise through effects such as saltwater intrusion into coastal aquifers and flooding resulting from storm surges (Al-Maktoumi et al. 2018; Shammas & Jacks 2007). However,

[11] This section draws heavily on Lahn et al. (2021), which covers both North Africa and the Middle East, as well as on Müller et al. (2021), which covers the Euphrates-Tigris basin countries more specifically.

[12] While worth mentioning here, the (geo)political implications of a global green energy transition will be further explored in the coming phase of the CASCADES project and are hence not further specified in this report. Interested readers may consult Ivleva et al. (2019) and Stevens (2019) in the meantime.

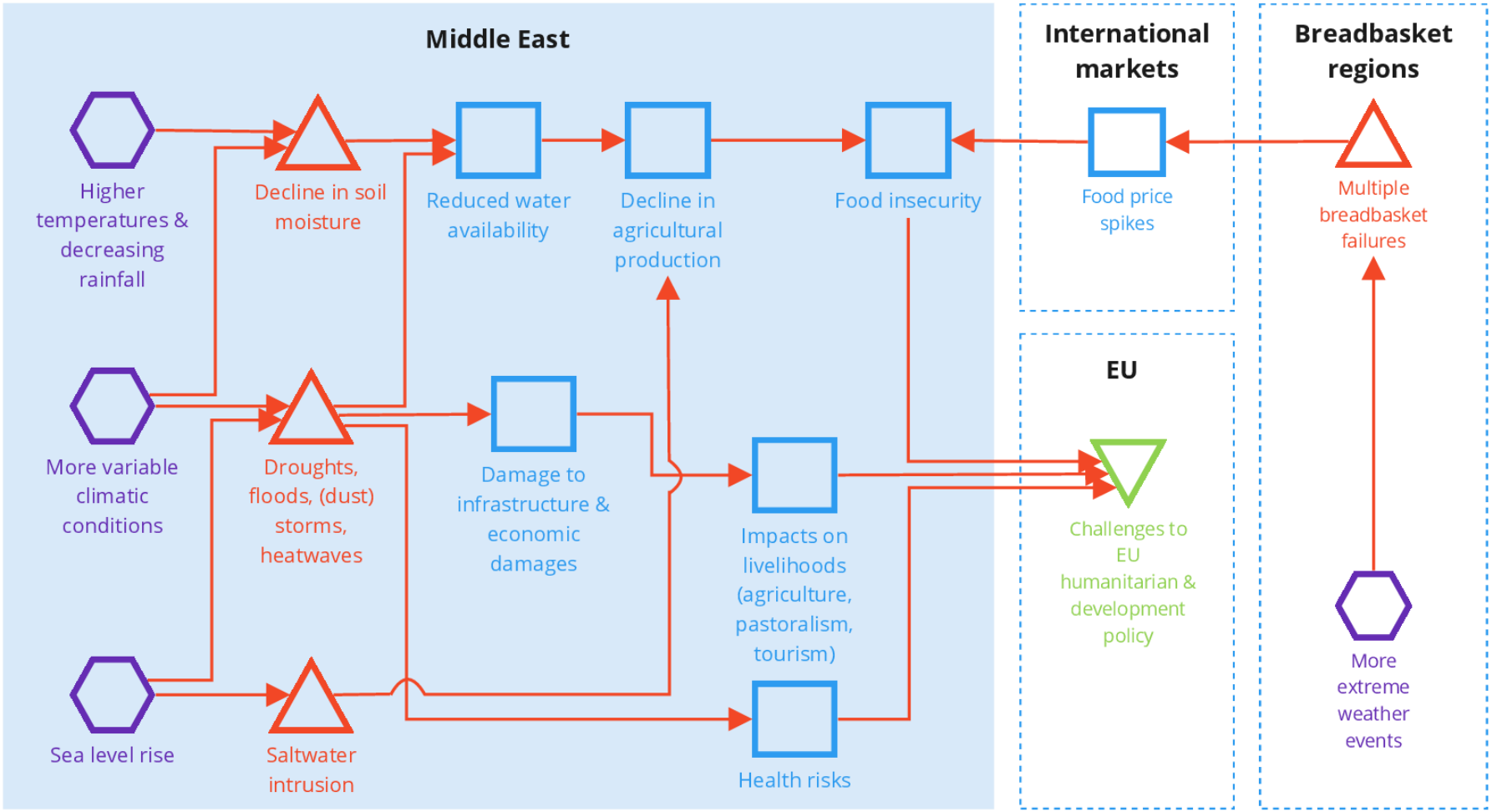
the extent to which climatic shocks and pressures affect agricultural production also depends on other factors on the ground, including water management, crop varieties, and farming techniques (Lahn et al. 2021).

Countries that are less dependent on agriculture will not be spared from the impacts of climate change. Opportunities to diversify economies beyond oil and gas - most notably through tourism, professional travel, and fisheries - could be reduced as a result of climatic events. This would have severe implications for international investments and assets in the Middle East, particularly in the property sector (Lahn et al. 2021).

In addition, several countries in the Middle East are among the world's largest importers of cereals and other basic food items, and some are heavily reliant on imports, such as for wheat (FAO et al. 2021:31). This is particularly true for many Gulf states - Saudi Arabia, for example, imported ten times its production of cereals in 2018 (FAO 2021a), of which over 40% came from the EU (Chatham House 2021). As such, food security in these countries is highly vulnerable to international food price spikes (Maystadt et al. 2014; Werrell & Femia 2013), in which climate change could play a significant part (Climate Diplomacy n.d.c).

Furthermore, a number of studies have also drawn close links between climate change and public health in the region (Efron 2021; NOAA 2020; Pal & Eltahir 2016; Paz 2015; Sayez-Ahmed 2016; Zittis et al. 2021). These links manifest themselves in the form of heat stress, infectious diseases, water-borne diseases (due to higher pollutant levels caused by lower water availability), and respiratory illnesses (resulting from dust storms in combination with air pollution from traffic and industries). Additionally, these health impacts could affect certain groups far worse than others, including the elderly, refugees, displaced people, outdoor labourers, and poorer households, particularly those who lack access to temperature-regulated housing or air-conditioning (Lahn et al. 2021).

Figure 8. Climate change, livelihoods, and human security in the Middle East.



Breadbasket regions include major food-producing regions such as Brazil, the United States' Midwest, and eastern China.

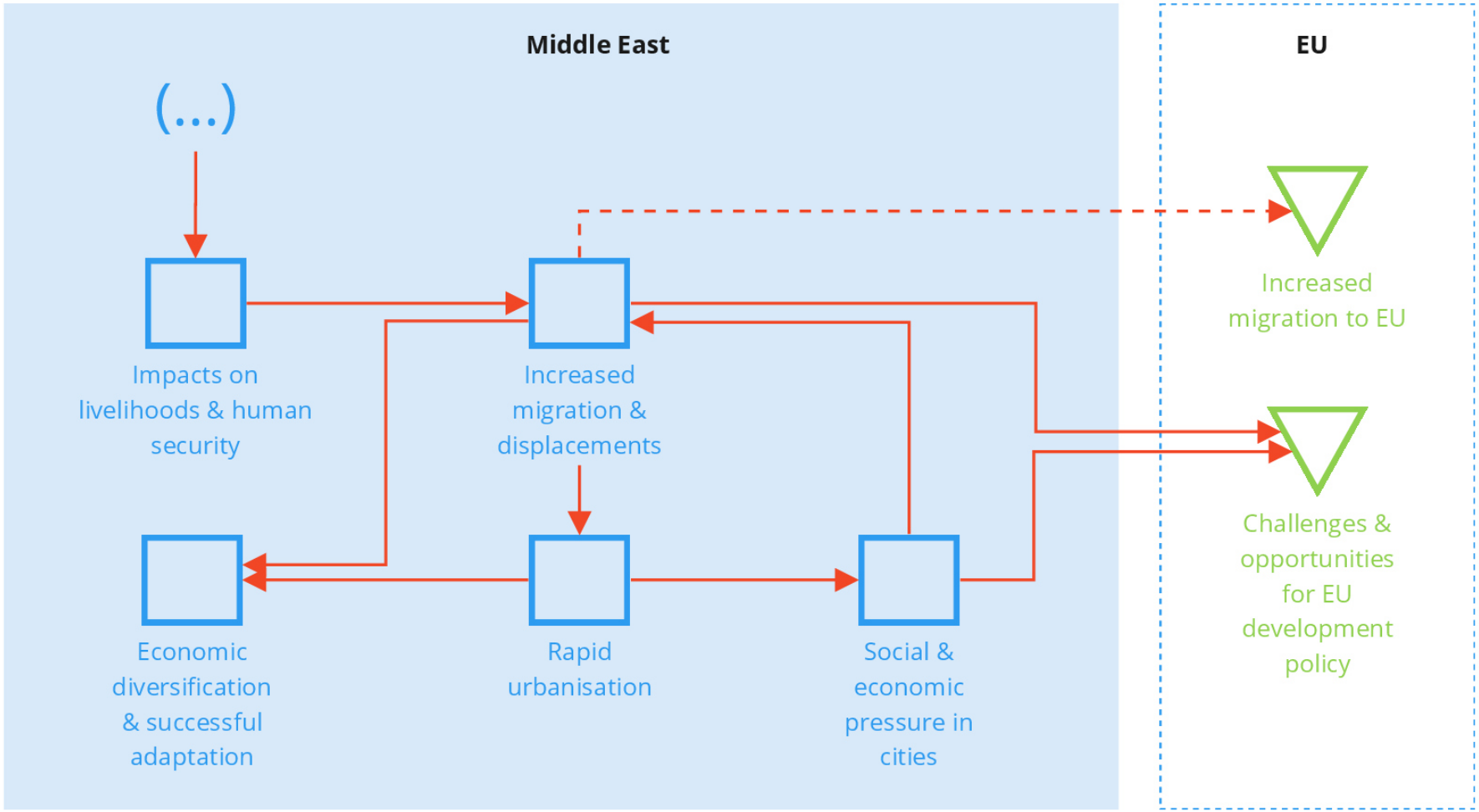
Migration and urbanisation

In the past decade, migration in the Middle East has often made sensational headlines across the globe, and discussions over its implications to other regions, particularly to the EU, are manifold. Regardless of the narrative that is used, recent observations indicate that large-scale migration will likely continue within countries, between countries in the region, and from outside into the region (Lahn et al. 2021).

Although past links between migration and climatic change are still widely debated (Gleick 2017; Kelley et al. 2017; Selby et al. 2017a, b), increasingly frequent extreme weather events, most notably droughts and floods, could displace more people and accelerate rural-urban migration in the coming years. A case in point is the aftermath of the 2006-2010 droughts in Syria during which drought-induced crop losses, poverty, and unemployment pushed rural populations into cities (Ash & Obradovich 2020).

Moreover, many cities in the Middle East, both in wealthier and poorer states, lack sufficient infrastructure to cope with extreme weather events such as flooding (Daoudi & Niang 2019). Many of these cities are also located along coastal areas, leaving them vulnerable to the impacts of sea level rise. These, along with the damages that climate-related events can cause to existing infrastructure, would place urban and migrant populations under direct risk from climate change - the impacts of which could be amplified if rural-urban migration trends continue (Lahn et al. 2021).

Figure 9. Climate change, migration, and urbanisation in the Middle East.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 8.

Social cohesion and political stability

Access to resources and services plays an important part in shaping social relations in the Middle East - if one group perceives itself to be at a disadvantage compared to another, relations among groups may become more strained. A case in point are Israel's settlement policies in the West Bank; Israeli communities generally consume more water - and enjoy a higher standard of living and security - than their Palestinian neighbours, all of which have exacerbated the latter's sense of injustice (Lahn et al. 2021).

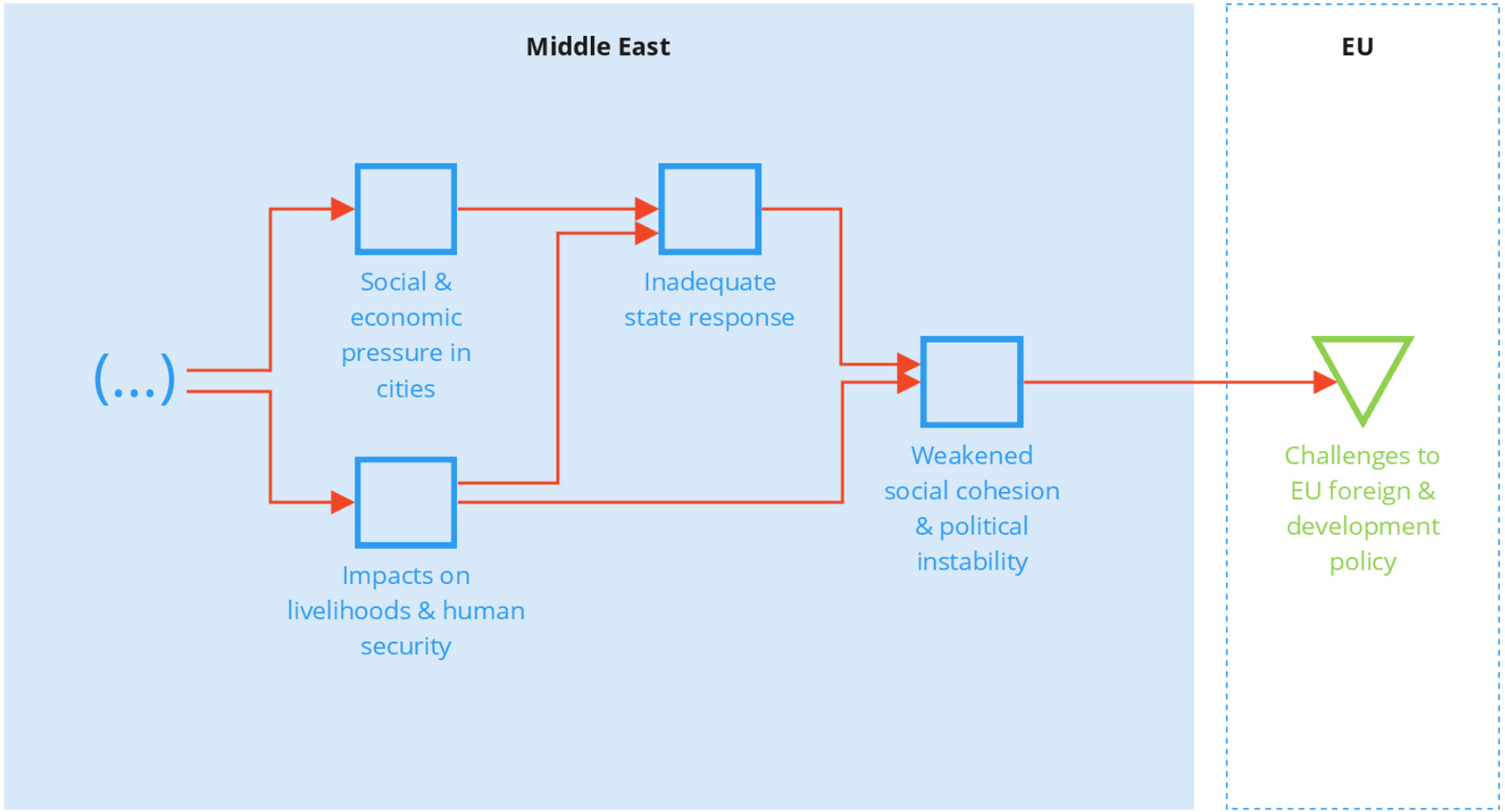
Climate change could play some role in further straining social relations. Reduced rainfall and water shortages, for example, could exacerbate existing tensions and social inequalities, as those with more wealth and political influence could use their power to control limited resources. To some extent, this has already been observed among farming communities in Yemen (Lackner 2019), as well as between Palestinian and Israeli settler communities in Palestinian territories (Lahn et al. 2021).

At the same time, the governments' failure to adequately manage resources and handle the consequences of extreme weather events such as droughts could worsen state-citizen relations and affect political stability in the Middle East (Müller et al. 2021). Syria is a notable example of this - the Ba'athist government's inefficient water policies led to a deterioration of water management systems and climate resilience, thereby fuelling public grievances against the government in the wake of drought (De Châtel 2014; Sowers et al. 2013; Werrell & Femia 2013). Similarly, in Basra, Iraq, violent protests in 2018 were the consequence of drinking water supply issues, combined with public frustration over rising wealth inequalities, unemployment, and corruption (Lahn & Shamout 2018).

The question of 'equity in access' also plays a significant role in shaping state-citizen relations in the region. If governments are seen to favour resource access for an elite minority, this can worsen tensions, erode trust, and possibly fuel unrest (Lahn et al. 2021; Müller et al. 2021). In Syria, for example, state-citizen relations - already at a low due to the country's struggling agricultural and water sectors - worsened when the Bashar al-Assad government decided to cut agricultural subsidies and redirect funds towards industries controlled by his supporters (Müller et al. 2021).

It is clear from the above examples that water, in combination with pre-existing political and socioeconomic factors, is a key element in determining social and state-citizen relations in the Middle Eastern context. It follows that climate change, although usually not the primary cause of dissent, could worsen the very conditions that have made relations as complicated as they have been in the past.

Figure 10. Climate change, social cohesion, and political stability in the Middle East.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 8.

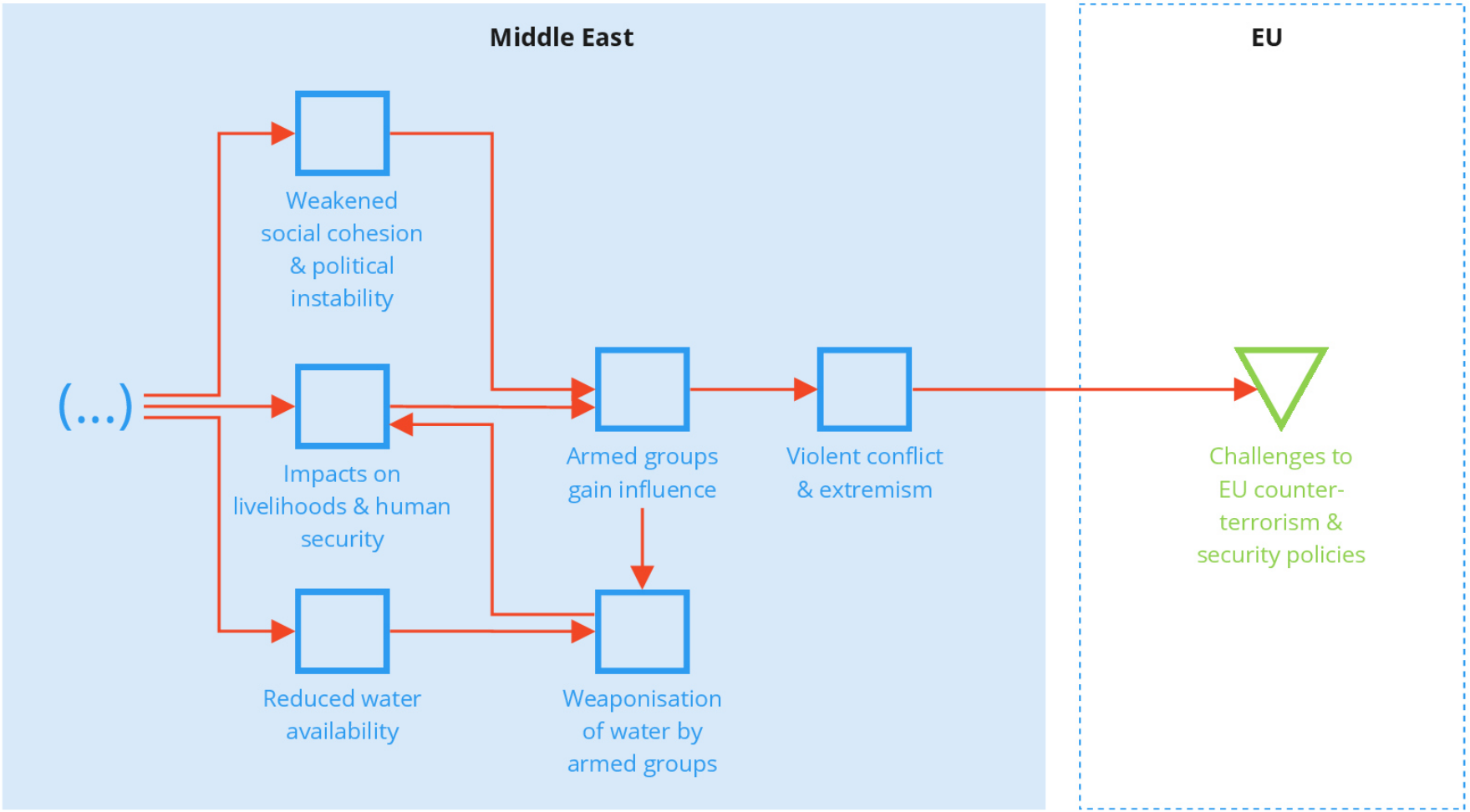
Opportunities for armed groups

Past observations in the Middle East have indicated that the loss of livelihoods as well as collapse in social and state-citizen relations - due in part to climate-related stresses - could be exploited by armed groups to further their causes (King 2016; Nett & Rüttinger 2016). Where governments fail to provide support to those left destitute from droughts, for example, armed groups could fill the gap by providing the necessary assistance to affected communities, thereby garnering support and increasing recruitment.

