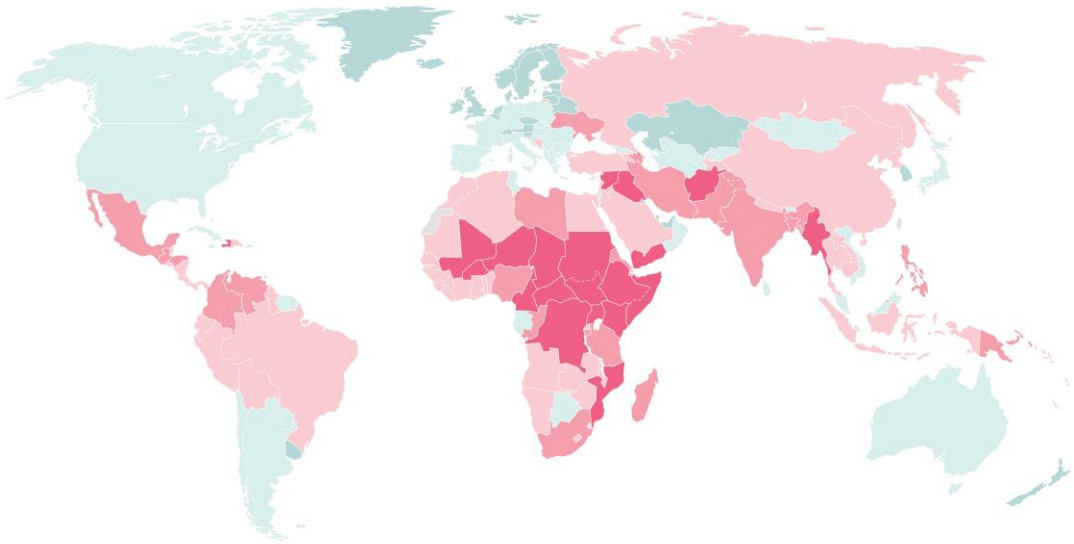
Commissioned by the Swiss Agency for Development and Cooperation

SDC Climate foresight analysis

Global and regional risks and hotspots Update 2023

Zürich, May 31, 2023

Myriam Steinemann, Cyril Willimann



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Editorial Information

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Written by
Myriam Steinemann, Cyril Willimann
INFRAS, Binzstrasse 23, 8045 Zürich
Tel. +41 44 205 95 95
zuerich@infras.ch

Copy editing: Geoff Hughes, Zoï Environment Network

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Executive Summary

The climate foresight report provides the SDC directorate and SDC units with information about short- and medium-term climate-related risks that might influence the programmes and strategic work of SDC. It analyses these risks with regard to regional stability and socioeconomic development, water, food, energy, and health with a focus on short- and medium-term projections of 1–3 years. This report updates the climate foresight report of 2021, and takes into account recent developments, updated risk assessments and new data.

Since the last climate foresight report, the overall risk landscape has deteriorated in most world regions. As of 2023, non-climatic factors are continuing to dominate the risk landscape, and multiple overlapping crises are exacerbating societal vulnerabilities. Major shocks such as the COVID-19 pandemic and the war in Ukraine affect people all over the world, and have increased the vulnerability to climate-related impacts. The updated climate foresight largely confirms the assessment of the previous analyses, with major global shocks amplifying and accentuating the prevailing risk situation. Several climate-related disasters have collided with non-climatic global shocks. The Horn of Africa continues to face severe multi-year drought. Heavy rainfall and associated flooding affected parts of South Asia and West Africa, and a tropical cyclone caused devastating damage across south-eastern Africa. In tandem with ongoing global crises, these climatic extreme events contribute to an increase in overlapping risks that put affected populations at heightened risk.