A frequently cited example is the 2007-2011 droughts in Syria, during which the militant group Islamic State in Iraq and Syria (ISIS) was able to recruit a large portion of its fighters among impoverished farmers from the north-western region of Jazeera, where the droughts affected rural populations particularly hard (King 2016; Schwartzstein 2017). A similar dynamic has also been observed in southern Iraq, where past droughts and subsequent water shortages have not only led to armed tribal conflicts (Al Hasan 2020), but also increased the susceptibility of men from farming communities to join ISIS (Schwartzstein 2017).

In some cases, armed groups may even 'weaponise' resources to harm opponents and gain influence. This is particularly evident in the Euphrates-Tigris Basin, in which armed groups have targeted water infrastructure to manipulate the volume and quality of water that reaches communities (von Lossow 2016). The effect of this 'weaponisation' of water is particularly strong among communities who have had to endure repeated cycles of droughts, coupled with inadequate water infrastructure and services (von Lossow 2016).

Figure 11. Climate change and opportunities for armed groups in the Middle East.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 8.

Conflict and cooperation in transboundary river basins

Globally, when it comes to issues surrounding cross-border river basins, interactions between riparian countries have been more cooperative rather than conflictual, even in the face of ongoing disputes over other issues (Müller et al. 2021). This has historically been the case for much of the Middle East, including in the Euphrates-Tigris Basin and Jordan Valley (Climate Diplomacy, n.d.d; Climate Diplomacy, n.d.g; Müller et al. 2021). Tensions, however, have been on the rise in recent years, particularly as the water-related impacts of climate change become increasingly evident.

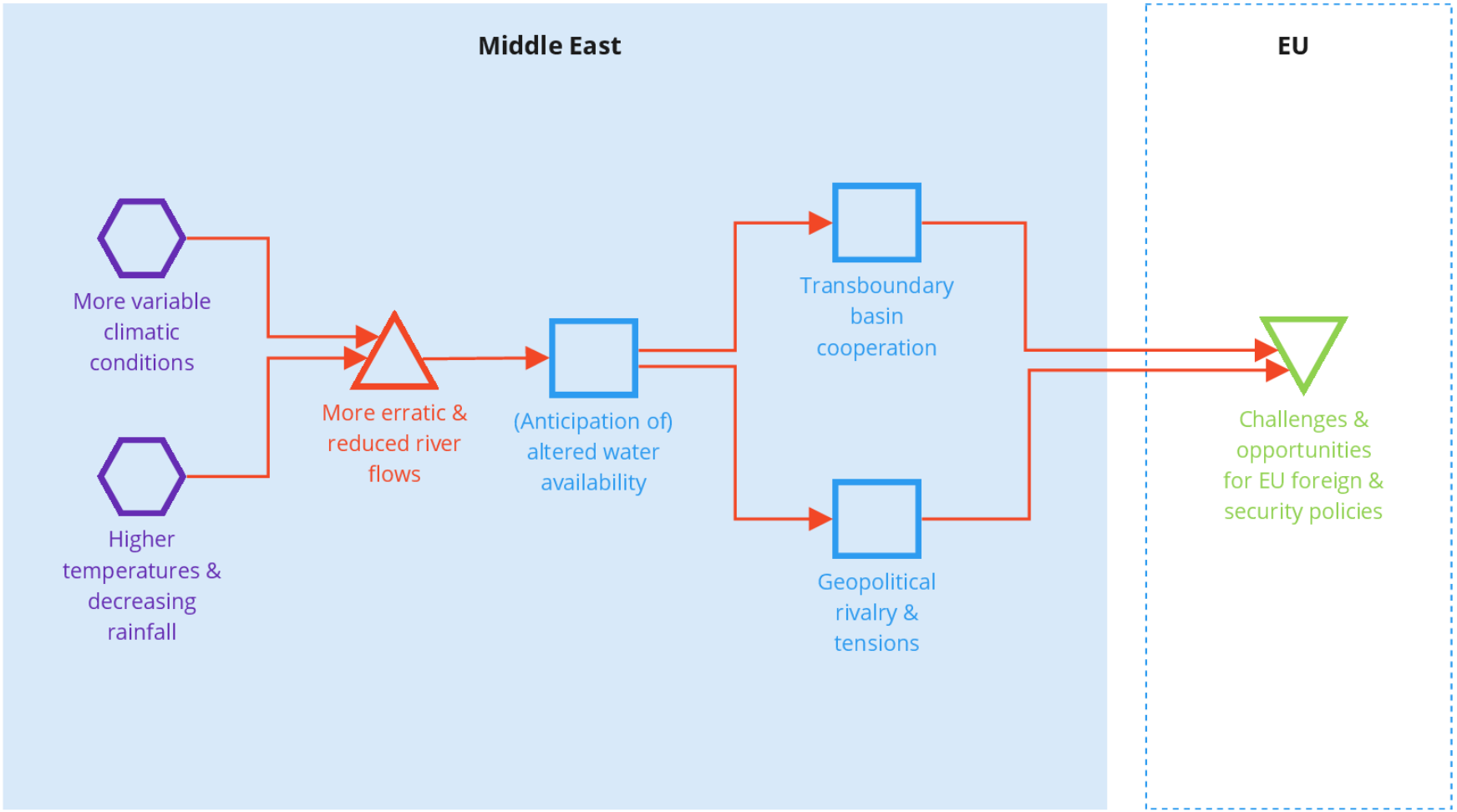
For the Euphrates-Tigris Basin in particular, several studies have indicated that the combination of climate change, water stress, and socioeconomic developments could raise the risk of diplomatic tension and conflict (Bernauer & Böhmelt 2014; Farinosi et al. 2018; Rüttinger et al. 2015). This is because the increase in water risks could weaken existing cooperative structures, incite unilateral decisions to the detriment of other riparian countries, and thus weaken overall capacities to withstand the impacts of climate change in the basin (Müller et al. 2021).

Conversely, drought-induced water stress and other climate-related water risks could also produce the opposite effect - that is, to compel riparian states of the Euphrates-Tigris Basin to cooperate. This has happened in the past - the 1989 filling of the Atatürk Dam, for example, prompted Iraq to set up a permanent joint technical body to strengthen water cooperation (Kibaroglu 2015), although talks have eventually been suspended (Kibaroglu & Sayan 2021). More recently, Turkey agreed to postpone the filling of the Ilisu Dam in 2018 after Iraq voiced complaints about its downstream effects on flows (Aboulenein & Karadeniz 2018).

Ultimately, the question of whether climate change may bring about more conflict or cooperation between riparian states would depend on a range of factors beyond resource availability per se, including each country's domestic political situation and stability (Müller et al. 2021). The Syrian Civil War, for example, could hamper any future water cooperation between Syria and Turkey due to the breakdown of bilateral relations between the two riparian states as a consequence of the war (Kibaroglu & Scheumann 2013).

Other key factors include the prevailing relations between states, as well as the international community's involvement in providing assistance and mediation support (Müller et al. 2021). These dynamics can also be observed in the Euphrates-Tigris Basin - while the regional power contest between Iran and Turkey is a major impediment towards successful cross-border cooperation in the basin, external third parties such as Saudi Arabia and various global organisations have been instrumental in mediating conflicts and promoting dialogue (Müller et al. 2021).

Figure 12. Climate change, conflict, and cooperation in transboundary river basins in the Middle East.



Social context and future vulnerability

The strength and likelihood of climate change impacts in the Middle East will not only depend on future climate trends but also on the evolution of a number of social, economic, and political factors that moderate the relationship between climate change, livelihoods, human mobility, and security in the region.

For instance, effective institutions and transboundary cooperation structures could help ease climatic pressures and discourage conflicts over natural resources like water that are likely to become scarcer in the wake of climate change. A lot will depend on the evolution of diplomatic relations between states in the region - for example, between the riparians of the Euphrates-Tigris Basin (Müller et al. 2021).

Likewise, strongly centralised governance structures are currently an obstacle to effective climate adaptation. Future resilience will thus partly depend on the success of political reforms and decentralisation efforts in the region, as well as on the evolving role of civil society and private sector actors in promoting environmental awareness, mobilising necessary investments, and bringing about social and technological change (Lahn et al. 2021).

Numerous Middle Eastern countries will further need to overcome a legacy of armed conflict and violence, which hampers effective collaboration and investments in climate adaptation, and which increases the vulnerability of Middle Eastern economies to extreme weather events and climate-induced food price spikes (Lahn et al. 2021).

The vulnerability (or resilience) of Middle eastern countries will also depend a great deal on their ability to increase agricultural productivity and maintain food imports - given high projected population growth and food demand. This could be particularly challenging for countries relying on oil and gas exports to finance imports, if demand and prices for hydrocarbons were to decline as part of a worldwide transition towards cleaner energy sources (Lahn et al. 2021).

In sum, future climate vulnerability (or resilience) in the Middle East will depend on a number of factors: success in finding peaceful resolutions to ongoing conflicts and tensions; improvements to governance and national and local institutional capacity building; the application of sustainable agricultural practices, building techniques, and technologies; and room for cross-border cooperation on managing shared resources. As the evolution of these factors is uncertain, we can envision different futures for the region, each characterised by different challenges in connection with climate change. Table 3 summarises our assumptions about possible socioeconomic and political scenarios for the Middle East along the key dimensions discussed in Section 2.2, and highlights their implications for vulnerability (or resilience) to the cascading effects of climate change. The scenarios follow the five SSPs over the period 2020-2050. A more detailed analysis and discussion of underlying factors of vulnerability and resilience can be found in the appendix (Table 6).

Table 3. Future resilience and vulnerability to cascading climate impacts in the Middle East.[13]

Context Factor	SSP1 – Sustainability (2050)	SSP2 – Middle of the road (2050)
Technology and physical infrastructure	Adopting more sustainable technologies and using resources more efficiently, people in the region are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Yet, productivity levels remain slightly lower than in SSP5 due to limited fertiliser use.	Slow diffusion of new technologies and progress towards sustainability means that Middle Eastern countries are susceptible to some extent to experiencing adverse effects of climate change on water availability and agricultural production.
Resource governance and conservation	Cooperative and sustainable approaches to cross border resource management limit the adverse economic effects of climate change and discourage conflicts over climate-sensitive resources.	Conflicts over access to water and land are possible in the wake of climate change, due to imperfect institutions and cooperation mechanisms. Population growth and increasing water demand make it somewhat more challenging to withstand climatic shocks and pressures.
Economic structure and opportunities	More equitable access to education facilitates income diversification and makes it easier to prepare for- and to recover from climatic shocks, due to food import dependence.	Moderate opportunities outside the agricultural sector and intermediate access to education make climate adaptation somewhat challenging.
Trade and access to markets	Good access to global markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes. Reduced revenues from oil and gas exports make it more challenging to finance climate adaptation measures.	Obstacles to international trade somewhat reduce the ability to cope with climate change. Global food price spikes remain a challenge.
Governance and state-citizen relations	Improved governance, more equitable access to services and improved state-citizen relations and civil society empowerment increase adaptive capacity and reduce the prospects of climate-induced grievances and social turmoil. Yet, political reforms in rentier states bring some governance challenges and uncertainty.	To some extent, climatic pressures can lead to or aggravate public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges. Institutions remain somewhat centralised, which hampers effective climate adaptation.
Social relations	Greater social equity and cohesion reduce the risk of grievances in the wake of climate change. More harmonious and cooperative relations between communities and states discourage conflicts over access to resources.	To some extent, climatic pressures can aggravate social and diplomatic tensions as Middle Eastern countries come to grips with a legacy of inequality and tensions among and within countries.

[13] Sources: Abdelkader et al. (2018); Andrijevic et al. (2020); Borgomeo et al. (2018); Burek et al. (2016); Carter et al. (2020); Dellink et al. (2015); Jiang & O'Neill (2017); KC & Lutz (2017); Lahn et al. (2021); Mazzoni et al. (2018); Müller et al. (2021); Nechifor & Winning (2016); O'Neill et al. (2017); Rao et al. (2019); Riahi et al. (2017); Wada et al. (2016).

Table 3. Continued.

Context Factor	SSP3 – Regional rivalry (2050)	SSP4 – Inequality (2050)	SSP5 – Fossil-fuelled development (2050)
Technology and physical infrastructure	Overexploitation of natural resources and disregard for sustainability and climate resilience make Middle Eastern countries much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Resurgent nationalism and antagonisms hamper the diffusion of resilient technologies.	Deepening inequalities in the access to technologies and resources make low income countries and disadvantaged groups in the region much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. They are thus also more vulnerable to knock-on effects on livelihoods and political stability.	Due to rapid technological change, infrastructure development, and efficiency gains, Middle Eastern countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Yet, heavy reliance on hydrocarbons raises notable environmental risks that hamper climate adaptation.
Resource governance and conservation	Rapid population growth and rising water demand paired with inefficient resource governance increase climate-related risks for livelihoods and human security. At the same time, geopolitical rivalries are likely to aggravate resource use conflicts in the wake of climate change.	Unequal power and access to resources create tensions that risk to be aggravated by climate change but are unlikely to spawn full blown war. Disadvantaged groups remain vulnerable to the effects of climate change, in particular in rural and peri-urban areas. Violent protest can ensue when political responses to climate change are inadequate.	Pragmatic and mostly cooperative approaches to resource governance limit the adverse effects of climate change, as well as potential conflicts over climate-sensitive resources. Yet, potentials for more sustainable and equitable resource use are not fully realised, leaving some communities vulnerable to the effects of climate change.
Economic structure and opportunities	Poor access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change.	Unequal access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and susceptible to social turmoil.	Rapid economic development and opportunities outside the agricultural sector make it easier to withstand the adverse effects of climate change.
Trade and access to markets	Trade restrictions hamper effective climate adaptation. Protectionist policies in food producing countries increase the risk of global food price spikes in the event of multiple breadbasket failures.	Limited access to global markets hampers effective climate adaptation by low income countries and small producers, which also remain vulnerable to global food price spikes.	Good access to international markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes.
Governance and state-citizen relations	Ineffective governance, poor service delivery for a rapidly growing population, and divisive rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. Institutional reforms are stalling and heavily centralised governance systems make it difficult to address climate-related challenges.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. In particular in structurally neglected areas.	Improved governance and access to services lead to more harmonious state-citizen relations and higher resilience against climate-induced social and economic pressures.
Social relations	Social inequalities and polarisation increase the prospect of grievances and communal conflict in the wake of climate change. Poor relations between states increase the risk of conflicts over climate-sensitive resources.	Social inequalities and the concentration of power among a small elite increase the prospect of social tensions in the wake of climate change. Yet, aggrieved groups will rarely have the means to challenge political regimes in a significant way.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) in the wake of climate change. Unequal military and economic power is a cause of grievances in the region but also has a stabilising effect. Climate-related tensions are thus less likely to lead to full blown violent conflict.

3.3 Central Sahel

The Sahel is widely recognised as a region that will be strongly affected by climate change (IPCC 2019). Besides warming temperatures, recent projections also indicate higher rainfall variability, along with more frequent extreme weather events such as droughts, storms, and flood-inducing heavy rains (IPCC 2021a; IPCC 2021b), all of which are expected to increase the burden on Sahelian societies. Monsoon precipitation will especially increase in the central part of the Sahel (IPCC 2021b).

At the same time, the Sahel, and in particular its central parts, figure prominently in European foreign policy, security, and development strategies. Burkina Faso and Mali are among the top recipients of European development aid while also being the focus of stabilisation and counter-terrorism efforts by different EU member states (see West et al. 2020:41, 44). Niger is a major transit country for migrants and thus also of particular relevance to European policymakers. And even if migrants from the region predominantly leave for other African countries (see Puig et al. 2021:23), the EU remains a main destination for Central Sahelian migrants and refugees when compared to other OECD countries (see West et al. 2020:38f). Regardless of the direct impacts climate change is having on its people, the region's economies and political stability will thus also affect the EU and its foreign policy.

Rural livelihoods and food security

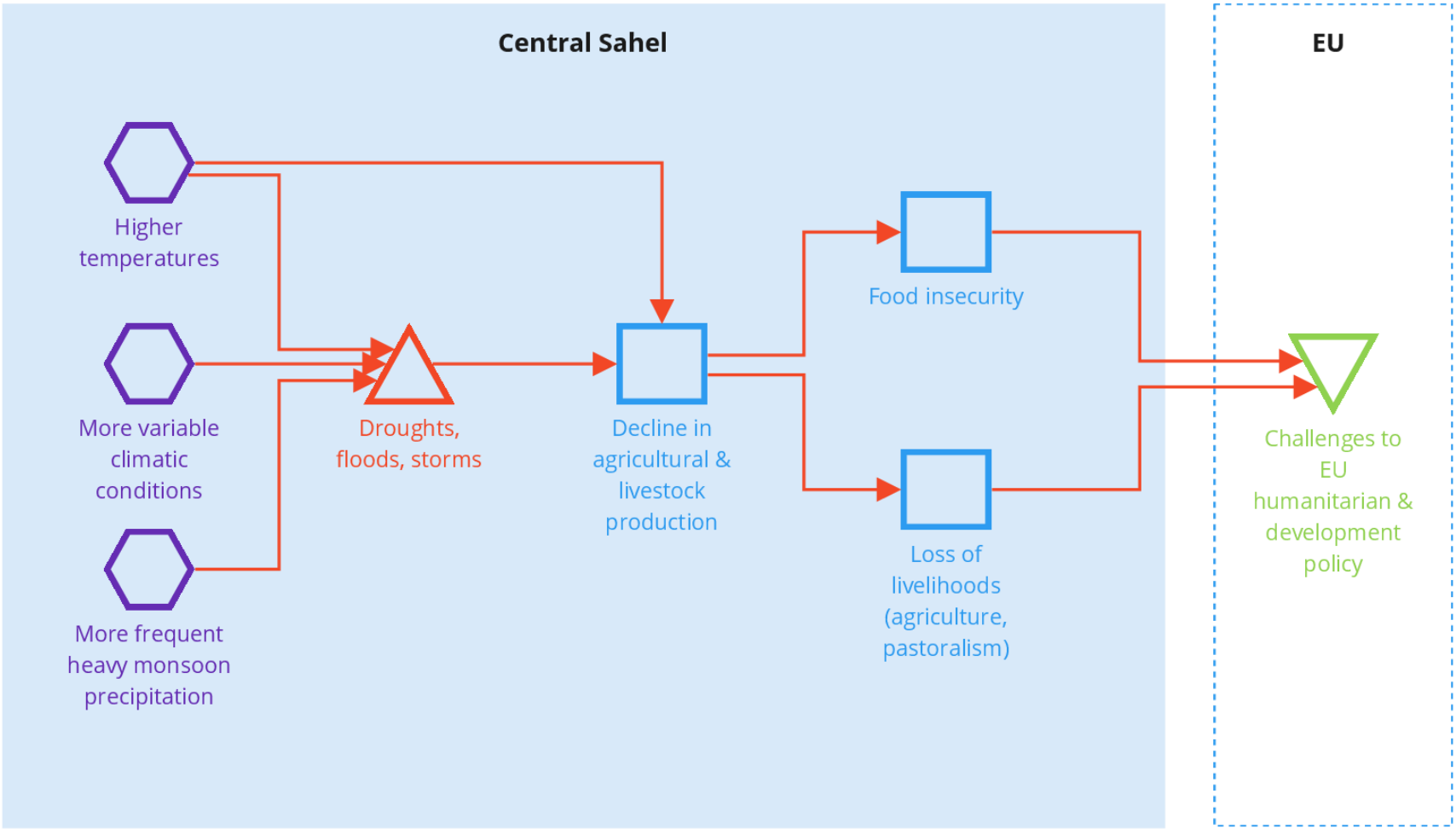
Rural communities in the Central Sahel are highly dependent on rainfed agriculture, livestock rearing, and fishing for their livelihoods. In turn, these activities are adversely affected by climate change, most notably through the increased frequency and severity of extreme weather events, less predictable rainfall, and rising temperatures (Puig et al. 2021). In Burkina Faso, for example, cereal yields are very likely to decline if maximal temperatures during the warmest month were to increase, including in the fertile southwestern part of the country (Puig et al. 2021). The severity of these impacts, however, largely depend on crop type, irrigation capacities, as well as access to markets, services, and social safety nets (Brottem & McDonnell 2020) - with women, youth, and other marginalised groups being particularly more vulnerable (Görman & Chauzal 2019).