Current risks and hotspots strongly influence the projected risk situation in 1–3 years as exposure and vulnerabilities – the key determinants of risk – do not change much from year to year. Current events also have implications for short-term risk as they may negatively influence vulnerability and the ability to cope with future shocks in upcoming years. Overall, hotspots of high climate-related risks within SDC's priority regions are identified in large parts of sub-Saharan Africa, Syria, Yemen, Afghanistan, Bangladesh, Myanmar, Cambodia, and Haiti. Those areas show interlinkages between various climate-related and non-climatic stressors, high vulnerability, and a lack of coping capacity. Specifically, high climate-related risks are found in arid and semi-arid areas, in low-lying coastal areas and cities, in high mountains, and in downstream areas where changes in the cryosphere strongly affect water resources. Regions affected by recent events such as droughts, floods, and tropical cyclones in parts of sub-Saharan Africa are especially at risk. Furthermore, high climate-related risks are often present in countries with persisting conflicts and high fragility such as Haiti, Yemen, Syria, parts of the Sahel, and East Africa. In almost all regions with high climate-related risks, non-climatic drivers have a stronger effect on current risks than climate variability and change, calling for a strongly systemic perspective. This climate foresight report can serve as a comprehensive knowledge base.

1. Aim and scope of the climate foresight analysis

The climate foresight report provides the SDC directorate and SDC units with information on climate-related risks that might influence the programmes and strategic work within SDC's priority countries and regions. It analyses these risks with regard to regional stability and socioeconomic development, water, food, energy, and health, with a focus on short- and medium-term projections of 1–3 years. The focus of the climate foresight report is on human systems. Interlinkages of climate with biodiversity and ecosystem services are not extensively addressed, but are mentioned where relevant, e.g. through their effects on food systems.[1]

This update reanalyses the previous climate foresight report, and incorporates recent developments and newly published scientific insights. Given that climate-related risks not only depend on the climate but to a large extent on exposure and vulnerabilities of people and ecosystems, on the ability to address those risks, and on other non-climatic drivers, the foresight report also considers a broad range of non-climatic factors.

The first climate foresight was published in early 2020, followed by an update in 2021. This report is an updated version as of 2023 with a thematic focus on energy, where extreme climatic conditions interact with non-climatic factors such as the war in Ukraine to impact the global energy system.

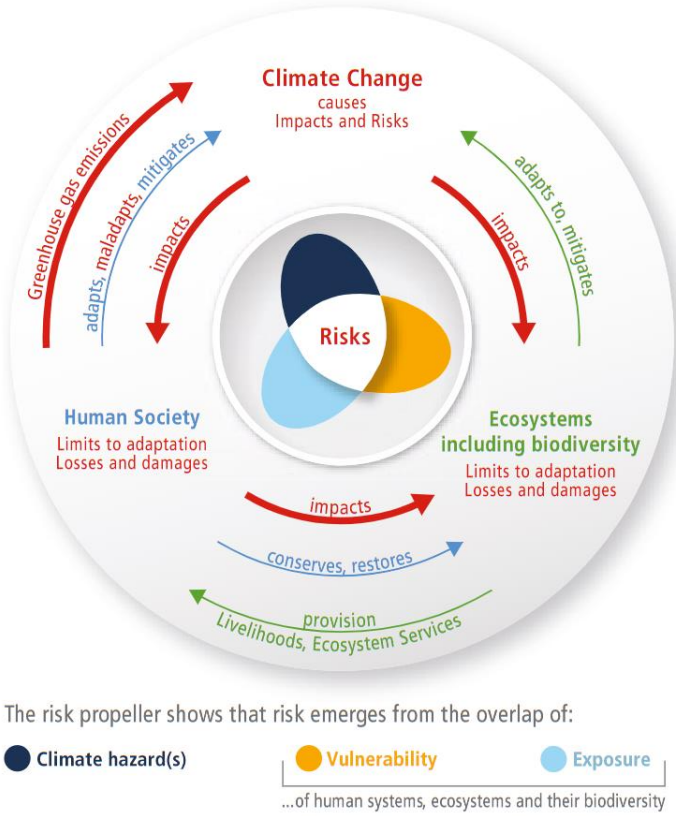
2. Current global risks and hotspots

2.1. Overall climate-related risks

To identify climate-related risks in SDC's priority regions, the climate foresight report applies the IPCC risk framework as used in the IPCC 6th Assessment Report (Figure 1). Risks result from dynamic interactions among climate-related hazards and the exposure and vulnerability of affected human or natural systems (IPCC, 2020). Hence, the climate-related risks identified in this report are a combination of climatic drivers of risk, e.g. the occurrence of drought or flood in a certain region, and non-climatic drivers. The analysis includes the exposure of people, infrastructure, and ecosystems, and the consideration of people, infrastructure, or ecosystems that are particularly vulnerable or unable to adapt to them. The risk component of vulnerability encompasses a variety of concepts and elements, including vulnerability of infrastructure systems, economic sectors and financial systems, and the capacity to cope and adapt.