Closely related to the topic of rural livelihoods is food security. According to a recent survey of experts from the Central Sahel, one of the major causes for food insecurity in the region - particularly in Mali and Niger - is climate change (Puig et al. 2021), along with violent conflicts that have disrupted food production and market access (FEWSNET 2021a, b). Historical data has shown that areas of the Central Sahel that experienced drought or heavy rainfall events had higher levels of food insecurity, and that these effects were more pronounced in areas with lower levels of economic development (Puig et al. 2021). Additionally, other longer-term, more chronic factors contributing to food insecurity include population growth and social inequalities (FAO 2018; Peng & Berry 2019).

It should be noted that food production systems in the Central Sahel are capable of feeding local populations. Yet, the region imports large quantities of basic foodstuffs, especially rice, which exposes its population to international food price spikes and speculations, thereby pressuring the region’s food security further (Olivier de Sardan 2005).

Through various instruments and strategies, the EU has been intensively engaged in supporting regional development, sustainable agriculture, and food security across the Sahel (Puig et al. 2021; Wolfmaier et al. 2021). The success of these initiatives is at stake, particularly in the face of climate change and its compounding impacts on livelihoods and food security.

Figure 13. Climate change, rural livelihoods, and food security in the Central Sahel.



Human mobility

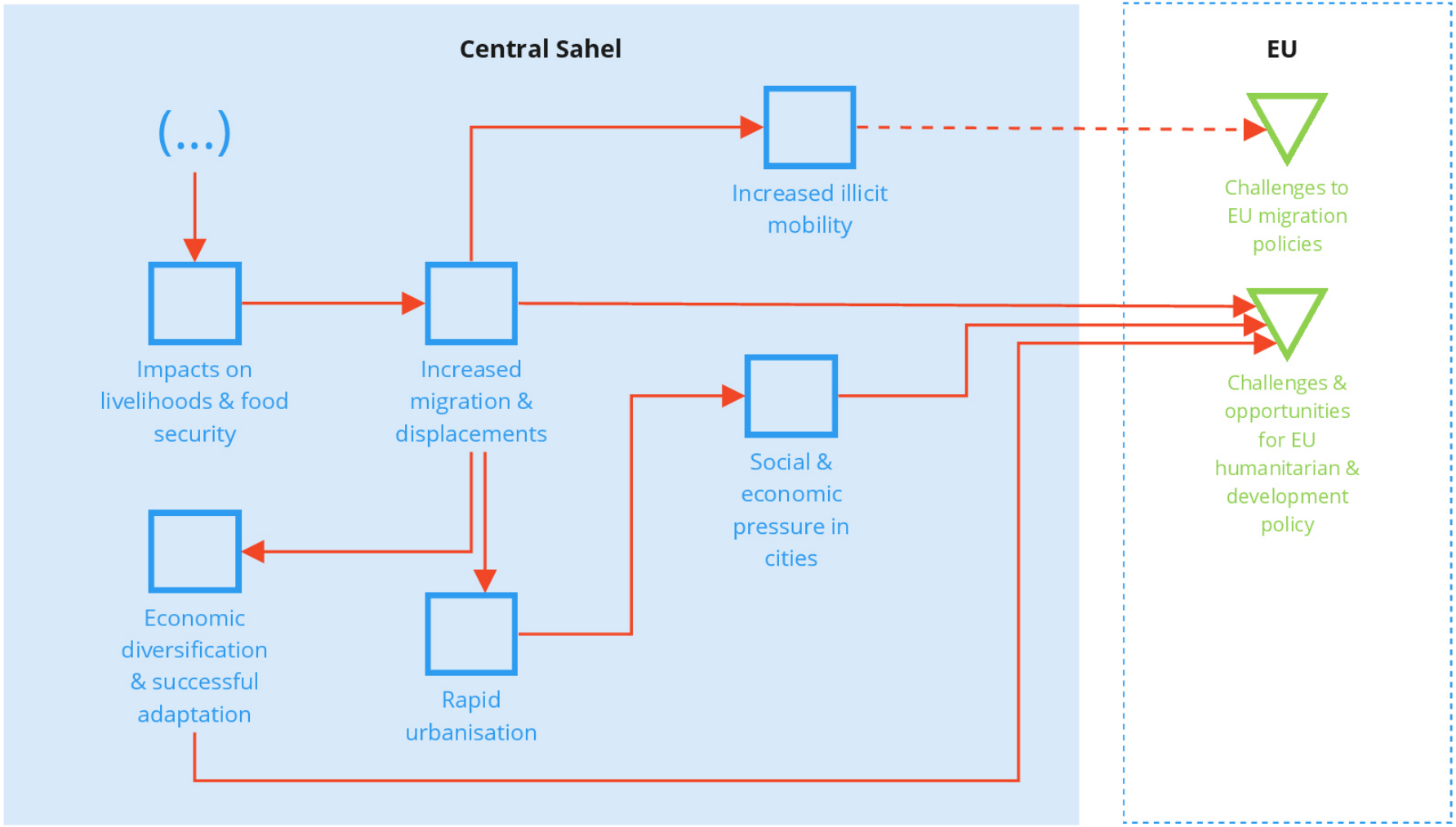
Mobility has historically been a way for Central Sahelian communities to diversify income and to cope with economic and environmental challenges. Because mobility plays such an important role for the region's livelihoods, the Sahelian countries have established protocols on the free movement of people (Aduloju 2015; Idrissa 2019). At the same time, the region has also been experiencing episodes of forced displacements as a result of both climatic shocks and violent conflict.

Climate change could influence all types of mobility in the Central Sahel - rainfall variability and changes in water and forage access, for example, could alter herd movements that would deviate from established grazing practices (Brottem & McDonnell 2020; De Haan et al. 2016). Climate change could also increase migration in the region through its effects on local resources, loss of livelihoods, and conflicts. However, the most vulnerable households could remain trapped as climate change affects their incomes and hence their ability to relocate (Black et al. 2011).

Moreover, mobility in the Central Sahel is largely internal, with emigration being mostly directed towards coastal West African countries - movements to Europe, on the other hand, only make up a small share of total migration. Even with climate change in the picture, mobility trends will likely remain the same, with the bulk of climate-related mobility remaining within West Africa (Puig et al. 2021; see also De Haas et al. 2020).

Despite this, many EU policymakers are concerned about a possible increase in climate-related in-migration from Sahel countries, propagating a "refugee crisis" narrative, and devising policies and strategies to curb transit flows in the region. Since the 2015 Valletta Summit, the EU has put in place a strategy of border reinforcement and development cooperation, with the aim of stemming mobility in the region (Puig et al. 2021). While migrant numbers have declined since, EU policies have encouraged other forms of illicit mobility, thereby putting migrants at greater risk (Brachet 2018; Pérez & Puig 2019).

Figure 14. Climate change and human mobility in the Central Sahel.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 13.

Box 2: COVID-19 in the Central Sahel.

Despite low numbers of confirmed infections,[14] COVID-19 interacts in different ways with people's vulnerability to climate change, including in their ability to use migration as an important coping mechanism in the face of adverse environmental and economic conditions. In particular, border closures and other restrictions to movement in the wake of the pandemic represent serious obstacles to effective climate adaptation in the region.

Mobility restrictions have, for example, curtailed the movement of pastoralists and led to the closure of major rural markets (Hammer et al. 2020). Farmers, on the other hand, have also faced challenges in accessing land in preparation for the agricultural season (WFP & FAO 2021). Hindering access to land and water resources, the pandemic could therefore aggravate tensions between farmers and herders, as well as between pastoralist groups (Bisson 2020), whose relations are already challenged by climate change (see also following sections of this report).

COVID-19 has also left a devastating toll on another important adaptation strategy in the Central Sahel - seasonal labour migration. In addition to restricting movement, the pandemic has also increased the cost of migrating and reduced the demand for products and labour, making such forms of migration not only more difficult, but less lucrative. As a result, many Sahelian households have had to take up debt or use savings to cope with the pandemic's impacts (REACH 2021), making it even more difficult for individuals to adapt to the worsening impacts of climate change.

Travel bans have also restricted humanitarian aid delivery, development support, and peacekeeping operations - potentially compromising the progress of regional strategies for sustainable development, conflict prevention, and food security. Consequently, these restrictions reduce the adaptive capacity and climate resilience of vulnerable groups even further.

Source: Wolfmaier et al. (2021).

[14] See, for example, data from Johns Hopkins University: https://coronavirus.jhu.edu/data/mortality.

Social cohesion

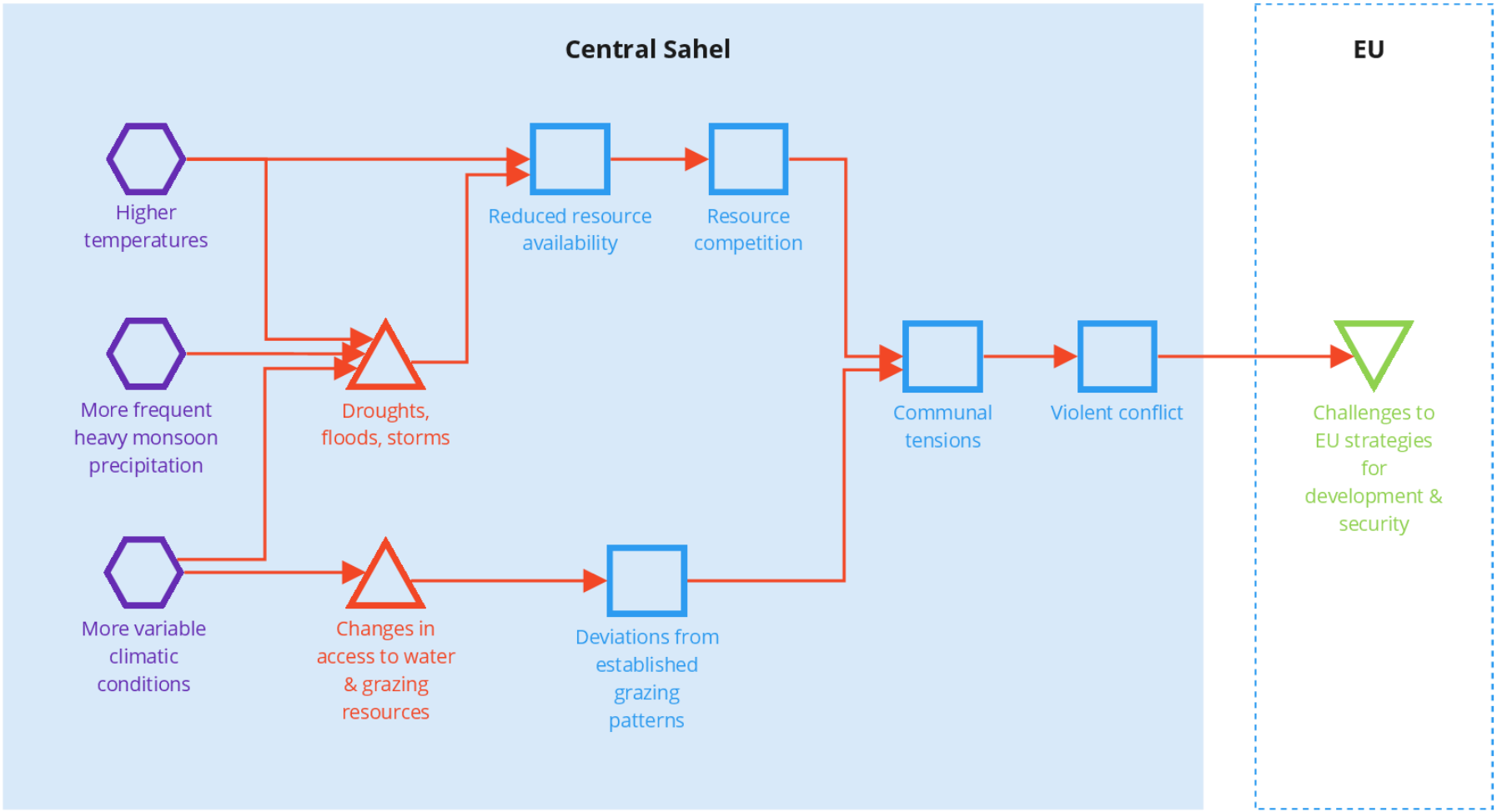
Historically, dispute resolution mechanisms to manage access and use of natural resources between communities have been widespread across the Central Sahel. While peaceful coexistence and cooperation have largely prevailed, these mechanisms have come under pressure in recent years - leading to violent conflicts in some cases (UNOWAS 2018).

The rise in communal tensions can be attributed to a number of reasons, among them being the proliferation of weapons and the loss of trust and legitimacy of formal and informal institutions due to the involvement of political elites and armed groups (Puig et al. 2021). Historical grievances and social inequalities, along with incongruous or biased rules for governing the access to resources are other important factors underpinning communal violence in the region (Benjaminsen & Ba 2018; Bisson et al. 2021).

Scholars are divided over the role and extent to which climate change affects communal tensions in the Sahel. However, there is more agreement that climate change could indirectly drive communal tensions and violence through its impacts on livelihoods, food security, and mobility (Puig et al. 2021), as described in previous sections. For instance, the effects of climate change in altering the distribution of water and grazing resources - and thereby disrupting established patterns of transhumance - could aggravate inter-communal disputes over agricultural encroachment, crop damages, and access to water points (Brottem & McDonnell 2020).

Several EU policies and strategies are committed towards strengthening social cohesion and governance structures in the Sahel, and are, at the same time, increasingly acknowledging their links with climate change and regional security (Wolfmaier et al. 2021). Climate change is an important factor to consider for the long-term success of these policies.

Figure 15. Climate change and social cohesion in the Central Sahel.



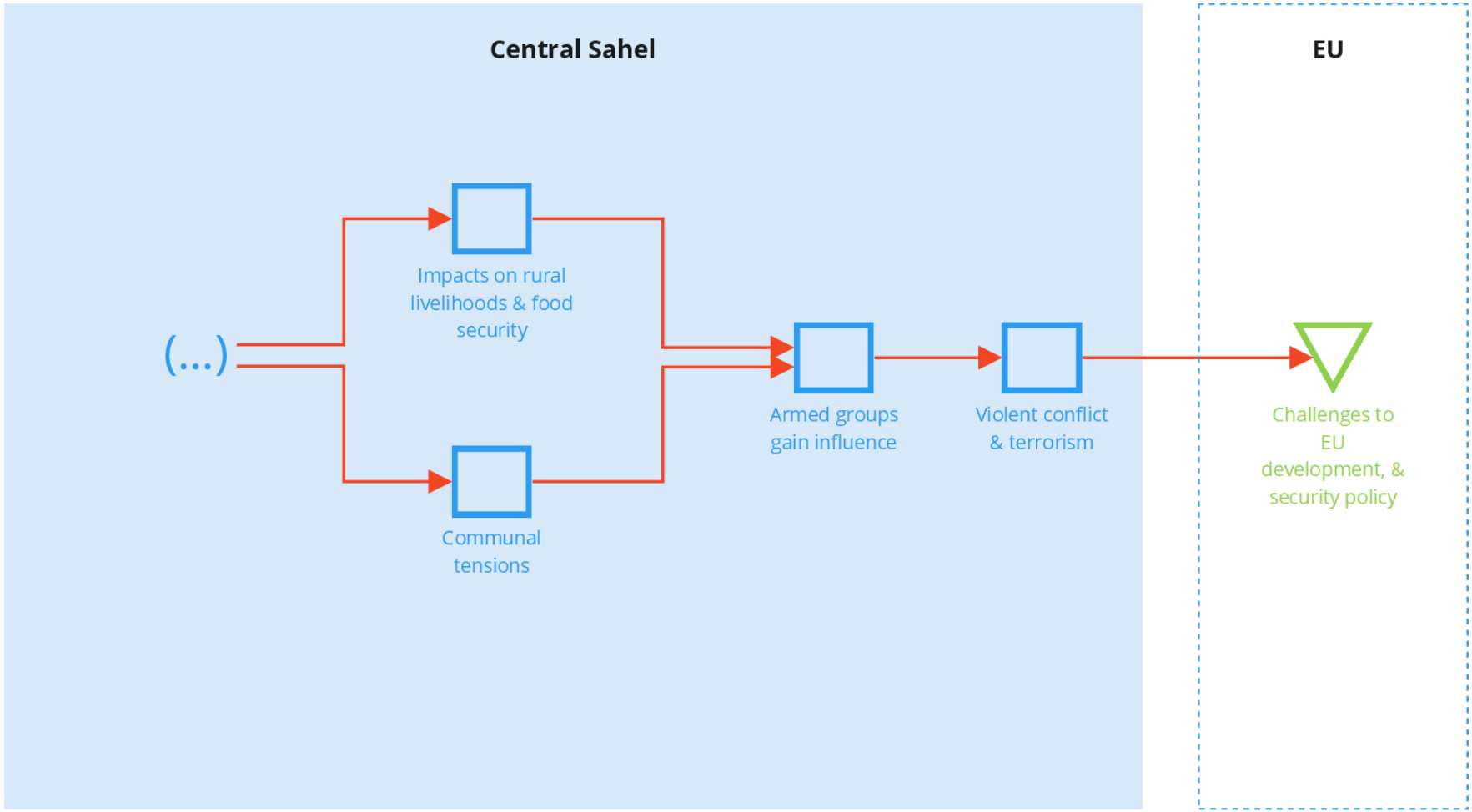
Opportunities for armed groups

In parts of the Central Sahel, armed groups have taken advantage of social vulnerabilities, lack of economic opportunities, and weak state-citizen relations to proliferate and expand their influence (Benjaminsen & Ba 2018). Key to their establishment, expansion, and survival is their involvement in pre-existing criminal networks, with illicit activities ranging from the trafficking of drugs and weapons to artisanal gold mining and poaching (Assanvo et al. 2019). In some cases, such as in Mali, armed groups have also intervened in natural resource management and the provision of food and services, enabling these groups to garner support from local communities (Marquette 2020).

The role that climate change plays in this context is subject to debate. Proponents of a connection between climate change and the proliferation of armed groups in the Sahel mostly assume an indirect link. That is, climate change could create opportunities for armed groups through its impacts on rural livelihoods, food security, resource access, communal tensions, and state-citizen relations (Ba & Cold-Ravnkilde 2021). These effects can be particularly pronounced in structurally abandoned and peripheral areas where armed groups can exploit socioeconomic vulnerabilities and discontent with political authorities to recruit followers and promote their political agendas (Puig et al. 2021).

In response to the security situation in the Central Sahel, the EU, together with other actors from the international community, have deployed extensive military missions in an effort to contain the operations of armed groups. However, rather than defusing violence, foreign military interventions appear to have exacerbated the Sahel's situation (Puig et al. 2021), and have increasingly encountered hostile public dissatisfaction (Venturi 2019). A recent survey of experts from the Central Sahel confirmed these observations, indicating that foreign military interventions and religious factors to be important drivers of terrorism in the region, more so than climate change and resource scarcity (Puig et al. 2021). Nevertheless, the impacts of climate change in providing favourable conditions for armed groups to operate in may exacerbate the challenges these operations face.

Figure 16. Climate change and opportunities for armed groups in the Central Sahel.



The symbol (…) indicates climate triggers and initial impacts as illustrated in Figure 13.

Social context and future vulnerability

The strength and likelihood of climate change impacts in the Central Sahel will not only depend on future climate trends but also on the evolution of a number of social, economic, and political factors that moderate the relationship between climate change, livelihoods, human mobility, and security in the region.

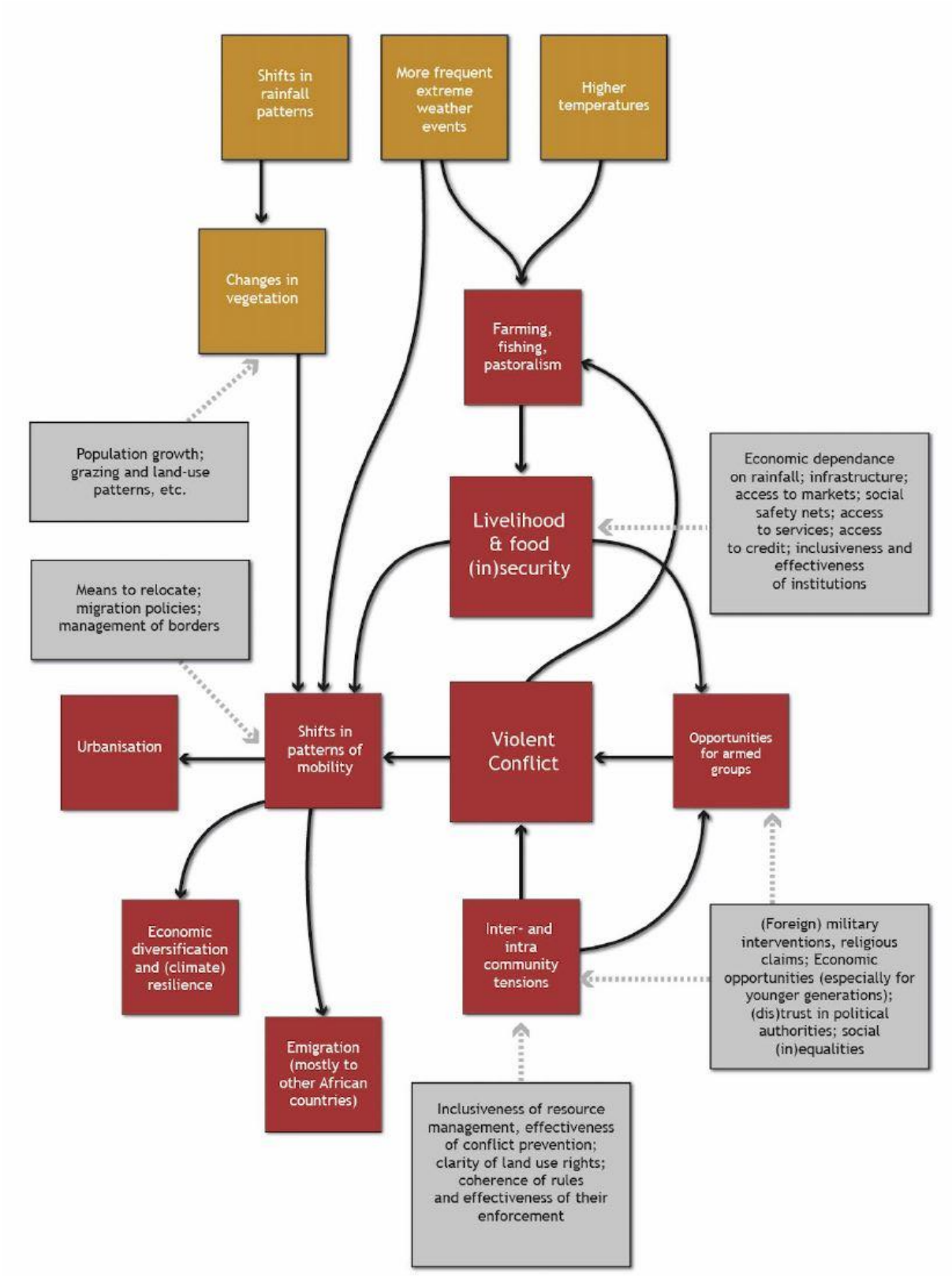
For example, the likelihood of seeing increased poverty or food insecurity as a consequence of more frequent extreme weather events will depend on the dependence of rural communities on rainfed agriculture and other climate-sensitive livelihoods. Similarly, formal and customary systems of resource management and conflict prevention will play a decisive role in whether climate-induced hardship and food insecurity will aggravate conflicts over shared resources like land or water further down the line (Desmidt et al. 2021; Puig et al. 2021).

Social safety nets and access to services such as health and education, which make it easier to cope with adverse climatic conditions and seek more resilient livelihoods, are also important to consider. This is especially true for women and minority groups, who are often not only more vulnerable to climatic shocks but also less likely to benefit from such services. Access to social services and inclusive institutions will also more generally influence state-citizen relations, trust in public authorities, and ultimately opportunities for armed groups to capitalise on anti-state sentiment (Desmidt et al. 2021; Puig et al. 2021).

Examples for such contextual variables and the influence they have on the relationship between climate change, migration, and human security in the Central Sahel are highlighted in the grey boxes in Figure 17. Their future evolution will determine vulnerability (or resilience) in the region and hence also the likelihood of seeing cascading impacts of climate change materialise. We can thus envision different scenarios for the region, each characterised by different challenges in connection with climate change.

Table 4 summarises our assumptions about possible socioeconomic and political scenarios for the Central Sahel along the key dimensions discussed in Section 2.2, and highlights their implications for vulnerability (or resilience) to the cascading effects of climate change. The scenarios follow the five SSPs over the period 2020-2050. A more detailed analysis and discussion of underlying factors of vulnerability and resilience can be found in the appendix (Table 7).

Figure 17. Climate impacts and key contextual factors in the Central Sahel.[15]



[15] Source: Desmidt et al. (2021:9).

Table 4. Future resilience and vulnerability to cascading climate impacts in the Central Sahel.[16]

Context Factor	SSP1 – Sustainability (2050)	SSP2 – Middle of the road (2050)
Agricultural productivity and technologies	Adopting more sustainable technologies and using resources more efficiently, people in the region are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production.	Slow diffusion of new technologies and progress towards resilience make people somewhat susceptible to experiencing adverse effects of climate change on agricultural production and food security.
Resource and conflict management	Slow expansion of agricultural areas, communal dialogue and inclusive resource management institutions prevent climate-related land use conflicts from escalating.	Violent conflicts over access to land are possible in the wake of climatic shocks in a context of intermediate agricultural expansion and imperfect institutions for resource and conflict management.
Economic structure and opportunities	More equitable access to education facilitates income diversification and makes it easier to prepare for - and to recover from - agricultural shocks.	Moderate opportunities outside the agricultural sector and intermediate access to education make climate adaptation somewhat challenging.
Trade and access to markets	Regional integration and improved access to international markets make it easier for agricultural producers to withstand adverse climatic shocks.	Imperfect market integration and obstacles to cross-border trade somewhat reduce the ability to cope with climate change.
Governance and state-citizen relations	Improved governance, more equitable access to services and improved state-citizen relations reduce the prospects of climate-induced grievances on which armed groups could capitalise.	To some extent, climatic pressures can lead to - or aggravate - public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges.
Social relations	Greater social equity and cohesion reduce the risk of grievances and communal conflict in the wake of climate change. Social openness facilitates migration as a coping strategy.	To some extent, climatic pressures can aggravate social tensions as Sahelian societies come to grips with a legacy of inequality and communal conflict.

[16] Sources: Ahmed et al. (2016); Andrijevic et al. (2020); Biewald et al. (2015, 2017); Burek et al. (2016); Carter et al. (2020); Dagnachew et al. (2019); Dellink et al. (2017); Doelman et al. (2018); European Commission (2018a); Jiang & O'Neill (2017); Kabir (2019); KC & Lutz (2017); Nicolas et al. (2019); O'Neill et al. (2017); Palazzo et al. (2017); Rao et al. (2019); Riahi et al. (2017); Van Ackern & Detges (forthcoming).

Table 4. Continued.

Context Factor	SSP3 – Regional rivalry (2050)	SSP4 – Inequality (2050)	SSP5 – Fossil-fuelled development (2050)
Agricultural productivity and technologies	Overexploitation of natural resources and disregard for sustainability and climate resilience make Sahelian countries much more susceptible to experiencing adverse effects of climate change on agricultural production and food security.	Deepening inequalities in the access to technologies and resources disadvantaged groups in the region much more susceptible to experiencing adverse effects of climate change on agricultural production and food security.	Improved irrigation and the modernisation of agricultural and pastoral production increase resilience to the effects of climate change. Yet, the expansion of production with little concern for sustainability creates challenges for climate adaptation.
Resource and conflict management	Rapid expansion of agricultural land, inefficient resource management, and co-optation of local institutions increase the risk that climate-related conflicts over land turn violent.	Due to rapid expansion of agricultural land, inefficient resource management, and weak institutions in peripheral areas, land use conflicts can escalate among marginalised communities.	Relatively coherent land use rights and concerns for economic efficiency reduce incentives for violent conflict over resources. However, legal mechanisms are not always inclusive, and biases persist vis-à-vis some groups.
Economic structure and opportunities	Poor access to education and the prevalence of climate-sensitive activities make populations more vulnerable to the adverse effects of climate change.	Poor access to education for most and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change, even if some elites are well shielded.	Rapid economic development, better access to credit and opportunities outside the agricultural sector make it easier to switch to less climate-sensitive activities.
Trade and access to markets	Stagnant regional integration and trade restrictions hamper effective climate adaptation.	Limited access to markets and discriminatory trade practices hamper effective climate adaptation by low income countries and small producers.	Regional integration and improved access to international markets make it easier for agricultural producers to withstand adverse climatic shocks.
Governance and state-citizen relations	Ineffective governance, poor service provision, and divisive political rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change, particularly in structurally neglected areas.	Improved governance and access to services lead to more harmonious state-citizen relations. Opportunities for armed groups to capitalise on climate-induced hardship and grievances are limited.
Social relations	Social inequalities and polarisation increase the prospect of grievances and communal conflict in the wake of climate change.	Social inequalities and the concentration of power among a small elite increase the prospect of social tensions in the wake of climate change. Yet, resulting violence is likely to be confined to peripheral areas.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) and facilitate human mobility in the wake of climate change.

3.4 Further regions and impacts

Beyond the issues covered in previous sections, further climate-related challenges and regions deserve attention. In this section, we expand our analysis to also include regions that are somewhat less vulnerable to the immediate effects of climate change today, but that could increasingly become so in the future. We also discuss migration as a strategy to cope with adverse climatic change and analyse its dynamic in regions that play or could play an increasingly important role for European external action.

Migration and political pressures in the Western Balkans

The economies and political dynamics of the Western Balkans (also referred to as South-Eastern Europe) are closely tied to those of the EU. The EU is the region's largest trading partner, and EU companies are the biggest foreign investors in the region (European Commission 2018b). On the political front, countries in the Western Balkan have achieved candidate status[17] or are potential candidates[18] for EU accession (European Commission 2020). As such, policies in these countries, including those on climate, environment, and energy, are expected to be more closely aligned with EU legislation - in fact, the region's energy systems are "already partially integrated with those of the EU" (Rüttinger et al. 2021).

Migration is also an important topic that connects both the EU and Western Balkans. Over the past decade, the EU has been a major destination for refugees leaving the Balkans (West et al. 2020). In a recent stakeholder consultation process organised by the OSCE and adelphi, migration was identified as a priority climate-related security challenge affecting the region (Rüttinger et al. 2021).

Although not the most climate-vulnerable compared to other regions covered in this report, the Western Balkans has been described as one of the world's "warming hot spots" (World Bank 2014). For the entire Mediterranean region, temperatures are set to rise between 3.5 and 8.75°C under a RCP8.5 scenario by the end of the century, with enhanced warming projected over the Balkans (Doblas-Reyes et al. 2021:110). Wildfires are also expected to increase in frequency and coverage, with devastating consequences to forest degradation, defoliation, and mortality (Vuković & Vujadinović Mandić 2018). Likewise, more flood events are projected to occur, putting urban populations in hazard-prone areas such as floodplains and hillsides at high risk from both deluges and landslides (World Bank 2014).

These projections could lead to significant economic damages and loss of livelihoods through their impacts on agriculture, forestry, health, and tourism (Rüttinger et al., 2021). Floods in 2014, for example, resulted in economic losses of almost 15% and 5% of the GDPs of Bosnia and Herzegovina and Serbia respectively (Van Gelder 2018). Energy security is also not spared from these impacts: Albania, for example, had to import 80% of its electricity in the summer of 2017, due to both disruptions to hydropower production and higher energy demands for air conditioning (Balkan Green Energy News 2017). Consequently, these economic and infrastructural impacts could stir up popular discontent with

[17] Albania, Montenegro, North Macedonia, and Serbia.

[18] Bosnia and Herzegovina and Kosovo.

the region's government leaders, leading to political instability (Rüttinger et al. 2021).

All of these challenges could pressure more people to leave the Western Balkans - historically, the region has already seen large-scale emigration to the EU, mainly driven by low employment and economic prospects (Rüttinger et al. 2021). At the same time, the Western Balkans, being located along the so-called 'eastern route', is an important transit point for migration from other regions, which themselves are to a large extent also threatened by climate change (Rüttinger et al. 2021). All in all, these impacts could challenge the EU's migration policies for the region, as well as disrupt ongoing accession processes.

Box 3: COVID-19 in the Western Balkans.

Like in most other regions around the world, the COVID-19 pandemic has disrupted societies in the Western Balkans. In addition to the massive burden on healthcare systems, COVID-19 has led to a sharp drop in tourism - one of the most important drivers of economic growth in the region - as well as reduced remittances from the rest of Europe. This reduction in financial resources consequently could weaken the adaptive capacity of people to withstand the adverse impacts of climate change.

Pandemic-related movement restrictions could also rob individuals of the option to migrate to cope with the region's economic and environmental challenges, forcing potential migrants to remain in their precarious living conditions (Mosello et al. 2020). Mobility restrictions could also make migration a less viable adaptation strategy - migrants transiting the Western Balkans may be forced to remain for longer periods of time under deteriorating conditions, and they may find themselves exposed to xenophobic sentiment and violence (Strochlic 2021).

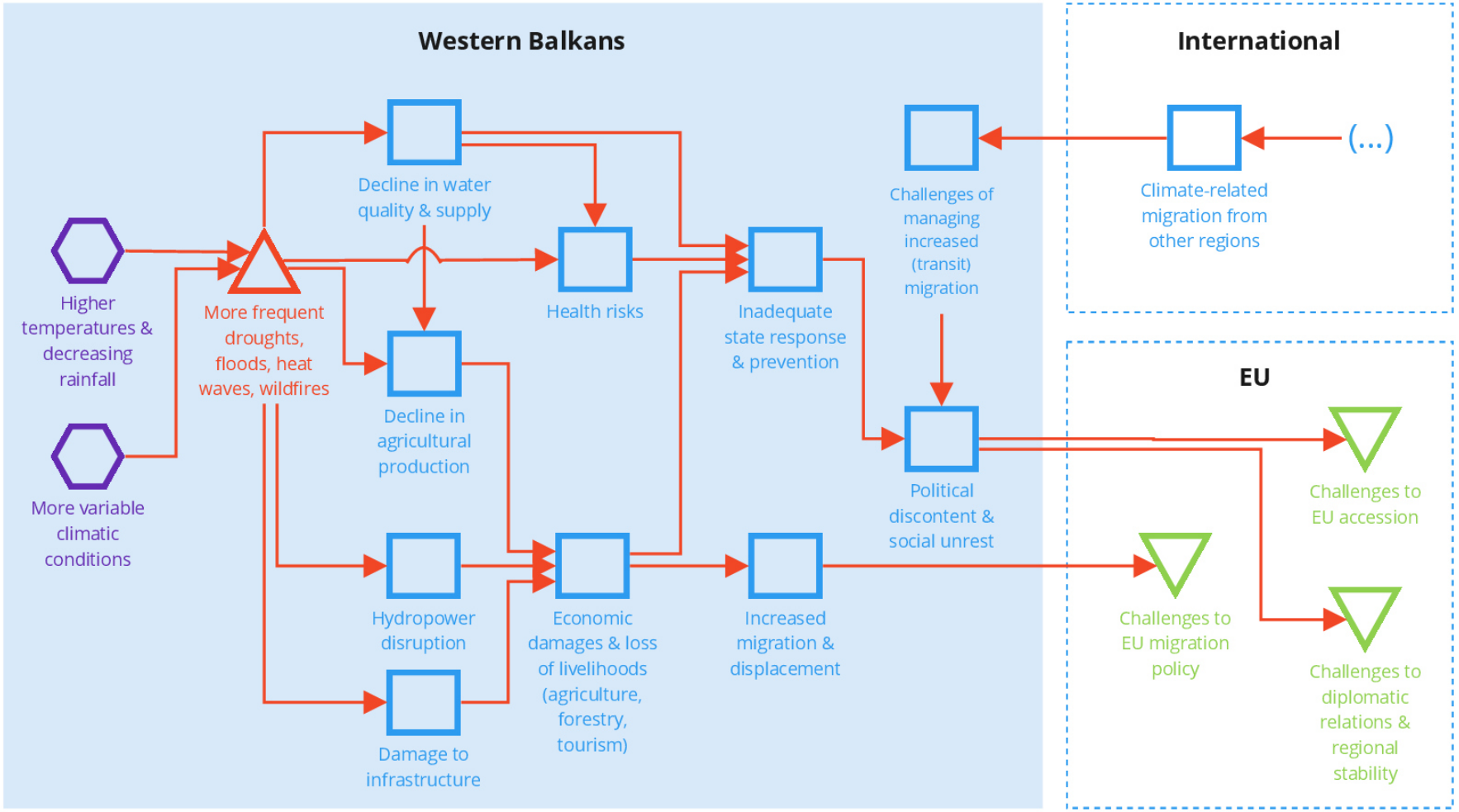
Neither is the political landscape across the Western Balkans immune to the pandemic. Several Western Balkan governments have instrumentalised health-related measures as a means to strengthen their position and to silence critics and political opponents (Huszka & Lessenska 2020). As a result, protests have gripped much of the region in the past year - Serbia, for example, saw some of the country's most serious unrest after its elections in summer 2020 (EWB 2020).

Additionally, the pandemic has put many Western Balkan countries at a geopolitical crossroads. China, Russia, and Turkey, for example, were perceived by several Western Balkan countries - most notably Serbia - to be more proactive than their EU counterparts in providing medical assistance and vaccines (Huszka & Lessenska 2020).

These instances of democratic backsliding, political instability, and geopolitical competition could undermine EU-Western Balkan relations. The far-reaching impacts of the COVID-19 pandemic could complicate and endanger the EU accession process and compromise EU efforts to promote climate adaptation, democratic institutions, and political stability in the region.

Source: Wolfmaier et al. (2021).

Figure 18. Climate change, migration, and political pressures in the Western Balkans.



Migration in South Asia

Several countries in South Asia are among the most climate-vulnerable in the world (The Energy and Resources Institute 2015). Warmer temperatures, sea level rise, accelerating glacial melt, and more frequent and intense extreme weather events are just some of the climate projections that could have severe consequences to the region's agriculture, fisheries, water sector, and human health (Jayaram 2019). Agricultural impacts are particularly acute: in the Indo-Gangetic Plains, half of the most productive wheat area could be lost due to heat stress, while sea level rise will affect the rice-growing regions of low-lying areas (Hijioka et al. 2014). With the latest climate projections of more intense and frequent humid heat stress and continued sea level rise (IPCC 2021c), such impacts are likely to become more severe.

In turn, these impacts could exacerbate food, economic, and livelihood insecurity in South Asia. In Nepal, where two-thirds of the population is directly engaged in agriculture (FAO 2020), rice yields could decline by as much as 30% by the end of the century due to climate impacts, thus severely threatening the food security of poor and marginalised populations (Pandey et al. 2020).