[1] Future updates of the climate foresight report may examine whether impacts on ecosystems and biodiversity should be included as an additional focus.

Figure 1: IPCC risk framework



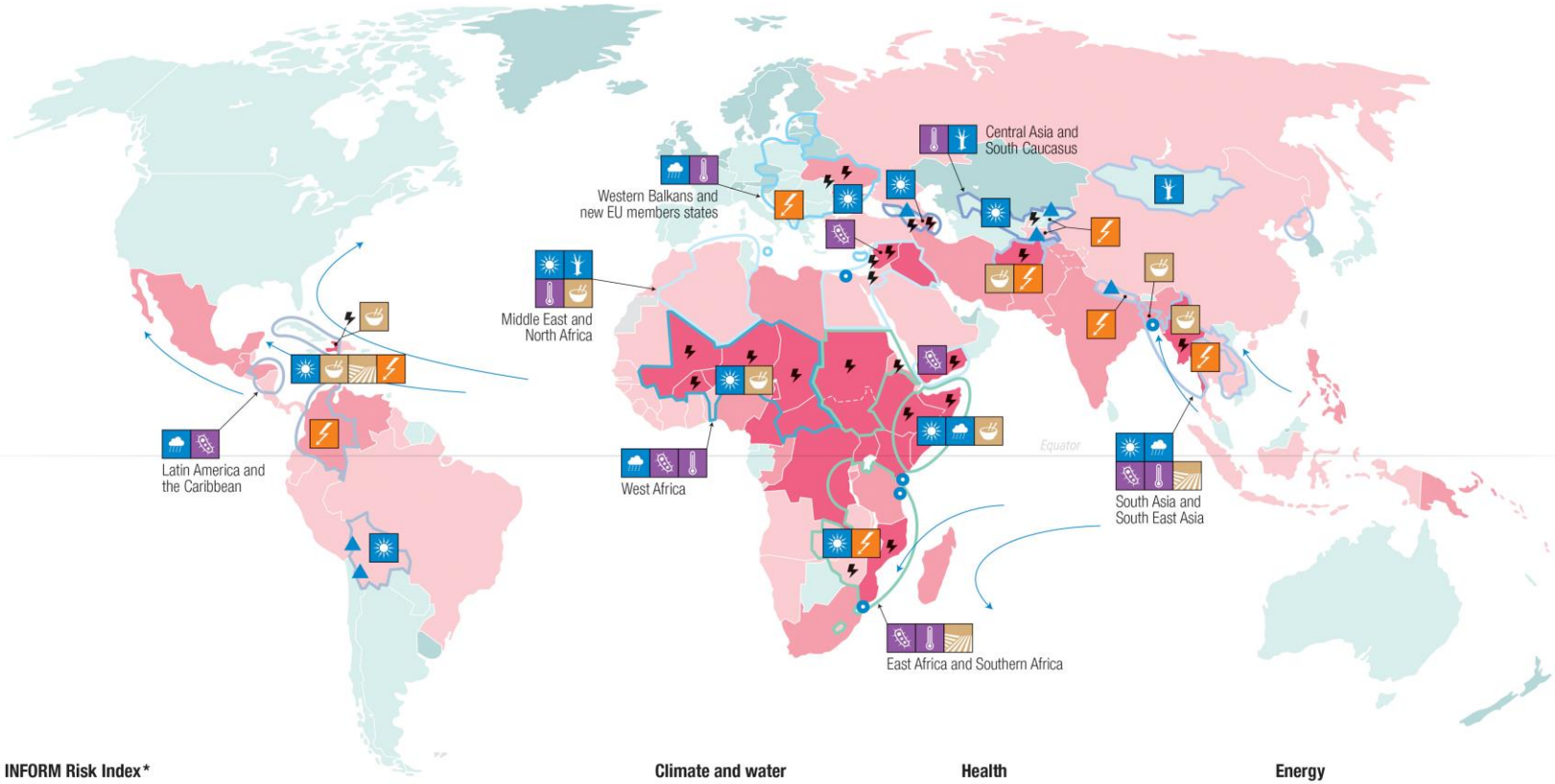
Source: IPCC 2022

Figure 2 gives an overview of the current climate-related risk situation in the world by highlighting the most relevant climate-related risks for the SDC priority regions identified in this report. The map is based on the INFORM Risk Index which quantifies overall risks relevant to humanitarian crises and disasters and provides a good foundation for systematically assessing near-term climate-related risks and vulnerabilities.[2]

The latest IPCC Synthesis Report (2023) reiterates that every region across the globe is already affected by human-caused climate change and that the most vulnerable people, regions, and sectors are disproportionately affected. Non-climatic factors, however, have dominated the overall risk landscape in the last 1–3 years, and their consequences strongly affect the susceptibility to climate change on the short- and medium-term.

[2] There are several other compound indices estimating climate-related risks and/or vulnerabilities, e.g. the ND-GAIN Index which summarises a country's vulnerability to climate change in combination with its readiness to improve resilience, or the Germanwatch Global Climate Risk Index, which analyses the extent to which countries have been affected by the impacts of weather-related loss events. The INFORM Risk Index was chosen for its broadness, its up-to-date data and associated focus on current risks as well as an underlying risk definition that is more closely aligned with IPCC than other risk indices.

Figure 2: Climate change foresight analysis 2023



* The INFORM Risk Index summarises a country's current risk related to climate hazards and other drivers of humanitarian crises and disasters. It is considered a good proxy for near-term climate foresight analysis as it is up to date (mid-2023) and incorporates indicators related to countries' vulnerability and coping capacity.

Map produced by Zoï Environment Network, May 2023

Recent developments

Since the last climate foresight report was published in 2021, the overall risk landscape has further deteriorated in many regions and countries. The COVID-19 pandemic has continued to cause great disruption and the magnitude and unequal nature of the crisis have resulted in an enormous setback to recent development gains, with impacts on vulnerability in general, and on unemployment, poverty and inequality (UNCTAD, 2021). The war in Ukraine, which began in February 2022, ignited further global repercussions, impacting food and energy insecurity and worsening a global cost-of-living crisis. Global economic growth is projected at 1.9 per cent for 2023, one of the lowest growth rates in recent decades (UNCTAD, 2023). The resulting reduced capacity to deal with (climate-related) shocks is reflected in the INFORM Risk Index, a measure for overall risks related to humanitarian crises and disasters. Its evolution in recent years, as depicted in Figure 3, shows increased overall risk within most regions considered in this report.