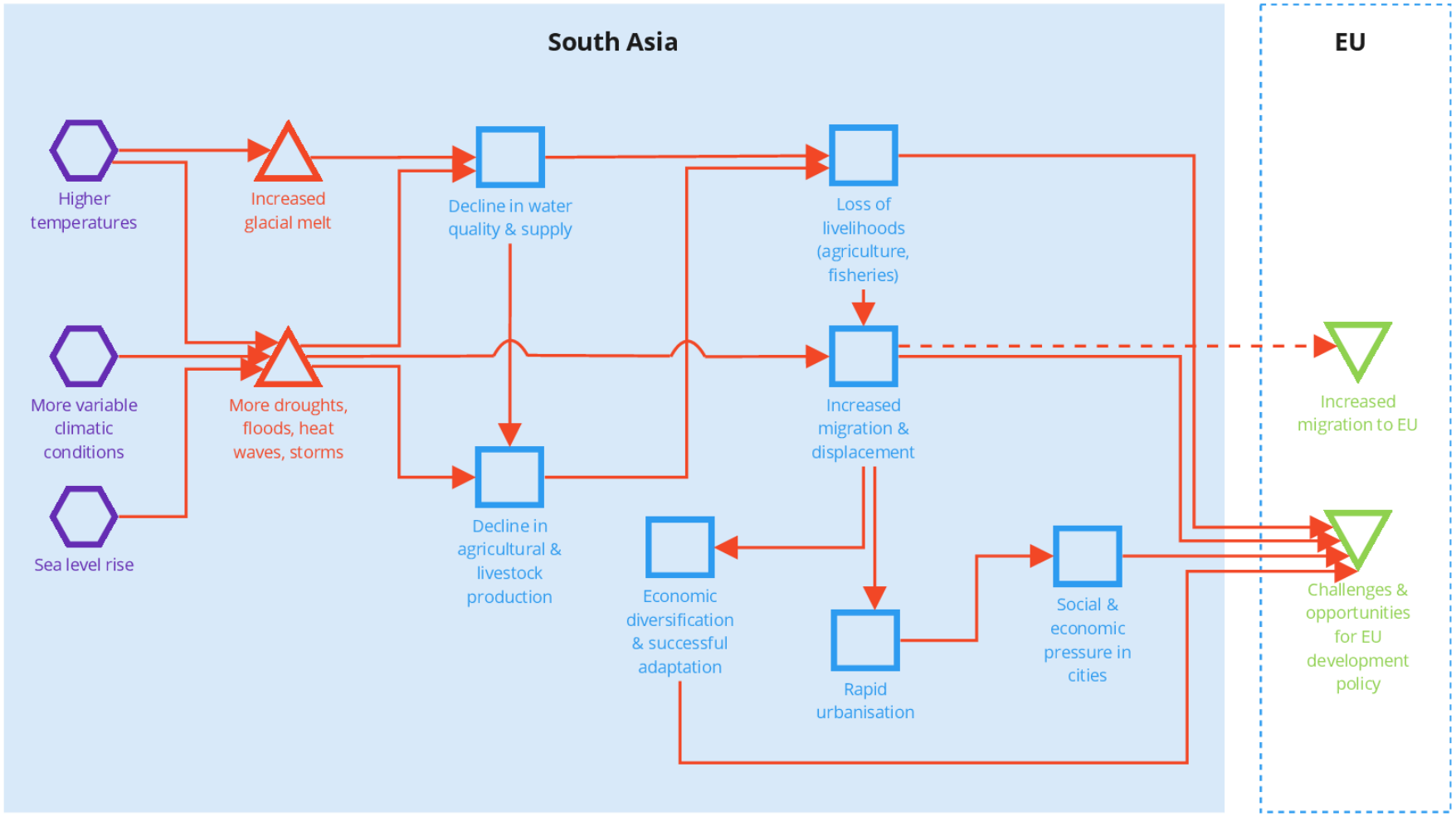
Consequently, climate impacts could drive more human mobility in the future. This could happen indirectly through climate change impacts on economies and livelihoods as discussed previously, as well as directly, such as in the aftermath of a rapid onset disaster (Jayaram 2019). For the most part, mobility in South Asia has been internal or within the Asian continent - in Bangladesh, the majority of migration is, and will likely remain, internal (Mosello et al. 2021). Meanwhile in Nepal, climate impacts could contribute to more international migration (mainly to the Gulf states and Malaysia), as well as to more seasonal migration to India and internal migration to lowland and urban areas (Pandey et al. 2020). These movements, whether internal or abroad, have been an important strategy to cope with environmental and economic challenges in the regions (Mosello et al. 2021).

Rural-urban migration presents a challenge in the face of climate change, as many urban areas are ill-equipped to withstand adverse environmental changes, and many have been built at the expense of critical ecosystems that provide protection from such changes (Jayaram 2019). Many South Asian cities are therefore struggling to cope with the massive influx of migrants - Dhaka, for example, receives up to 400,000 low-income migrants every year (Szczepanski et al. 2018).

Furthermore, rapid urbanisation could worsen tensions between host and migrant communities, and expose migrants to the risks of exploitation and human rights violations (Jayaram 2019). Nonetheless, migration remains an important coping strategy in the face of environmental change - remittances, for example, contribute a significant portion to several South Asian economies such as Bangladesh (Mosello et al. 2021).

Looking beyond South Asia, the number of migrants leaving the region for the EU is large in absolute terms - however, it is relatively small compared to the share of migrants that leave for other OECD countries - especially since migrants to the United Kingdom are not accounted for anymore post-Brexit (West et al. 2020). But with the devastating impacts of climate change becoming more severe and frequent, the EU may become an increasingly important destination for South Asian migrants in the future.

Figure 19. Climate change and migration in South Asia.



Migration in Central Asia

Central Asia ranks among the world's 'hot spot' regions with regards to climate change - the desiccation of the Aral Sea and melting of glaciers and permafrost are, among other impacts, testament to this (adelphi 2020; Climate Diplomacy n.d.a; OSCE 2017). Agriculture, for example, is threatened by floods, mudslides, and erratic water supply, all of which could intensify competition for land and water, thereby aggravating historical disputes between communities - such is the case in the border region of the Fergana valley (Mirimanova et al. 2018; see also Climate Diplomacy n.d.e). Furthermore, projections indicate that - unless irrigation is optimally managed - cotton and wheat production could experience significant losses by 2050 (IMPRESSIONS n.d.)

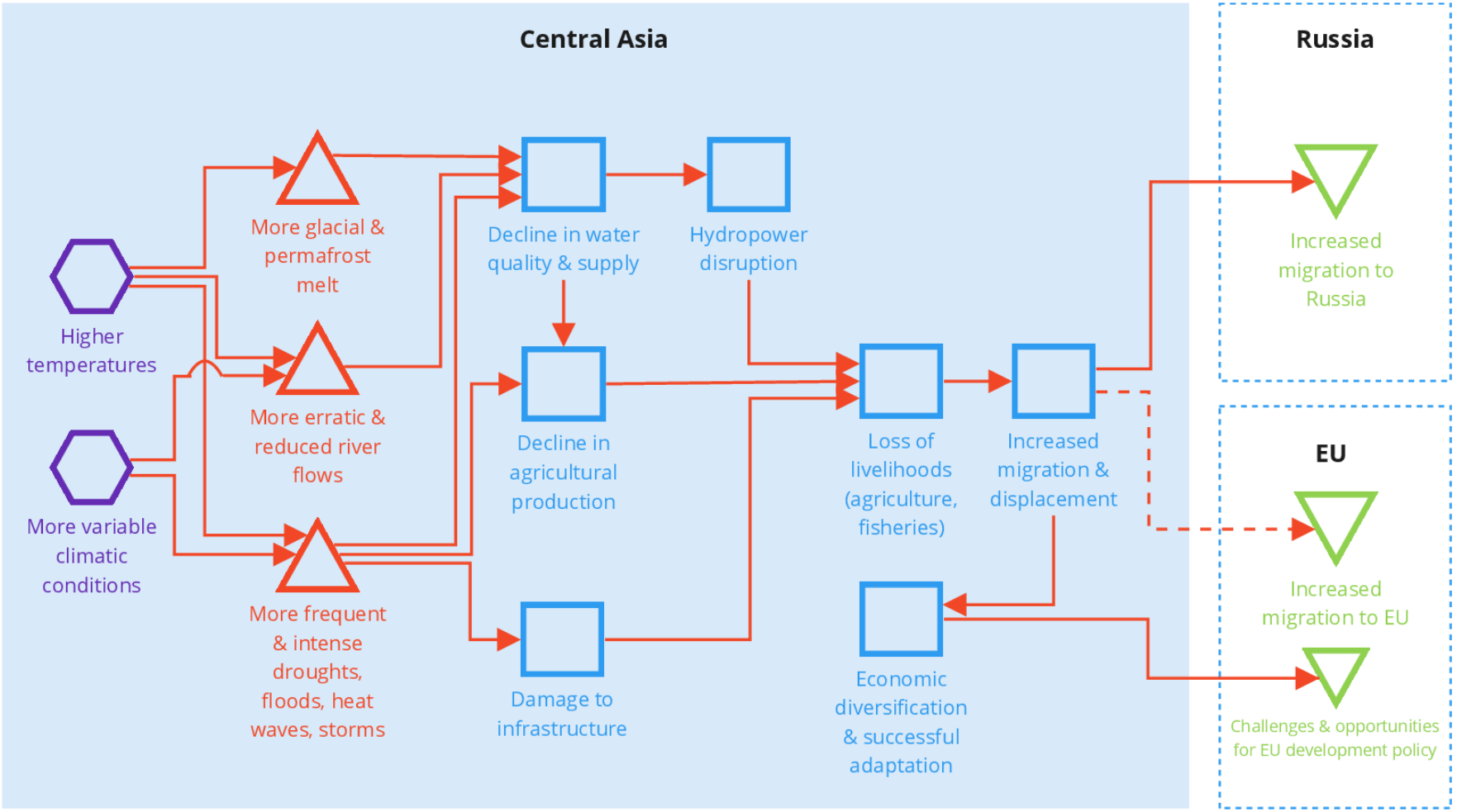
Likewise, the increasing variability and decreasing volume of water flows could also result in more frequent disruptions to hydropower generation. This would not only affect energy security and public service provision at large, but also spark cross-border disputes, especially if upstream countries hoard more water for their own use (Mirimanova et al. 2018; see also Climate Diplomacy, n.d.f). In the long run, these dynamics could not only exacerbate Central Asian livelihoods and security, but also affect human mobility.

Migration is not a new phenomenon in Central Asia. The cycles of drought and insufficient water supply in the Aral Sea region have led to multiple waves of migration in the 1990s and 2000s (Novikov & Kelly 2017). In addition to reducing pressure on natural resources in sending countries, cross-border migration has also been instrumental in maintaining regional political stability, as governments have long depended on the out-migration of young men - who are often at the heart of protests - to relieve the pressure on both economy and security (ICG 2010; Lang 2017). Furthermore, remittances from migrants are also important contributors to Central Asian livelihoods and in reducing poverty levels, although their significance is still debated (see e.g. Blondin 2019; Novikov & Kelly 2017; Rocheva & Varshaver 2018).

Because of linguistic, social, and infrastructural ties, migrants from Central Asian countries have been largely headed to the Russian Federation (Mosello et al. 2021). However, a sizable number of refugees leaving the region have also been found to leave for the EU between 2008 and 2017, most notably from Kazakhstan, Kyrgyzstan, and Tajikistan (West et al. 2020). This dynamic could intensify in the future as a result of growing pressures from climate change impacts, and the resulting socioeconomic and security consequences as highlighted above.

Mobility to the EU could also grow as Central Asian migrants seek alternatives to Russia, where they have limited access to services and housing, and face complicated and costly visa applications that limit their legal protection (Rocheva & Varshaver 2018). More recently, Russia's struggling economy amidst the COVID-19 pandemic, as well as the drop in oil prices have left many Central Asian migrants stranded in the country without employment and income (Blondin 2020; Ratha et al. 2020). These conditions, if they persist, could potentially encourage more migration towards the EU in the future.

Figure 20. Climate change and migration in Central Asia.



4. Summary and discussion

In a globalising and warming world, the cross-border effects of climate change are increasingly important to consider. Given trade, financial, and political linkages between countries, the direct impacts of climate triggers in one location are likely to have knock-on consequences in other locations and for other sectors than the ones initially affected. Yet, such *cascading effects* are not inevitable. As argued throughout this report, social, economic, political, and various other conditions ultimately attenuate or reinforce these effects. These moderating conditions have an important role to play when it comes to thinking about possible challenges in connection with climate change, and about opportunities for addressing them.

In this report, we have more specifically discussed the possible effects of climate change on issues at the core of European development, foreign, and security policy. In doing so we have focused mostly on regions in the European Neighbourhood but in part also on more distant regions with close ties to Europe. Our results offer insights into relevant mechanisms of risk transmission and pinpoint the conditions that make third countries more or less vulnerable to the effects of climate change, and are likely to struggle with climate-related social, economic, and political challenges.

Across regions, we identify a number of key moderating variables and group them into eight categories, for the sake of simplicity: 1) technology and physical infrastructure, 2) resource and conflict management, 3) economic structure, resources and opportunities, 4) trade and access to markets, 5) governance and state-citizen relations, 6) social and diplomatic tensions, 7) demography, and 8) natural and physical environment. Those are important to consider for assessing future vulnerability (or resilience) to the possible effects of climate change on livelihoods, human mobility, social cohesion, and peace.

Despite considerable challenges and increasing climatic pressures in all considered regions, our results leave some room for optimism. Depending on their ability to build strong and inclusive institutions, promote sustainable technologies, or reach amicable agreements with their neighbours, for example, affected countries might be able to avert the worst effects of climate change and embark on a resilient pathway.

In fact, we envision different scenarios for each observed region along the five SSPs, each with different implications for European development, foreign, and security policy. First, we consider a sustainable future (**SSP1**) characterised by more resilient social and ecological systems. People have learned to make due with less in order to respect their environment and promote social equity. In this scenario, regions outside Europe are reasonably resilient to the effects of climate change, especially to those that could affect social cohesion and political stability. Economic opportunities and coping capacities are somewhat lower than in SSP5. Importantly, this scenario implies some adaptation challenges for countries that have hitherto heavily relied on fossil fuel exports economically and politically, as we assume that global demand and prices for hydrocarbons will decline in this scenario as part of a global transition towards cleaner energies.

But we can just as well imagine a future with strong economic growth, driven by the exploitation of fossil energies (**SSP5**). In this scenario, strong economic growth spurs innovative solutions and generates financial resources for climate adaptation. In particular, Middle Eastern and North African countries fare relatively well at first. Yet, over the long term, path dependencies will make it increasingly difficult for hydrocarbon producers to cut their greenhouse gas emissions, should climate conditions worsen and political pressure thus augment. Meanwhile, marginalised communities remain vulnerable to the effects of climate change, which creates a number of additional challenges for sustainable development.

In contrast, we can also envision two more pessimistic scenarios. In **SSP3**, which is marked by strong geopolitical rivalries and political instability within third countries, mounting climatic pressures risk aggravating social tensions and competition over shared natural resources, triggering a downward spiral of violence, poverty, further environmental degradation, and displacements of populations. This scenario will create the biggest challenges for European external action. **SSP4** is marked by high social inequalities that challenge social cohesion and political stability in third countries. Yet, elites are too powerful to be overthrown and generally cooperate to maintain their privileges. Widespread social turmoil is unlikely, even in the presence of strong climatic pressures, but grievances prevail and less privileged groups are exposed to crime, exploitation, intimidation, and violence. In this scenario, mounting climatic pressures will mostly deepen existing social inequalities and create significant challenges for sustainable development. Lastly, we also consider a "middle of the road" scenario (**SSP2**), which is at the crossroads between the four other scenarios.

Looking beyond possible developments in regions that are in the focus of European foreign policy today, we should consider that the relationships between the EU and these regions might change as well. Following future shifts in global politics and realignments of the international systems, the EU might find itself in a different position and with different opportunities to cooperate with third countries. For example, we can imagine a situation in which interests of the member states converge, paving the way for a common foreign policy and an assertive global role in support of strong multilateral institutions. In such a scenario, the EU would be relatively well equipped to collaborate with climate-vulnerable third countries and to address cross-border climate risks that originate outside its borders. Current partners and the immediate neighbourhood would still be focal points of EU external actions, but there would also be opportunities to deepen cooperation with new and more distant partners.

We might just as well imagine a different future in which the EU is weakened by internal struggles and withdraws from the international stage. National interests of the member states dominate and external action is marred by intra-European rivalries. In such a scenario, European countries could tend to focus their diplomatic efforts on a few strategic partners in the immediate European neighbourhood, but without stable alliances and by adopting one-sided approaches to, for example, migration policy, military cooperation, and trade. Meanwhile, the rise of a number of regional powers with competing interests would further complicate external action, in particular in more distant regions. Depending on how relationships between the EU and the rest of the world will evolve, the risks and opportunities for the EU identified in this report will need to be appraised differently.

Climate change will become increasingly challenging in the coming years, yet its effects will ultimately be moderated by social, economic, and political factors. Studying what makes societies susceptible to be adversely affected by climate change and how such conditions evolve over time then gives not only an indication of where to direct adaptation efforts, but also of what specific vulnerabilities to address. In fact, the potential vulnerabilities presented in this report offer as many "levers" for preparing against the cascading effects of climate change. We encourage European policymakers to take the results of this report as an opportunity to intensify their effort towards addressing future climate risks and developing forward looking policies and adaptation strategies in cooperation with their partners in third countries.

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6. Appendix

For our review in Section 2.2, we primarily focused on quantitative research articles and working papers that empirically studied variables that moderate the effects of climate change on political and socioeconomic outcomes. However, we also complemented our review with qualitative studies and literature summaries, particularly where certain moderating factors and dependent variables (e.g. health) were lacking.

Papers were selected using a snowball method; starting with a selection of articles and texts based on expert recommendations, previous literature reviews, and CASCADES reports (i.e. Adams et al. 2018; Detges 2017a; Detges et al., 2020; Ide et al. 2020; Lahn et al. 2021; Mach et al. 2019; Müller et al. 2021; Puig et al. 2021). Additional literature search was conductor via Google Scholar and Scopus, using keywords related to "climate change", "moderating", and "conditioning", as well as keywords based on our dependent variable of interest (e.g. "conflict", "security", "migration", "sustainable development", "health").

In total, 139 papers were included in our review, of which 70 looked at climate-conflict relationships, while the remainder of the papers analysed the effects of climate change on other outcomes, such as income, migration, or food security. Figures 21-23 summarise the scope of reviewed papers.

Figure 21. Number of papers by type of climate stressor.

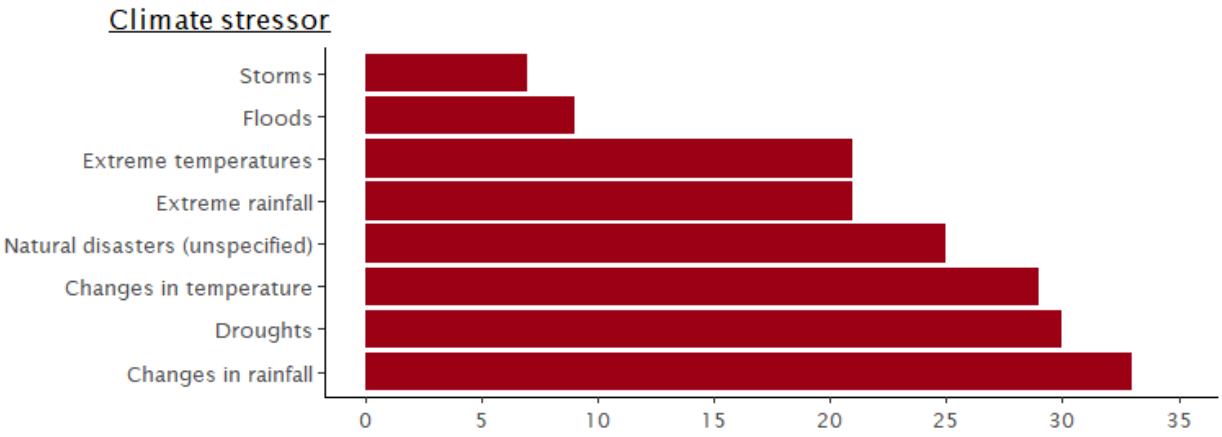

Figure 22. Number of papers by type of outcome.