Figure 3: Trends in the INFORM Risk Index in SDC's priority regions

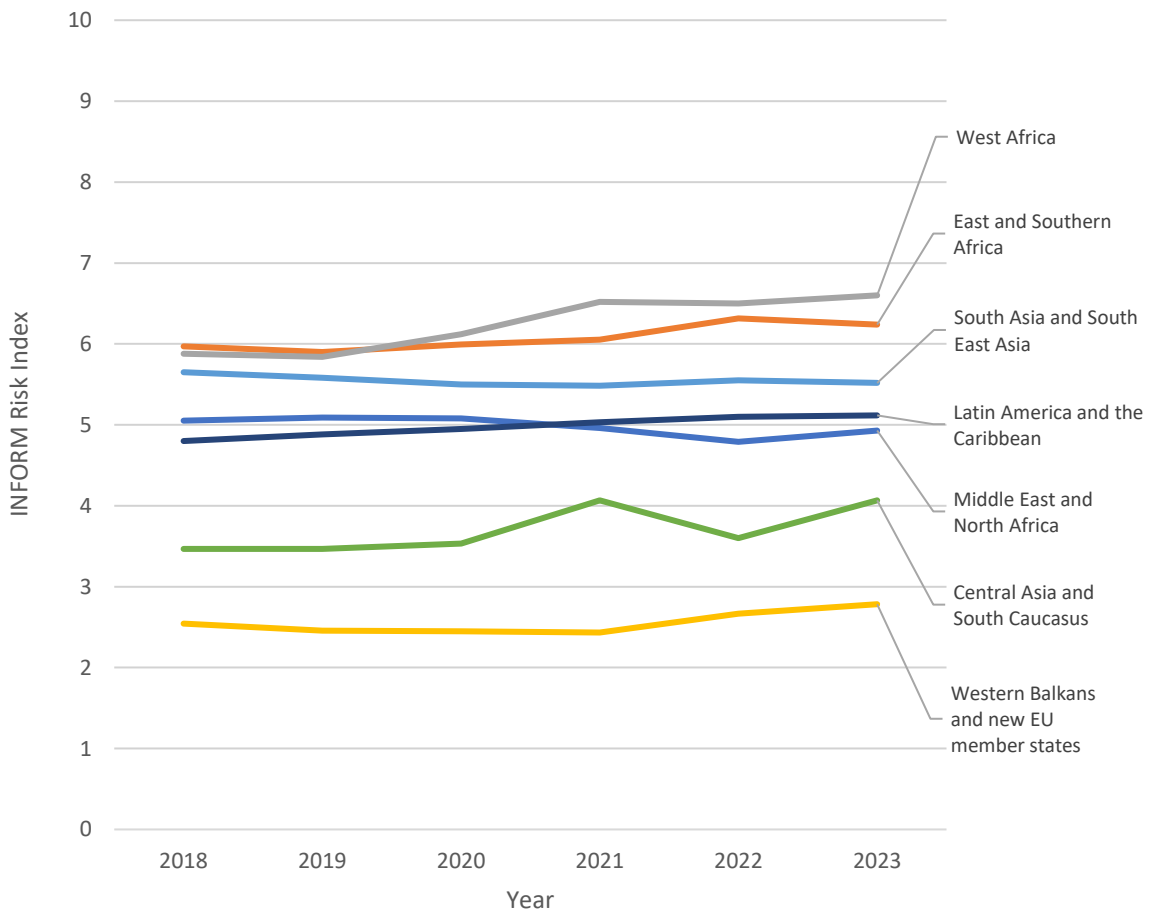


Figure: INFRAS. Data source: INFORM Risk Index.

Recent events such as sequential tropical cyclones in south-eastern Africa, floods in South Asia and West Africa and the ongoing drought in East Africa occurred in regions that are strongly affected by other global and regional shocks that further compromise recovery.

Large parts of sub-Saharan Africa (in particular the Horn of Africa and parts of the Sahel region), Syria, Yemen, the Hindu Kush region, Bangladesh, Myanmar and Haiti all qualify as current hotspots with high climate-related risks. Those countries and regions show interlinkages between various climate-related and non-climatic stressors as well as high vulnerability and a lack of adaptive capacity. A systemic perspective considering such interlinkages allows the identification of regions with currently high climate-related risks.

Arid and semi-arid areas are extremely vulnerable to climatic trends

Climate-related risks are high in water stressed regions with food systems that entirely depend on rainfall, and to a lesser extent irrigation-based food systems. Consequences can be particularly severe where agriculture (including crops or livestock) is the predominant livelihood activity and source of income. Such conditions can be found in large parts of the world, in particular in the Sahel region and in large parts of East and Southern Africa, the Middle East and North Africa, Central Asia and Central America.

Low-lying coastal areas and cities are at high risk from coastal hazards and sea level rise

Given the high population densities in many coastal areas and growing urban populations, exposure and hence the risks are particularly high and increasing. This is the case for Bangladesh, coastal areas of Myanmar, parts of East and Southern Africa (Mombasa, Dar-es-Salaam, Maputo), the Nile delta in Egypt, and Haiti.

Some high mountain areas and downstream areas are strongly affected by glacier melt

With glaciers and permafrost melting in many high mountain areas, landslides, glacial lake outburst floods, and debris flow events are becoming more frequent. Apart from these natural disasters, run-off will increase due to glacier melting up to a certain point – called “peak water” – when the glacial mass is reduced to such a degree that run-off will start to decline. Peak water has likely already been reached in the Caucasus and parts of the Andes and is a future concern in Central Asia (the Syr Darya and Amu Darya rivers are mostly fed by snow melt and glacier melt) and the Hindu Kush.

Risks are particularly high in regions affected by compound or sequential extreme events

Compound or sequential hazards[3] include increased frequency of events such as concurrent heatwaves and droughts or several tropical cyclones within a few weeks, resulting in increased and more complex risks to livelihoods, infrastructure, water resources, agricultural systems, energy supply, and human health. In March 2023, 100,000 people in Somalia were affected by heavy rainfall and flooding amid a multi-year drought (ReliefWeb, 2023) and Mozambique was impacted by sequential heavy rainfall and flooding as tropical cyclone Freddy made landfall several times in February and March 2023 (ReliefWeb, 2023).

Countries with persisting conflicts and high fragility often have high climate-related risks

Climate exposure and fragility overlap in many parts of the world, increasing joint risks. This is in part a result of the complex interaction between climate and various drivers of conflicts and instability (water scarcity or food insecurity). High political instability may prevent people from cultivating their land and may further affect people's ability to cope with possible future climate shocks. Conflicts currently persist in Ukraine, Yemen, Syria, Afghanistan, Myanmar, Haiti, and parts of the Sahel and East Africa.

Unsustainable natural resource management practices influence climate-related risks

The overuse of scarce land and water resources, along with environmental degradation and population growth are putting pressure on natural systems. Climate-related risks further affect natural systems but in most regions, non-climatic drivers such as inadequate governance have a stronger effect on short-term risks than climate variability and change. Examples include the shrinking of the Aral Sea, large-scale deforestation in the Amazon region and the depletion of aquifers in the Middle East and North Africa (MENA) region.

In a globalized food system, local climate risks exacerbate global food insecurity

The current food supply crisis ranks among the top five of current risks, with greatest potential impact on global scale (WEF, 2023). It is in large part a result of pandemic-related bottlenecks in agri-food supply chains and geopolitical turmoil affecting the world's largest exporters of wheat and other crucial crops (EU, 2023). The situation is particularly critical in countries of Africa and the Middle East, of which many are highly dependent on Russian and Ukrainian agricultural exports (EU, 2023). Furthermore, the high inflation of food prices affecting almost all countries has increased food insecurity with particularly severe consequences for the poorest populations, who spend a large share of their household budgets on food (World Bank, 2023).

[3] Compound risks emerge as two or more shocks, such as heatwaves and wildfires, overlap. Sequential risks in turn emerge as shocks occur successively and within a timespan that does not permit sufficient recovery.

Against this backdrop, global food security is under pressure, and local extreme weather events affecting key agricultural areas or regions already experiencing food crises and degraded land can have severe consequences.

Critical dependencies along the water-energy-food nexus need attention

The continued growth of populations and economies in recent years has accelerated the competition for water, energy and food, and climate-related drivers affect each of these interdependent resources with potential cascading effects. In many countries of sub-Saharan Africa, for example, hydropower infrastructure is being expanded in tandem with irrigation infrastructure, likely compounding the overall risk along the water-energy-food nexus in years of low rainfall and river run-off (IPCC, 2022). Understanding and managing such dependencies and interlinkages of water, energy, and food systems without compromising the needs of the local population calls for systemic thinking that considers various climate-related risk drivers, underlying non-climatic risks, vulnerabilities and coping capacities.

2.2. Thematic focus: Climate impacts on energy security

Climate-related events and trends affect every segment of the world's energy systems

Increasing temperatures, changing rainfall patterns, extreme weather events and rising sea levels challenge the resilience of electricity systems. These events and trends affect energy generation, the resilience of transmission and distribution networks and demand patterns. Already today, extreme weather events are the dominant cause of large-scale electricity outages (IEA, 2021), and climate variability and change are increasingly recognised as drivers of energy insecurity (IPCC, 2022). Some of the most relevant risks specifically highlighted in this climate foresight report are:

- **Extreme heat**: Higher temperatures affect the energy generation potential by decreasing the efficiency of thermal power plants (i.e. coal-, petroleum- and natural gas-fired power plants). Furthermore, extreme heat leads to significantly higher energy demands through its effects on cooling demand (IEA, 2021).
- **Drought**: With 94.7 per cent of the world's electricity generation stemming from hydroelectric or thermoelectric energy production, projected changes in water availability during drought are essential for assessing energy system vulnerability (IPCC, 2022). Changes in precipitation patterns and drought directly affect the energy generation potential of hydropower plants and indirectly affect thermal power plants through the reliance on cooling water (IEA, 2021). The availability of water also affects energy demand because energy-

intensive technologies such as desalination are increasingly adopted to satisfy water demands in water-scarce areas (IEA, 2020).

- **Extreme events**: Electricity systems are vulnerable to extreme events such as flooding, tropical cyclones, and wildfires that lead to physical damage to energy assets such as transmission lines (IEA, 2021).
- **Coastal flooding**: Sea level rise can limit the development of new energy assets and damage electricity systems such as thermal power plants or transmission and distribution lines near coastlines through floods and erosion (IEA, 2021).