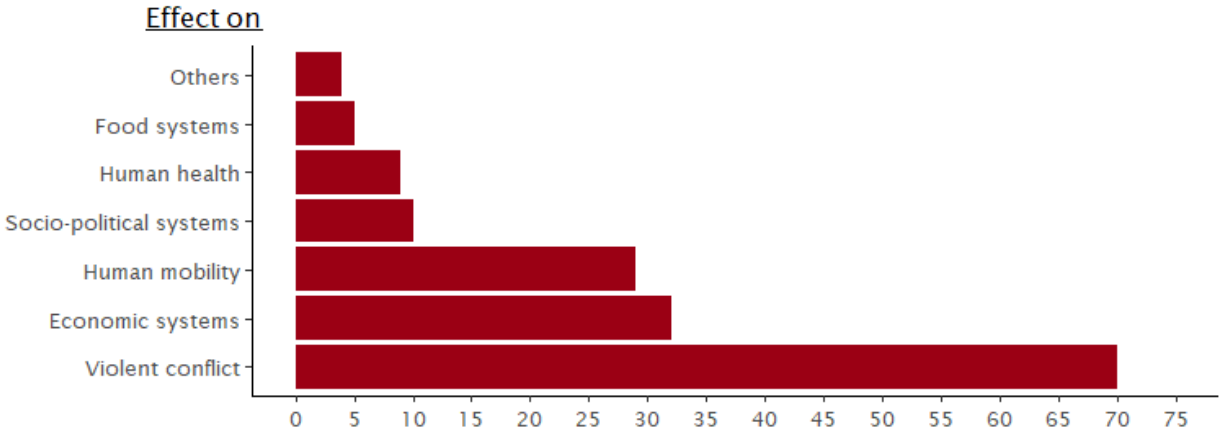

Figure 23. Number of papers by type of moderating factor.

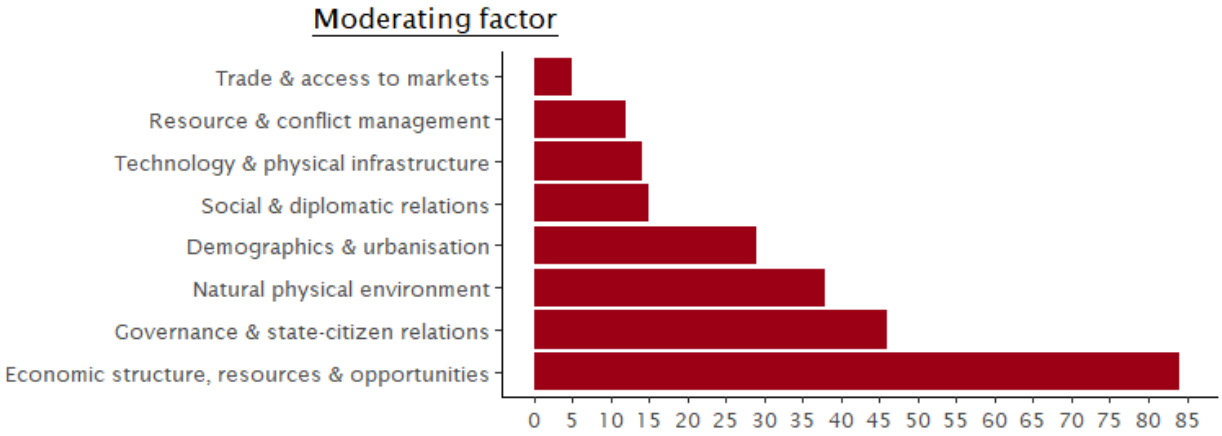

Table 5. Possible evolution of moderating influences and resulting vulnerabilities in North Africa until 2050.[19]

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Technology and physical infrastructure	International cooperation is increasingly effective and promotes sustainable technologies and risk sharing mechanisms. Technology transfer is facilitated by appropriate international agreements. Agricultural productivity in North Africa is high in comparison to other SSPs, while pollution is declining at a faster rate. Yet, a more sustainable, organic type of agriculture in SSP1 may not deliver the types of yields that a fertiliser-based agriculture can and hence productivity might remain below levels attained in SSP5. Improved infrastructure and maintenance reduce waste and improve water quality. A shift towards solar power and widespread use of water-saving technologies also reduce water demand for energy production and industrial and domestic use.	North African countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production and knock-on effects on livelihoods, food, water, and energy security, as well as on health and diplomatic relations.
Resource governance and conservation	Management of the global commons (including water) improves as cooperation and collaboration of local, national, and international organisations and institutions, the private sector, and civil society become enhanced. Countries adopt strong regulations on nature conservation worldwide. In North Africa, lower population growth compared to most other SSPs (and close to the global average) makes it easier to ensure sustainable resource use and limit pollution. Supported by their international partners, countries in the region increasingly adopt cooperative approaches that emphasise risk- and benefit-sharing. Water demand augments slightly, but remains low in comparison to other SSPs, thus limiting groundwater storage depletion. Irrigation withdrawals increase and are slightly higher than in SSP2. Climate adaptation readiness increases in the region and reaches medium levels compared to other regions in 2050.	Cooperative and sustainable approaches to resource management limit the adverse effects of climate change on agriculture, livelihoods, and human security and discourage conflicts over access to resources.
Economic structure and opportunities	The integration of global labour markets allows people to move around more freely. Regional production predominates, which reduces incentives for specialisation and leads to more diversified economies. In North Africa, economic activity increases faster than in most other SSPs, except SSP5. The transition of the economy away from oil and gas production holds opportunities for more sustainable industries but also implies some adaptation costs. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to better access to education.	More equitable access to education facilitates income diversification and makes it easier to prepare for - and to recover from - climatic shocks.

[19] Sources: Abdelkader et al. (2018); Andrijevic et al. (2020); Burek et al. (2016); Borgomeo et al. (2018); Carter et al. (2020); Dellink et al. (2015); Jiang & O'Neill (2017); KC & Lutz (2017); Lahn et al. (2021); Mazzoni et al. (2018); Müller et al. (2021); Nechifor & Winning (2016); O'Neill et al. (2017); Rao et al. (2019); Riahi et al. (2017); Wada et al. (2016).

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Trade and access to markets	Markets are globally connected. International markets, including markets for agricultural products, function well and with few distortions. North African countries trade with a range of partners globally, reducing dependency for food-importing countries. Yet, overall food imports increase in the region and are higher than in other SSPs, except SSP5. Reduced revenues from oil and gas exports make it more challenging to finance climate adaptation measures.	Good access to global markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes. Reduced revenues from oil and gas exports make it more challenging to finance climate adaptation measures.
Governance and state-citizen relations	International cooperation is increasingly effective and promotes more inclusive institutions. Access to global oil and gas plays a less important role in international relations. Rent-seeking and corruption in the energy sector are reduced, but challenges arise through necessary economic and political reforms in rentier states. Governance improves in North Africa. Government effectiveness and control of corruption surpass medium levels compared to other regions in 2050. Access to education and other services improves and attains high levels in comparison to other SSPs; education levels among the younger generation are slightly above the global average in 2050. This has a positive effect on state-citizen relations. Moderate population growth in comparison to other SSPs implies less pressure on institutions and public services. Rapid urbanisation (in comparison to other SSPs and other regions in the same scenario) remains a challenge, despite a commitment to effective urban planning and equitable access to services.	Improved governance, more equitable access to services, and improved state-citizen relations and civil society empowerment increase adaptive capacity and reduce the prospects of climate-induced grievances and social turmoil. Yet, political reforms in rentier states bring some governance challenges and uncertainty.
Social relations	A global focus on increasing equity also increases social cohesion, while maintaining high levels of social and cultural diversity within and across countries. In North Africa, social inequalities and poverty diminish and are lower than in most other scenarios. Differences between communities, gender, and age groups are fading. A focus on inclusive development and political participation in SSP1 leads to a more social cohesion and a stronger civil society.	Greater social equity and cohesion facilitate climate adaptation and reduce the risk of grievances in the wake of climate change. More harmonious and cooperative relations between communities discourage conflicts over access to resources.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Technology and physical infrastructure	Some international cooperation and investment in research. However, new sustainable technologies developed in industrialised countries are only slowly shared with middle- and low-income countries. Agricultural productivity in North Africa is at intermediate levels in comparison to other SSPs, while pollution is somewhat declining. Weak environmental awareness and moderate pace in technological development lead to only slow progress in water use efficiency. No effective halt to groundwater over-exploitation.	North African countries are susceptible to some extent to experiencing adverse effects of climate change on water availability and agricultural production with knock-on effects on human security and political stability.
Resource governance and conservation	Countries adopt medium regulations on nature conservation worldwide. Global and national institutions, and lack of cooperation and collaboration, make slow progress in achieving sustainable development goals. In North Africa, population growth creates some challenges for sustainable resource use and conservation. Corruption and competition between countries and resource users persist to some extent. Water demand augments slightly, but remains low in comparison to other SSPs, thus limiting groundwater storage depletion. Irrigation withdrawals increase but remain lower than in any other SSPs. Climate adaptation readiness in the region is at a low-medium level compared to other regions in 2050, albeit with differences among North African countries.	Conflicts over access to water and land are possible in the wake of climate change, due to imperfect institutions and cooperation mechanisms. Population growth and increasing water demand make it somewhat more challenging to withstand climatic shocks and pressures.
Economic structure and opportunities	Moderate barriers to international migration owing to the restriction of labour markets. Technological progress but no major breakthrough in manufacturing. In North Africa, economic activity increases somewhat, but less than in SSP1 and SSP5. There are some economic opportunities outside the agricultural sector but challenges persist with regard to education and acquiring the necessary skills. Education levels have increased and are intermediate compared to other SSPs.	Moderate opportunities outside the agricultural sector and intermediate access to education, credit etc. make climate adaptation somewhat challenging.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Trade and access to markets	Markets are globally connected but function imperfectly; entry barriers to agricultural markets are reduced only slowly. North African countries trade with a range of partners globally, reducing dependency for food importing countries. The level of food imports remains more or less stable until 2050.	Obstacles to international trade somewhat reduce the ability to cope with climate change. Global food price spikes remain a challenge, due to food import dependence.
Governance and state-citizen relations	Some international cooperation. Access to oil, gas, and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves in North Africa. Government effectiveness and control of corruption are almost at medium levels compared to other regions in 2050, albeit with some differences between countries. Access to education and other services makes steady progress and attains intermediate to high levels in comparison to other SSPs; education levels among the younger generation are slightly lower than in SSP1 and SSP5. State-citizen relations are heterogenous across the region and can fluctuate in some North African countries. Population growth creates some challenges for institutions and public services. Urbanisation rates are at an intermediate level compared to other SSPs and above the global average creating some challenges for urban planning.	To some extent, climatic pressures can lead to - or aggravate - public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges. Institutions remain somewhat centralised, which hampers effective climate adaptation.
Social relations	Income inequalities persist worldwide or improve only slowly. Societal stratification across and within countries persists. In North Africa, social inequalities and poverty diminish slightly and are at an intermediate level compared to other scenarios. Differences between communities, gender, and age groups are decreasing more slowly than in SSP1 and SSP5 and remain obstacles for social cohesion.	To some extent, climatic pressures can aggravate social tensions as North African countries come to grips with a legacy of inequality and social tensions. Social inequalities and the concentration of power among a small elite somewhat reduce adaptive capacity.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Technology and physical infrastructure	A resurgent nationalism, concerns about competitiveness and security, and regional conflicts hamper international cooperation. Sustainable technology development is slow, especially with very limited transfer to developing countries. Agricultural productivity in North Africa is low in comparison to other SSPs, while pollution levels are comparably high, partly due to unreliable water and energy supply for agricultural producers. Only modest improvements in irrigation water use efficiency and largely inefficient use of water for households, especially in growing urban slums. Persistent over-exploitation of groundwater aquifers. Insufficient maintenance puts infrastructures and major dams at risk of collapsing and increases the risk of water-borne diseases. Weaponisation of water infrastructure by armed groups is more frequent than in other SSPs.	North African countries are much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production with knock-on effects on livelihoods, food, water, and energy security, health, as well as military security and political stability.
Resource governance and conservation	Low priority worldwide to halt environmental degradation caused by agriculture. Management of cross-border watersheds is hampered by regional rivalry and conflicts over shared water resources. In North Africa, rapid population growth hampers sustainable resource use and conservation. Corruption is pervasive and resource governance is co-opted by powerful elites. Tensions between countries undermine effective cooperation. Water demand and irrigation withdrawals augment and are high compared to other SSPs, accelerating groundwater storage depletion. Climate adaptation readiness in the region is at a low level compared to other regions in 2050, albeit with differences among North African countries.	Rapid population growth and rising water demand paired with inefficient resource governance increase climate-related risks for livelihoods and human security. At the same time, geopolitical rivalries are likely to aggravate resource use conflicts in the wake of climate change.
Economic structure and opportunities	International migration is strongly restricted. Technological development and the expansion of non-agricultural sectors is limited. In North Africa, economic activity increases only marginally in comparison to other SSPs. Economic opportunities outside the agricultural sector are limited, in part because access to education and vocational training is poor compared to other scenarios. A comparably large share of uneducated youth struggle to find employment in the region or overseas, which increases political instability.	Poor access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and more susceptible to social turmoil.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Trade and access to markets	Barriers to international trade and restricted access to agricultural markets in particular. National and regional security issues foster stronger national policies to secure resources access. North African countries trade with a range of partners globally, but trade barriers remain an obstacle to food import diversification. Overall food imports increase in the region but not as much as in other SSPs.	Trade restrictions hamper effective climate adaptation. Protectionist policies in food producing countries increase the risk of global food price spikes in the event of multiple breadbasket failures.
Governance and state-citizen relations	International cooperation is limited. Access to oil, gas and mineral resources plays a central role in international relations, encouraging support for corrupt and authoritarian regimes. Governance reforms stagnate in North Africa. Government effectiveness and control of corruption remain at a low level compared to other regions in 2050. Access to education and other services is poor compared to other SSPs. This strains state-citizen relations. Elites resort to demagogy, coercion, and cronyism to stay in power, often stoking ethno-nationalist and xenophobic sentiment. Rapid population growth in North Africa compared to other SSPs pressures institutions and public services. Urbanisation is much slower than in other SSPs, but urban planning and access to urban services is generally poor.	Ineffective governance, poor service delivery for a rapidly growing population, and divisive rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. Institutional reforms are stalling and heavily centralised governance systems make it difficult to address climate-related challenges.
Social relations	Social relations worldwide are marred by resurgent nationalism, ethno-centrism, and persisting social inequalities. In contrast to most other SSPs, social inequalities and poverty increase in North Africa (but remain below the global average). Marginalised communities struggle to maintain living standards and access essential services. Social polarisation and negative sentiment against other groups, including Sahelian migrants is widespread.	Social inequalities and polarisation increase the prospect of grievances and violence in the wake of climate change.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Technology and physical infrastructure	International institutions and power structures increasingly focus on and serve the needs of the globally connected economy. The worldwide adoption of sustainable technologies is slow. Flow of information and technology where it benefits elites. Compared to other SSPs, agricultural productivity in North Africa is low in low-income and high in high income countries. Pollution levels are comparably high. Land and water grabbing to the benefit of elites and large international corporations. Efficient irrigation systems used for profitable and internationally traded cash crops. Little improvements in irrigation efficiencies of the low-income farm sector. Although water-saving technologies have been developed in high-income areas, lower-income North African countries cannot benefit, as they lack financial resources for investments. Climate adaptation readiness in the region is at a relatively low level compared to other regions in 2050, with some differences among North African countries.	Low and middle income North African countries are more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Knock-on effects on livelihoods, food, water, and energy security, as well as on health and political stability, are thus also more pronounced than in other scenarios for this group of countries.
Resource governance and conservation	Hardly any regulations on nature conservation and sustainable resource use in low income countries; and still important governance gaps in middle-income countries. In North Africa, population growth slows down, facilitating resource management. But resource management and water sector reforms serve the interests of the elite. Other groups lack the capacity to organise and assert their claims. Unequal access to clean water and sanitation fuels grievances and can lead to protests. Economic pragmatism leads to some cooperation between countries, but solutions rarely include provisions to avoid negative externalities for the most vulnerable. Water demand and irrigation withdrawals augment somewhat and are intermediate compared to other SSPs. Groundwater storage depletion continues in the region. Overall climate adaptation readiness in the region is at relatively low level compared to other regions in 2050, but large differences remain among and within North African countries.	Unequal power and access to resources create tensions that risk to be aggravated by climate change but are unlikely to spawn full blown war. Marginalised and poor population segments remain highly vulnerable to climate impacts on livelihoods and human security, in particular in rural and peri-urban areas. Violent protest can ensue when political responses to climate change are inadequate.
Economic structure and opportunities	International labour migration is easy for better educated (skilled) people, but difficult for less privileged groups. In North Africa, economic activity increases somewhat but economic development mainly benefits a small elite. There are opportunities outside the agricultural sector, but most cannot afford the necessary education and training. Social inequalities and slim economic prospects for less privileged groups incite illicit activities and fuel popular discontent with the political regime.	Unequal access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and susceptible to social turmoil.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Trade and access to markets	Trade barriers are relaxed for developed countries but remain for developing regions. Co-existence of well-organised value chains, run by the elite, and widespread subsistence and landless dwellers in rural areas. High-income North African countries trade with a range of partners globally, which allows for import diversification but trade barriers remain a challenge for low-income countries. Overall food imports increase in the region but not as much as in other SSPs.	Limited access to global markets hampers effective climate adaptation by low-income countries and small producers, which also remain vulnerable to global food price spikes.
Governance and state-citizen relations	Institutions and power structures increasingly focus on and serve the needs of the globally connected economy. Governance reforms are sluggish in North Africa and inequalities persist among and within countries. Government effectiveness and control of corruption barely improve and remain at a low level compared to other regions in 2050. Access to education and other services is poor overall except for the elite who can afford private solutions. Young people, in particular, struggle to obtain a good education. Lack of political commitment to reduce inequalities strains state-citizen relations. Population growth creates some challenges for sustainable resource use and conservation, but remains close to the global average. Urbanisation rates increase faster than in SSP2 and SSP3, exacerbating urban inequalities.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change, particularly in structurally neglected areas. Yet, aggrieved groups will rarely have the means to challenge political regimes in a significant way.
Social relations	Power becomes more concentrated in a relatively small political and business elite, even in democratic societies, while vulnerable groups have little representation in national and global institutions. Social cohesion degrades and grievances loom large. In contrast to most other SSPs, social inequalities and poverty increase in North Africa. Marginalised communities struggle to maintain living standards and access essential services. Negative sentiment against elites is widespread. Crime and violence are common in structurally neglected areas.	Social inequalities and the concentration of power among a small elite reduce adaptive capacity and increase the prospect of social tensions in the wake of climate change.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP5 Fossil-fuelled development Technology and physical infrastructure	Countries pursue a global "development first" agenda and increasingly cooperate on economic, development, and security policies. Technology transfer is facilitated by international agreements (e.g. on intellectual property rights). Agricultural productivity in North Africa is high in comparison to other SSPs, while pollution is somewhat declining. Large-scale engineering of water infrastructure to manage and provide reliable water supply. North African countries increasingly coordinate dam-building and operation (including data-sharing). Rapid economic development leads to much better access to safe drinking water and piped water access, as well as improved household water use efficiency. Yet, the development of oil and gas resources raises notable water quality risks and increases water use intensity in the energy sector, especially for fuel extraction and processing.	North African countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production and knock-on effects on livelihoods, food, water, and energy security, as well as on health and diplomatic relations.
Resource governance and conservation	Countries adopt some regulations on nature conservation. However, international frameworks are dominated by economic concerns. In North Africa, lower population growth compared to other SSPs reduces the burden on local resources. Governance and water sector reforms emphasise economic performance; potentials for more sustainable and equitable access are not fully realised. Pragmatism dominates diplomatic relations, which are for most parts stable in the region. Water demand augments rapidly and is high compared to other SSPs (in particular energy and manufacturing sectors). Groundwater storage depletion accelerates. Irrigation withdrawals increase and are slightly higher than in SSP2. Thanks to increased cooperation and financial resources, climate adaptation readiness increases in the region and reaches medium levels compared to other regions in 2050, albeit with some variation among North African countries.	Pragmatic and mostly cooperative approaches to resource governance limit the adverse effects of climate change, as well as potential conflicts over climate-sensitive resources. Yet, potentials for more sustainable and equitable resource use are not fully realised, leaving some communities vulnerable to the effects of climate change.
Economic structure and opportunities	International mobility is facilitated by gradually opening up labour markets as income disparities decrease. North Africa experiences rapid economic development compared to other SSPs. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to lower population growth and better access to education.	Rapid economic development and opportunities outside the agricultural sector make it easier to withstand the adverse effects of climate change.

Table 5. North Africa - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP5 Fossil-fuelled development Trade and access to markets	Global markets are increasingly integrated. Trade barriers are relaxed for all countries. North African countries trade with a range of partners globally, reducing dependency for food importing countries. Yet, overall food imports increase in the region and are higher than in any other SSPs.	Good access to international markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes.
Governance and state-citizen relations	Countries pursue a global "development first" agenda and support corresponding reforms in developing countries. Access to oil, gas, and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves in North Africa due to concerns for efficiency and economic performance. Government effectiveness and control of corruption surpass medium levels compared to other regions in 2050. Access to services improves and attains high levels in comparison to other SSPs. In particular younger generations find it easier to attain higher levels of education. This has a positive effect on state-citizen relations, yet some inequalities persist. Moderate population growth in comparison to other SSPs implies less pressure on institutions and public services. Yet, rapid urbanisation remains an important challenge.	Improved governance and access to services lead to more harmonious state-citizen relations and higher resilience against climate-induced social and economic pressures.
Social relations	Overall, within-country income disparities decrease worldwide and overall living standards slowly converge. In North Africa, social inequalities and poverty diminish faster than in any other scenario. Social relations have improved overall, but economic pragmatism dominates and efforts to include marginalised communities are limited. Power relations between gender, age, and other groups have somewhat evolved.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) in the wake of climate change.

Table 6. Possible evolution of moderating influences and resulting vulnerabilities in the Middle East until 2050.[20]

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Technology and physical infrastructure	International cooperation is increasingly effective and promotes sustainable technologies and risk-sharing mechanisms. Technology transfer is facilitated by appropriate international agreements. Agricultural productivity in the Middle East is high in comparison to other SSPs, while pollution is declining at a faster rate. Yet, a more sustainable, organic type of agriculture in SSP1 may not deliver the types of yields that a fertiliser-based agriculture can and hence productivity might remain below levels attained in SSP5. Improved infrastructure and maintenance reduce waste and improve water quality. A shift towards solar power and widespread use of water-saving technologies also reduce water demand for energy production and industrial and domestic use.	Middle Eastern countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production and knock-on effects on livelihoods, food, water, and energy security, as well as on health and diplomatic relations.
Resource governance and conservation	Management of the global commons (including water) improves as cooperation and collaboration of local, national, and international organisations and institutions, the private sector, and civil society become enhanced. Countries adopt strong regulations on nature conservation worldwide. In the Middle East, lower population growth compared to other SSPs (and close to the global average) makes it easier to ensure sustainable resource use and limit pollution. Supported by their international partners, countries in the region increasingly adopt cooperative approaches that emphasise risk and benefit sharing. Water demand augments slightly, but remains low in comparison to other SSPs, thus limiting groundwater storage depletion. Irrigation withdrawals increase but remain lower than in other SSPs. Climate adaptation readiness increases in the region and reaches medium levels compared to other regions in 2050, albeit with some variation among Middle Eastern countries.	Cooperative and sustainable approaches to cross-border resource management limit the adverse effects of climate change on agriculture, livelihoods, and human security, and discourage conflicts over access to resources.
Economic structure and opportunities	The integration of global labour markets allows people to move around more freely. Regional production predominates, which reduces incentives for specialisation and leads to more diversified economies. In the Middle East, economic activity increases faster than in most other SSPs, except SSP5. The transition of the economy away from oil production holds opportunities for more sustainable industries but also implies some adaptation costs. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to better access to education.	More equitable access to education facilitates income diversification and makes it easier to prepare for - and to recover from - climatic shocks.

[20] Sources: Abdelkader et al. (2018); Andrijevic et al. (2020); Burek et al. (2016); Borgomeo et al. (2018); Carter et al. (2020); Dellink et al. (2015); Jiang & O'Neill (2017); KC & Lutz (2017); Lahn et al. (2021); Mazzoni et al. (2018); Müller et al. (2021); Nechifor & Winning (2016); O'Neill et al. (2017); Rao et al. (2019); Riahi et al. (2017); Wada et al. (2016).

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Trade and access to markets	Markets are globally connected. International markets, including markets for agricultural products, function well and with few distortions. Middle Eastern countries trade with a range of partners globally, reducing dependency for food importing countries. Yet, overall food imports increase in the region and are higher than in other SSPs, except SSP5. Reduced revenues from oil and gas exports make adaptation more challenging.	Good access to global markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes. Reduced revenues from oil and gas exports make it more challenging to finance climate adaptation measures.
Governance and state-citizen relations	International cooperation is increasingly effective and promotes more inclusive institutions. Access to global oil and gas plays a less important role in international relations. Rent-seeking and corruption in the energy sector are reduced, but challenges arise through necessary economic and political reforms in rentier states. Governance improves in the Middle East. Government effectiveness and control of corruption are at a medium to high level compared to other regions in 2050. Access to education and other services improves and attains high levels in comparison to other SSPs; education levels among the younger generation are slightly above the global average in 2050. This has a positive effect on state-citizen relations. Moderate population growth in comparison to other SSPs implies less pressure on institutions and public services. Rapid urbanisation (in comparison to other SSPs and other regions in the same scenario) remains a challenge, despite a commitment to effective urban planning and equitable access to services.	Improved governance, more equitable access to services and improved state-citizen relations and civil society empowerment increase adaptive capacity and reduce the prospects of climate-induced grievances and social turmoil. Yet, political reforms in rentier states bring some governance challenges and uncertainty.
Social and diplomatic relations	A global focus on increasing equity also increases social cohesion, while maintaining high levels of social and cultural diversity within and across countries. In the Middle East, social inequalities and poverty diminish and are lower than in most other scenarios. Differences between communities, gender, and age groups are fading. A focus on inclusive development and political participation in SSP1 leads to a more social cohesion and a stronger civil society. Diplomatic relations between Middle Eastern countries improve, as polarisation and nationalist discourse give way to more cooperative and equitable relations.	Greater social equity and cohesion reduce the risk of grievances in the wake of climate change. More harmonious and cooperative relations between communities and states discourage conflicts over access to resources.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Technology and physical infrastructure	Some international cooperation and investment in research. However, new sustainable technologies developed in industrialised countries are only slowly shared with middle- and low-income countries. Agricultural productivity in the Middle East is at intermediate levels in comparison to other SSPs, while pollution is somewhat declining. Weak environmental awareness and moderate pace in technological development lead to only slow progress in water use efficiency. No effective halt to groundwater over-exploitation.	Middle Eastern countries are susceptible to some extent to experiencing adverse effects of climate change on water availability and agricultural production, with knock-on effects on human security and diplomatic relations.
Resource governance and conservation	Countries adopt medium regulations on nature conservation worldwide. Global and national institutions, and lack of cooperation and collaboration, make slow progress in achieving sustainable development goals. In the Middle East, population growth creates some challenges for sustainable resource use and conservation. Corruption and competition between countries and resource users persist to some extent. Water demand augments slightly, but remains low in comparison to other SSPs, thus limiting groundwater storage depletion. Irrigation withdrawals increase but remain lower than in other SSPs. Climate adaptation readiness in the region is at a medium level compared to other regions in 2050, albeit with some variation among Middle Eastern countries.	Conflicts over access to water and land are possible in the wake of climate change, due to imperfect institutions and cooperation mechanisms. Population growth and increasing water demand make it somewhat more challenging to withstand climatic shocks and pressures.
Economic structure and opportunities	Moderate barriers to international migration owing to the restriction of labour markets. Technological progress but no major breakthrough in manufacturing. In the Middle East, economic activity increases somewhat, but less than in SSP1 and SSP5. There are some economic opportunities outside the agricultural sector but challenges persist with regard to education and acquiring the necessary skills. Education levels have increased and are intermediate compared to other SSPs.	Moderate opportunities outside the agricultural sector and intermediate access to education, credit etc. make climate adaptation somewhat challenging.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Trade and access to markets	Markets are globally connected but function imperfectly; entry barriers to agricultural markets are reduced only slowly. Middle Eastern countries trade with a range of partners globally, reducing dependency for food-importing countries. Yet, overall food imports increase somewhat in the region and reach levels comparable to SSP1.	Obstacles to international trade somewhat reduce the ability to cope with climate change. Global food price spikes remain a challenge.
Governance and state-citizen relations	Some international cooperation. Access to oil, gas, and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves somewhat in the Middle East. Government effectiveness and control of corruption are at medium levels compared to other regions in 2050, albeit with some differences between countries. Access to education and other services makes steady progress and attains medium to high levels in comparison to other SSPs; education levels among the younger generation are slightly lower than in SSP1 and SSP5. State-citizen relations are heterogenous across the region and can fluctuate in some Middle Eastern countries. Population growth creates some challenges for institutions and public services. Urbanisation rates are at an intermediate level compared to other SSPs and above the global average, creating some challenges for urban planning.	To some extent, climatic pressures can lead to - or aggravate - public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges. Institutions remain somewhat centralised, which hampers effective climate adaptation.
Social and diplomatic relations	Income inequalities persist worldwide or improve only slowly. Societal stratification across and within countries persists. In the Middle East, social inequalities and poverty diminish slightly and are at an intermediate level compared to other scenarios. Differences between communities, gender, and age groups are decreasing more slowly than in SSP1 and SSP5 and remain obstacles for social cohesion. Inequalities between Middle Eastern countries persist to some extent, and diplomatic relations are marked by ups and downs; but overt conflict is rare.	To some extent, climatic pressures can aggravate social and diplomatic tensions as Middle Eastern countries come to grips with a legacy of inequality and tensions among and within countries.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Technology and physical infrastructure	A resurgent nationalism, concerns about competitiveness and security, and regional conflicts hamper international cooperation. Sustainable technology development is slow, especially with very limited transfer to developing countries. Agricultural productivity in the Middle East is low in comparison to other SSPs, while pollution levels are comparably high, partly due to unreliable water and energy supply for agricultural producers. Only modest improvements in irrigation water use efficiency and largely inefficient use of water for households, especially in growing urban slums. Persistent over-exploitation of groundwater aquifers. Insufficient maintenance puts infrastructures and major dams at risk of collapsing and increases the risk of water-borne diseases. Weaponisation of water infrastructure by armed groups is more frequent than in other SSPs.	Middle Eastern countries are much more susceptible to experiencing adverse effects of climate change on water availability and agricultural production, with knock-on effects on livelihoods, food, water, and energy security, as well as on health, military security, and diplomatic relations.
Resource governance and conservation	Low priority worldwide to halt environmental degradation caused by agriculture. Management of cross-border watersheds is hampered by regional rivalry and conflicts over shared water resources. In the Middle East, rapid population growth hampers sustainable resource use and conservation. Corruption is pervasive and resource governance is co-opted by powerful elites. Tensions between countries undermine effective cooperation. Water demand and irrigation withdrawals augment and are high compared to other SSPs, accelerating groundwater storage depletion. Climate adaptation readiness in the region is at a low to medium level compared to other regions in 2050, with some variation among Middle Eastern countries.	Rapid population growth and rising water demand paired with inefficient resource governance increase climate-related risks for livelihoods and human security. At the same time, geopolitical rivalries are likely to aggravate resource use conflicts in the wake of climate change.
Economic structure and opportunities	International migration is strongly restricted. Technological development and the expansion of non-agricultural sectors is limited. In the Middle East, economic activity increases only marginally in comparison to other SSPs. Economic opportunities outside the agricultural sector are limited, in part because access to education and vocational training is poor compared to other scenarios. A comparably large share of uneducated youth struggle to find employment in the region or overseas, which increases political instability.	Poor access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and more susceptible to social turmoil.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Trade and access to markets	Barriers to international trade and restricted access to agricultural markets in particular. National and regional security issues foster stronger national policies to secure resources access. Middle Eastern countries trade with a range of partners globally, but trade barriers remain an obstacle to food import diversification. Overall food imports increase in the region but not as much as in other SSPs.	Trade restrictions hamper effective climate adaptation. Protectionist policies in food-producing countries increase the risk of global food price spikes in the event of multiple breadbasket failures.
Governance and state-citizen relations	International cooperation is limited. Access to oil, gas and mineral resources plays a central role in international relations, encouraging support for corrupt and authoritarian regimes. Governance reforms stagnate in the Middle East. Government effectiveness and control of corruption remain at an intermediate level compared to other regions in 2050. Access to education and other services is poor compared to other SSPs. This strains state-citizen relations. Elites resort to demagogy, coercion, and cronyism to stay in power, often stoking ethno-nationalist and xenophobic sentiment. Rapid population growth in the Middle East compared to other SSPs pressures institutions and public services. Urbanisation is much slower than in other SSPs, but urban planning and access to urban services is generally poor.	Ineffective governance, poor service delivery for a rapidly growing population, and divisive rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change. Institutional reforms are stalling, and heavily centralised governance systems make it difficult to address climate-related challenges locally.
Social and diplomatic relations	Social relations worldwide are marred by resurgent nationalism, ethno-centrism, and persisting social inequalities. In contrast to most other SSPs, social inequalities and poverty increase in the Middle East (but remain below the global average). Marginalised communities struggle to maintain living standards and access essential services. Social polarisation and negative sentiment against other groups is widespread. Diplomatic relations between Middle Eastern countries are marred by rivalry, nationalist sentiment, and political polarisation. Military and economic power - although lower than in other scenarios - is more evenly distributed, increasing the risk of overt confrontations, with the tacit or implicit implication of greater global powers.	Social inequalities and polarisation increase the prospect of grievances and communal conflict in the wake of climate change. Poor relations between communities and states increase the risk of conflicts over access to climate-sensitive resources.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Technology and physical infrastructure	International institutions and power structures increasingly focus on and serve the needs of the globally connected economy. The worldwide adoption of sustainable technologies is slow. Flow of information and technology where it benefits elites. Compared to other SSPs, agricultural productivity in the Middle East is low in low-income and high in high-income countries. Pollution levels are comparably high. Land and water grabbing to the benefit of elites and large international corporations. Efficient irrigation systems used for profitable and internationally traded cash crops. Little improvements in irrigation efficiencies of the low-income farm sector. Although water-saving technologies have been developed in high-income areas, lower-income Middle Eastern countries cannot benefit, as they lack financial resources for investments. Climate adaptation readiness in the region is at low to medium levels compared to other regions in 2050, with large differences among Middle Eastern countries.	Low- and middle-income Middle Eastern countries are more susceptible to experiencing adverse effects of climate change on water availability and agricultural production. Knock-on effects on livelihoods, food, water, and energy security, as well as on health and political stability, are thus also more pronounced than in other scenarios for this group of countries.
Resource governance and conservation	Hardly any regulations on nature conservation and sustainable resource use in low income countries; and still important governance gaps in middle-income countries. In the Middle East, population growth creates some challenges for sustainable resource use and conservation, but remains close to the global average. Resource management and water sector reforms serve the interests of the elite. Other groups lack the capacity to organise and assert their claims. Unequal access to clean water and sanitation fuels grievances and can lead to protests. Economic pragmatism leads to some cooperation between countries, but solutions rarely include provisions to avoid negative externalities for the most vulnerable. Water demand and irrigation withdrawals augment somewhat and are intermediate compared to other SSPs. Groundwater storage depletion continues in the region. Overall climate adaptation readiness in the region is at medium levels compared to other regions in 2050, but large differences remain among and within Middle Eastern countries.	Unequal power and access to resources create tensions that risk to be aggravated by climate change, but are unlikely to spawn full blown war. Marginalised and poor population segments remain highly vulnerable to climate impacts on livelihoods and human security, in particular in rural and peri-urban areas. Violent protest can ensue when political responses to climate change are inadequate.
Economic structure and opportunities	International labour migration is easy for better educated (skilled) people, but difficult for less privileged groups. In the Middle East, economic activity increases somewhat but economic development mainly benefits a small elite. There are opportunities outside the agricultural sector, but most cannot afford the necessary education and training. Social inequalities and slim economic prospects for less privileged groups incite illicit activities and fuel popular discontent with the political regime.	Unequal access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change and susceptible to social turmoil.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Trade and access to markets	Trade barriers are relaxed for developed countries but remain for developing regions. Co-existence of well-organised value chains, run by the elite, and widespread subsistence and landless dwellers in rural areas. High-income Middle Eastern countries trade with a range of partners globally, which allows for import diversification, but trade barriers remain a challenge for low-income countries. Overall food imports increase in the region but not as much as in other SSPs.	Limited access to global markets hampers effective climate adaptation by low-income countries and small producers, which also remain vulnerable to global food price spikes.
Governance and state-citizen relations	Institutions and power structures increasingly focus on and serve the needs of the globally connected economy. Governance reforms are sluggish in the Middle East and inequalities persist among and within countries. Government effectiveness and control of corruption remain at an intermediate level compared to other regions in 2050. Access to education and other services is poor overall except for the elite who can afford private solutions. Young people, in particular, struggle to obtain a good education. Lack of political commitment to reduce inequalities strains state-citizen relations. Population growth creates some challenges for sustainable resource use and conservation, but remains close to the global average. Urbanisation rates increase faster than in other SSPs, exacerbating urban inequalities.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change, particularly in structurally neglected areas. Yet, aggrieved groups will rarely have the means to challenge political regimes in a significant way.
Social and diplomatic relations	Power becomes more concentrated in a relatively small political and business elite, even in democratic societies, while vulnerable groups have little representation in national and global institutions. Social cohesion degrades and grievances loom large. In contrast to most other SSPs, social inequalities and poverty increase in the Middle East. Marginalised communities struggle to maintain living standards and access essential services. Negative sentiment against elites is widespread. Crime and violence are common in structurally neglected areas. Inequalities between Middle Eastern countries persist to some extent, but diplomatic relations remain pragmatic and focused on the common interests of the elites.	Social inequalities and the concentration of power among a small elite increase the prospect of social tensions in the wake of climate change.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP5 Fossil-fuelled development Technology and physical infrastructure	Countries pursue a global "development first" agenda and increasingly cooperate on economic, development, and security policies. Technology transfer is facilitated by international agreements (e.g. on intellectual property rights). Agricultural productivity in the Middle East is high in comparison to other SSPs, while pollution is somewhat declining. Large-scale engineering of water infrastructure to manage and provide reliable water supply. Middle Eastern countries increasingly coordinate dam-building and operation (including data-sharing). Rapid economic development leads to much better access to safe drinking water and piped water access, as well as improved household water use efficiency. Yet, the development of oil and gas resources raises notable water quality risks and increases water use intensity in the energy sector, especially for fuel extraction and processing.	Middle Eastern countries are less susceptible to experiencing adverse effects of climate change on water availability and agricultural production and knock-on effects on livelihoods, food, water, and energy security, as well as on health and diplomatic relations.
Resource governance and conservation	Countries adopt some regulations on nature conservation. However, international frameworks are dominated by economic concerns. In the Middle East, lower population growth compared to other SSPs (and close to the global average) reduces the burden on local resources. Governance and water sector reforms emphasise economic performance; potentials for more sustainable and equitable access are not fully realised. Pragmatism dominates diplomatic relations, which are for most parts stable in the region. Water demand augments rapidly and is high compared to other SSPs (in particular energy and manufacturing sectors). Groundwater storage depletion accelerates. Irrigation withdrawals increase and are at intermediate levels compared to other SSPs. Thanks to increased cooperation and financial resources, climate adaptation readiness increases in the region and reaches medium levels compared to other regions in 2050, albeit with some variation among Middle Eastern countries.	Pragmatic and mostly cooperative approaches to resource governance limit the adverse effects of climate change, as well as potential conflicts over climate-sensitive resources. Yet, potentials for more sustainable and equitable resource use are not fully realised, leaving some communities vulnerable to the effects of climate change.
Economic structure and opportunities	International mobility is facilitated by gradually opening up labour markets as income disparities decrease. The Middle East experiences rapid economic development compared to other SSPs. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to lower population growth and better access to education.	Rapid economic development and opportunities outside the agricultural sector make it easier to withstand the adverse effects of climate change.