The current energy supply crises affects the livelihoods of a broad section of the population

The current energy supply crisis ranks among the top five of current risks with greatest potential impact on the global scale (WEF, 2023). In combination with other crises such as the food supply crisis and the cost-of-living crisis, this crisis affects livelihoods of a broader section of population than traditionally vulnerable communities and fragile states (WEF, 2023). Since 2021 and accelerating in the wake of Russia's invasion of Ukraine in February 2022, the prices of natural gas, electricity in some markets and oil prices reached record high levels. Higher energy prices have contributed to high inflation, pushed families into poverty and slowed economic growth (IEA, 2023). A recent study in Nature suggests that soaring energy costs could push 141 million people worldwide into extreme poverty (Guan et al., 2023). While some oil and gas producing and exporting countries (e.g. in the Middle East and North Africa) may benefit from higher energy prices in the short to medium term, they could come under growing pressure from global efforts to decarbonise the energy sector.[4] These countries must therefore accelerate development of clean energy while diversifying their economies away from reliance on oil and gas revenues (IEA, 2023).

Progress in access to affordable, reliable, sustainable energy slowed down

Ensuring access to affordable, reliable, sustainable and modern energy for all as defined in Sustainable Development Goal (SDG) 7 is a vital component of economic development (United Nations, 2022). After impressive gains in electrification rates, the COVID-19 pandemic and its global repercussions and the consequences of the war in Ukraine on energy markets are expected to slow down progress in providing universal access to affordable, reliable, sustainable energy by 2030 (IEA, 2022). The impact of COVID-19 on household incomes has made even basic energy services unaffordable for around 90 million people in Asia and Africa who had previously had access. Furthermore, reaching currently unserved rural and peri-urban populations

[4] This climate foresight report focuses on physical risks that arise from climate change. Risks related to the decarbonisation of the economy (so-called transition risks) are only mentioned where highly relevant.

becomes increasingly difficult, further contributing to the slowdown in achieving SDG7 (IEA, 2022). At current rates of progress, the world will reach only 92 percent electrification and 2.1 billion people will still lack access to clean cooking technologies in 2030, with potentially dramatic consequences for the environment, economic development, and health, particularly of women and children (IEA, 2022).

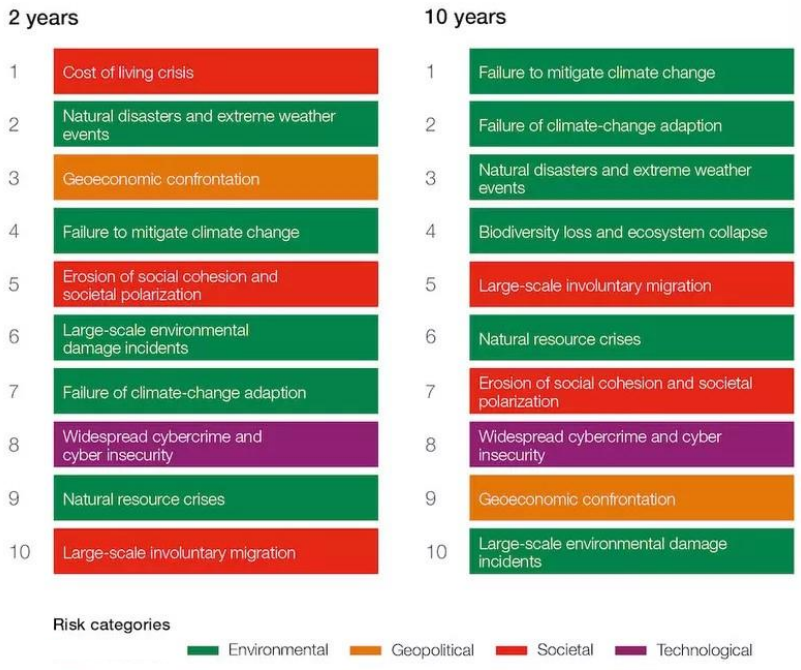
3. Future global risks and hotspots

Assessing short- and medium-term climate-related risks is challenging, as no specific weather or climate predictions can be made with a time horizon of 1–3 years (see Annex 2 for methodological details). Nevertheless, some estimates about short- and medium-term risks can be made by analysing current risks and developments, including climate-related risk drivers, underlying non-climatic risk drivers, vulnerabilities and coping capacity.