Table 6. Middle East - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP5 Fossil-fuelled development Trade and access to markets	Global markets are increasingly integrated. Trade barriers are relaxed for all countries. Middle Eastern countries trade with a range of partners globally, reducing dependency for food-importing countries. Yet, overall food imports increase in the region and are higher than in any other SSPs.	Good access to international markets makes it easier for agricultural producers to withstand adverse climatic shocks at home, yet the region remains somewhat vulnerable to global food price spikes.
Governance and state-citizen relations	Countries pursue a global "development first" agenda and support corresponding reforms in developing countries. Access to oil, gas, and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves in the Middle East due to concerns for efficiency and economic performance. Government effectiveness and control of corruption reach medium to high levels compared to other regions in 2050. Access to services improves and attains high levels in comparison to other SSPs. In particular, younger generations find it easier to attain higher levels of education. This has a positive effect on state-citizen relations, yet some inequalities persist. Moderate population growth in comparison to other SSPs implies less pressure on institutions and public services. Yet, rapid urbanisation remains an important challenge.	Improved governance and access to services lead to more harmonious state-citizen relations and higher resilience against climate-induced social and economic pressures.
Social and diplomatic relations	Overall, within-country income disparities decrease worldwide and overall living standards slowly converge. In the Middle East, social inequalities and poverty diminish faster than in any other scenario. Social relations have improved overall, but economic pragmatism dominates and efforts to include marginalised communities are limited. Power relations between gender, age, and other groups have somewhat evolved. Diplomatic relations between Middle Eastern countries improve, but inequalities in economic and military power persist, partly due to differences in fossil resource and technology endowments. Regional hegemons keep their privileged position, which adds to popular grievances but leads to more geopolitical stability.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) in the wake of climate change. Unequal military and economic power is a cause of grievances in the region but also has a stabilising effect. Climate-related tensions are thus less likely to lead to full blown violent conflict.

Table 7. Possible evolution of moderating influences and resulting vulnerabilities in the Central Sahel until 2050.[21]

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Agricultural productivity and technologies	International cooperation is increasingly effective and promotes sustainable technologies (including traditional knowledge) and risk-sharing mechanisms. Technology transfer is facilitated by appropriate international agreements. In West Africa, agricultural productivity increases, yet levels remain somewhat below those of SSP5 (which assumes more widespread fertiliser use) backed by investments and government support. Political will is strong but resources are sometimes limited. Water and land use become more efficient and irrigation is more widely implemented once investments in institutional capacity begin to take effect. Climate adaptation readiness increases in the Central Sahel and reaches medium levels compared to other regions in 2050.	Central Sahelian economies are less susceptible to experiencing adverse effects of climate change on agricultural production and knock-on effects on livelihoods and food security.
Economic structure and opportunities	The integration of global labour markets allows people to move around more freely. The emphasis is on regional production, which reduces incentives for specialisation and leads to more diversified national economies. In the Central Sahel, economic activity increases slightly less than in SSP5 and remains somewhat below the global average in 2050. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to lower population growth and better access to education for all. Access to insurance and credit is also more widespread and equitable compared to other scenarios.	More equitable access to education facilitates income diversification and makes it easier to prepare for - and to recover from - agricultural shocks.
Trade and access to markets	Markets are globally connected. International markets, including markets for agricultural products, open up to developing countries. Food imports and exports are balanced overall in Sub-Saharan Africa. Regional integration and cross-border trade are successfully promoted in West Africa.	Regional integration and improved access to international markets make it easier for agricultural producers to withstand adverse climatic shocks.

[21] Sources: Ahmed et al. (2016); Andrijevic et al. (2020); Biewald et al. (2015, 2017); Burek et al. (2016); Carter et al. (2020); Dagnachew et al. (2018); Doelman et al. (2018); Dellink et al. (2015); Jiang & O'Neill (2017); Kabir, 2019; KC & Lutz (2017); Lutz et al. (2018); Nicolas et al. (2019); O'Neill et al. (2017); Palazzo et al. (2017); Rao et al. (2019); Riahi et al. (2017); Van Ackern & Detges (forthcoming).

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP1 Sustainability Resource and conflict management	Countries adopt strong regulations on nature conservation worldwide. Land acquisitions by foreign investors and privatisation of communal and trust land are subject to stringent rules. In West Africa, the amount of cultivated areas augments only slowly in comparison to other SSPs, limiting agricultural encroachment on pastoral land and making it easier to maintain transhumance corridors and schedules. Land use rights are clearly defined and facilitate access for previously marginalised groups. Local committees work on the prevention of possible conflicts between farmers and herders. Compensation mechanisms are in place in case of damages and reparations are paid to the victims of past conflicts.	Slow expansion of agricultural areas, communal dialogue and inclusive resource management institutions prevent climate-related land use conflicts from escalating.
Governance and state-citizen relations	International cooperation is increasingly effective and promotes more inclusive institutions. Governance improves in the Central Sahel. Government effectiveness and control of corruption reach medium levels compared to other regions in 2050. Access to healthcare, education, and other services improves and attains high levels in comparison to other SSPs. This has a positive effect on state-citizen relations. Moderate population growth in the Central Sahel in comparison to other SSPs implies less pressure on institutions and public services. Rapid urbanisation (in comparison to other SSPs but still slower than in other regions) remains a challenge, despite a commitment to effective urban planning and equitable access to services.	Improved governance, more equitable access to services, and improved state-citizen relations reduce the prospects of climate-induced grievances on which armed groups could capitalise.
Social relations	A global focus on increasing equity also increases social cohesion, while maintaining high levels of social and cultural diversity within and across countries. In the Central Sahel, social inequalities and poverty diminish and are lower than in other scenarios. Differences between communities, gender, and age groups are fading. A focus on inclusive development and political participation in SSP1 leads to a more social cohesion and a stronger civil society.	Greater social equity and cohesion reduce the risk of grievances and communal conflict in the wake of climate change. Social openness facilitates migration as a coping strategy.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Agricultural productivity and technologies	Some international cooperation and investment in research. However, new agricultural technologies developed in industrialised countries are only slowly shared with middle- and low-income countries. In West Africa, agricultural productivity increases somewhat (but less than in SSP1 or SSP5). The professionalisation of farmers supported by social enterprises and CSO is combined with more effective technology; though benefiting largely those who already have some capacity for yield increase. Demand for meat drives private sector investment in livestock production. Small irrigation schemes can be set up by the private sector, but no big public investments in irrigation are made. Climate adaptation readiness increases in the Central Sahel and reaches low to medium levels compared to other regions in 2050.	Central Sahelian economies are susceptible to some extent to experiencing adverse effects of climate change on agricultural production with knock-on effects on livelihoods and food security.
Economic structure and opportunities	Moderate barriers to international migration owing to the restriction of labour markets. Technological progress but no major breakthrough in manufacturing. In the Central Sahel, economic activity increases, but less than in SSP5, and remains somewhat below the global average. There are some economic opportunities outside the agricultural sector but challenges persist with regard to education and acquiring the necessary skills. Education levels are intermediate compared to other SSPs and also somewhat higher than today.	Moderate opportunities outside the agricultural sector and intermediate access to education, credit etc. make climate adaptation somewhat challenging.
Trade and access to markets	Markets are globally connected but function imperfectly; entry barriers to agricultural markets are reduced only slowly. Growing demand for livestock products. Food imports for Sub-Saharan Africa exceed exports. Regional integration in West Africa progresses more slowly than in other SSPs and obstacles to cross-border trade remain.	Imperfect market integration and obstacles to cross-border trade somewhat reduce the ability to cope with climate change.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP2 Middle of the road Resource and conflict management	Countries adopt medium regulations on nature conservation worldwide. Land acquisitions by foreign investors and privatisation of communal and trust land are not uncommon. In West Africa, the amount of cultivated areas augments to the detriment of forest and pastoral land (but not as rapidly as in SSP3), making it somewhat challenging to maintain transhumance corridors and schedules. Land use rights are not always coherent or effectively enforced. Resource access is more difficult for marginalised groups. Compensation mechanisms exist but do not always take effect. This complicates the resolution of land use conflicts.	Violent conflicts over access to land are possible in the wake of climatic shocks in a context of intermediate agricultural expansion and imperfect institutions for resource and conflict management.
Governance and state-citizen relations	Some international cooperation. Access to oil, gas and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves modestly in the Central Sahel. Government effectiveness and control of corruption reach low to medium levels compared to other regions in 2050. Access to health care, education and other services makes steady progress and attains intermediate levels in comparison to other SSPs. State-citizen relations are marked by ups and downs and governments change frequently. Intermediate population growth in the Central Sahel in comparison to other SSPs implies some pressures on institutions and public services. Urbanisation is less rapid than in SSP1 and SSP5 and urbanisation rates are much lower than for the rest of the world, yet urban planning is sometimes sluggish.	To some extent, climatic pressures can lead to - or aggravate - public discontent in the context of governance challenges and fluctuating state-citizen relations. Growing urban populations create additional challenges.
Social relations	Income inequalities persist worldwide or improve only slowly. Societal stratification across and within countries persists. In the Central Sahel, social inequalities and poverty diminish slightly and are at an intermediate level compared to other scenarios. Differences between communities, gender, and age groups are decreasing more slowly than in SSP1 and SSP5 and remain obstacles for social cohesion.	To some extent, climatic pressures can aggravate social tensions as Sahelian societies come to grips with a legacy of inequality and communal conflict.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Agricultural productivity and technologies	A resurgent nationalism, concerns about competitiveness and security, and regional conflicts hamper international cooperation. Agricultural technology development is slow, especially with very limited transfer to developing countries. In West Africa, agricultural productivity is low in comparison to other SSPs. Investments favour rainfed crops that are economically viable on a large scale like biofuels to the disadvantage of staple foods. Very patchy investment and poor government planning characterise the livestock sector. Irrigation is poorly developed. Climate adaptation readiness increases barely in the Central Sahel and remains at a low level compared to other regions in 2050.	Central Sahelian economies are much more susceptible to experiencing adverse effects of climate change on agricultural production and knock-on effects on livelihoods and food security.
Economic structure and opportunities	International migration is strongly restricted. Technological development and the expansion of non-agricultural sectors is limited. In the Central Sahel, economic activity increases only marginally in comparison to other SSPs and remains below the global average. Economic opportunities outside the agricultural sector are limited, in part also because access to education and vocational training is much worse than in other scenarios. A comparably large share of uneducated youth struggle to find employment in the region or overseas, which increases social pressures and benefits armed groups.	Poor access to education and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change.
Trade and access to markets	Barriers to international trade and restricted access to agricultural markets in particular. National and regional security issues foster stronger national policies to secure resources access. Food imports for Sub-Saharan Africa exceed exports. Regional integration in West Africa is stagnating and suffers from geopolitical rivalries between greater powers. Cross-border trade and transhumance in particular are limited in the Central Sahel as resource competition intensifies among governments, investors, and rural communities.	Stagnant regional integration and trade restrictions hamper effective climate adaptation.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP3 Regional rivalry Resource and conflict management	Low priority worldwide to halt environmental degradation caused by agriculture. International competition for resources encourages land grabbing, privatisation, and encroachment on communal and trust land. In West Africa, the amount of cultivated areas augments rapidly to the detriment of other land. Loss of forest and pastoral land is more pronounced than in any other SSPs, making it very challenging to maintain transhumance corridors and schedules. Resource management systems struggle in the Central Sahel and are often co-opted by powerful elites. Communal conflict resolution is largely undermined and land use conflicts are often opportunistically exploited by elites and armed groups.	Rapid expansion of agricultural land paired with inefficient resource management and co-optation of local institutions increase the risk that climate-related conflicts over land turn violent.
Governance and state-citizen relations	International cooperation is limited. Access to oil, gas, and mineral resources plays a central role in international relations, encouraging support for corrupt and authoritarian regimes. Governance reforms stagnate in the Central Sahel. Government effectiveness and control of corruption remain at a low level compared to other regions in 2050. Access to health care, education, and other services is poor compared to other SSPs and has virtually not evolved. This strains state-citizen relations. Elites resort to demagogy, coercion, and cronyism to stay in power, often stoking ethno-nationalist and xenophobic sentiment. High population growth in the Central Sahel in comparison to other SSPs pressures institutions and public services. Urbanisation is much slower than in other SSPs, but urban planning and access to urban services is generally poor.	Ineffective governance, poor service delivery for a rapidly growing population, and divisive rhetoric strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change.
Social relations	Social relations worldwide are marred by resurgent nationalism, ethno-centrism, and persisting social inequalities. In contrast to most other SSPs, social inequalities and poverty increase in the Central Sahel (but remain below the global average). Marginalised communities struggle to maintain living standards and access essential services. Social polarisation and negative sentiment against other groups (in particular migrants) is widespread.	Social inequalities and polarisation increase the prospect of grievances and communal conflict in the wake of climate change.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Agricultural productivity and technologies	International institutions and power structures increasingly focus on and serve the needs of the globally connected economy. The worldwide adoption of agricultural technologies is slow. Flow of information and technology benefits elites. In West Africa, agricultural productivity is low in comparison to other SSPs. Investors and governments favour large-scale commercial agriculture. Smallholders are left behind. Important differences exist within countries regarding the development of irrigation and access to agricultural inputs and services. Climate adaptation readiness increases only very moderately in the Central Sahel and above all for privileged groups. It remains at a low level compared to other regions in 2050.	Central Sahelian economies are more susceptible to experiencing adverse effects of climate change on agricultural and pastoral production. Knock-on effects on livelihoods, food security, and social cohesion are thus also more pronounced than in other scenarios.
Economic structure and opportunities	International labour migration is easy for better educated (skilled) people, but difficult for less privileged groups. In the Central Sahel, economic activity increases only marginally and economic development mainly benefits a small elite. Opportunities outside the agricultural sector remain limited, in part also because access to education and vocational training is much worse than in other scenarios. Social inequalities and meagre economic prospects for most incite illicit activities.	Poor access to education for most and the prevalence of climate-sensitive economic activities make populations more vulnerable to the adverse effects of climate change, even if some elites are well-shielded.
Trade and access to markets	Trade barriers are relaxed for developed countries but remain for developing regions. Access to agricultural markets is limited, especially for low-income countries. Food imports for Sub-Saharan Africa exceed exports. Regional integration in West Africa progresses more slowly than in other SSPs. Obstacles remain for informal cross-border trade in the Central Sahel, which penalises small local producers and traders above all.	Limited access to markets and discriminatory trade practices hamper effective climate adaptation by low-income countries and small producers.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP4 Inequality Resource and conflict management	Hardly any regulations on nature conservation and expansion of agricultural land. International frameworks favour privatisation and large-scale land acquisitions by foreign investors. In West Africa, the amount of cultivated areas augments rapidly to the detriment of other land, making it very challenging to maintain transhumance corridors and schedules. Resource management systems serve the interests of large producers. Marginalised groups, in particular, have a hard time to assert their rights. Land use conflicts can turn violent in structurally neglected areas.	Due to rapid expansion of agricultural land, inefficient resource management and weak institutions in peripheral areas, land use conflicts can escalate among marginalised communities.
Governance and state-citizen relations	Institutions and power structures increasingly focus on and serve the needs of the globally connected economy. Governance is not very effective in the Central Sahel and marked by inequalities. Institutions work mostly for the benefit of well-connected elites. Government effectiveness and control of corruption remain at a low level compared to other regions in 2050. Access to health care, education and other services is poor for most people who cannot afford private solutions. Lack of political commitment to reduce inequalities strains state-citizen relations. The Central Sahel experiences high population growth in comparison to other SSPs but rural-urban migration is comparably low and remains a privilege for the wealthier and better educated. Urban planning favours affluent areas, while access to services remains poor in peri-urban and rural areas.	Ineffective governance, elite bias, and inequitable access to essential services strain state-citizen relations and make societies more vulnerable to social turmoil in the wake of climate change, particularly in structurally neglected areas.
Social relations	Power becomes more concentrated in a relatively small political and business elite, even in democratic societies, while vulnerable groups have little representation in national and global institutions. Social cohesion degrades and grievances loom large. In contrast to most other SSPs, social inequalities and poverty increase in the Central Sahel (but remain below the global average). Marginalised communities struggle to maintain living standards and access essential services. Negative sentiment against elites is widespread. Crime and violence are common in structurally neglected areas.	Social inequalities and the concentration of power among a small elite increase the prospect of social tensions in the wake of climate change. Yet, resulting violence is likely to be confined to peripheral areas.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SSP5 Fossil-fuelled development Agricultural productivity and technologies	Countries pursue a global "development first" agenda and increasingly cooperate on economic, development, and security policies. Technology transfer is facilitated by international agreements on intellectual property rights and other issues. In West Africa, agricultural productivity increases (but slightly less than in SSP1). Rainfed agriculture is expanded with little concern for conservation. The livestock sector benefits from new breeds and new inputs but not from structural investment; veterinary services decrease. Irrigation is expanded, but with little concern for sustainable water use. Climate adaptation readiness increases in the Central Sahel and attains medium levels compared to other regions in 2050.	Central Sahelian economies are somewhat less susceptible to experiencing adverse effects of climate change on agricultural production and knock-on effects on livelihoods and food security.
Economic structure and opportunities	International mobility is facilitated by gradually opening up labour markets as income disparities decrease. The Central Sahel experiences rapid economic development compared to other SSPs, but economic activity remains somewhat below the global average in 2050. Economic opportunities outside the agricultural sector are better than in other scenarios, especially for younger generations, due to lower population growth and better access to education. Markets for insurance and credit work well when compared to other scenarios.	Rapid economic development, better access to credit and opportunities outside the agricultural sector make it easier to switch to less climate-sensitive activities.
Trade and access to markets	Global markets are increasingly integrated. Trade barriers are relaxed for all countries. Food exports surpass imports in Sub-Saharan Africa. Regional integration and cross-border trade are successfully promoted in West Africa.	Regional integration and improved access to international markets make it easier for agricultural producers to withstand adverse climatic shocks.

Table 7. Central Sahel - Continued.

Context Factor	Possible evolution	Implications for resilience
SS5 Fossil-fuelled development Resource and conflict management	Countries adopt some regulations on nature conservation and expansion of agricultural land. International frameworks are dominated by efficiency concerns. In West Africa, the amount of cultivated areas augments to the detriment of forest and pastoral land (but not as rapidly as in SSP3), making it somewhat challenging to maintain transhumance corridors and schedules. Land use rights are more clearly defined. There are some efforts to improve access to land for marginalised groups. Land use conflicts are most addressed through legal mechanisms but resolutions are not always effectively enforced. Economic pragmatism prevails in these situations and more powerful groups often benefit.	Relatively coherent land use rights and concerns for economic efficiency reduce incentives for violent conflict over resources. However, legal mechanisms are not always inclusive and biases persist vis-à-vis some groups.
Governance and state-citizen relations	Countries pursue a global "development first" agenda and support corresponding reforms in developing countries. Access to oil, gas, and mineral resources continues to play an important role in international relations, allowing rentier states to persist to some extent. Governance improves in the Central Sahel. Government effectiveness and control of corruption reach medium levels compared to other regions in 2050. Access to services improves and attains high levels in comparison to other SSPs. This has a positive effect on state-citizen relations, yet some inequalities persist. Moderate population growth in the Central Sahel in comparison to other SSPs implies less pressure on institutions and public services. Yet, rapid urbanisation remains a challenge as public investments in urban services remain below SSP1 levels.	Improved governance and access to services lead to more harmonious state-citizen relations. Opportunities for armed groups to capitalise on climate-induced hardship and grievances are limited.
Social relations	Income disparities decrease worldwide. In the Central Sahel, social inequalities and poverty diminish (but not as rapidly as in SSP1). Social relations have improved overall, but economic pragmatism dominates and efforts to include marginalised communities are limited. Power relations between gender, age, and other groups have somewhat evolved. Migrants are accepted if they contribute to economic development.	Improved economic prospects and prevailing pragmatism create incentives for cooperation (rather than conflict) and facilitate human mobility in the wake of climate change.

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