A global cost-of-living crisis and climatic events are affecting the short-term risk landscape

The COVID-19 pandemic posed a severe shock to many socioeconomic systems, resulting in substantial changes in vulnerability and exposure of people to climate risks (IPCC, 2022). With the global consequences of the war in Ukraine, the world's capacity to cope with adversity has been further eroded. The ongoing cost-of-living crisis, manifesting in high food and energy prices, and tightening financial conditions is increasing poverty, and along with it, the vulnerability to climate impacts in the coming years (UNCTAD, 2022). The cost-of-living crisis is considered the most severe short-term risk of 2023 in the World Economic Forum's most recent survey on the perception of global risks (Figure 4). In the medium term, climate-related risks are considered the most relevant global risks and will likely intersect with other crises.

Figure 4: Global risks ranked by severity, 2023



Source: WEF, 2023

Short- and medium-term climate risks are dominated by the current climate risk landscape

Non-climatic drivers have a stronger effect on current and short-term future risks than climate variability and change. Given that non-climatic drivers related to exposure of people, infrastructure, and ecosystems as well as associated vulnerabilities and coping capacities do not change much from year to year, current risk hotspots are likely the most relevant in the next 1–3 years.

There is also evidence that past or current extreme events with severe impacts have implications for subsequent short-term risks. Extreme climate events push a system to near or beyond the ends of its normally observed range. Extremes can be very costly in terms of loss of life, ecosystem destruction and economic damage (IPCC, 2019), and have long-term effects as they increase vulnerability in upcoming years and decrease the ability to cope with future shocks. Last year, East Africa faced a severe multi-year drought, parts of South Asia and West Africa experienced widespread flooding, and tropical cyclone activity caused widespread damage in south-eastern Africa. These and other areas recently affected by non-climatic events such as the Turkey-Syria earthquake in February 2023, may face long-term negative effects and must be considered as particularly vulnerable to climatic shocks.

Gradual changes continuously increase risk

For changes related to slow onset events such as sea level rise and glacier retreat, we can extrapolate to the same or faster pace in the future, and implications for 1–3 years out are very likely. Hence, gradually increasing risks are likely in low-lying coastal areas and in high mountain and downstream areas where water resources depend on the cryosphere.

El Niño and La Niña are important drivers of climate variability

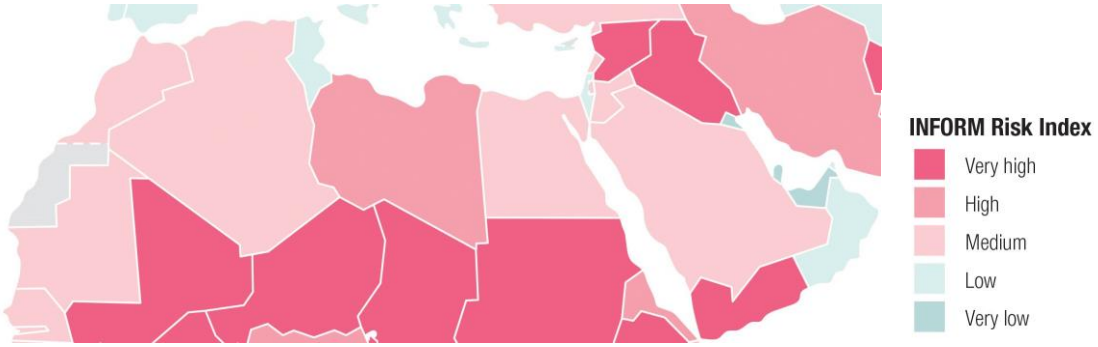
El Niño and La Niña are the most important drivers of climate variability and can trigger extreme weather events and disasters in various parts of the globe.[5] They affect infrastructure, food and energy systems, and many diseases such as malaria are sensitive to changes in weather patterns brought about by the El Niño/La Niña phenomena. After several years of La Niña, the World Meteorological Organization observed neutral conditions (neither El Niño nor La Niña) in May 2023, with the probability of developing El Niño conditions estimated at 60 per cent until July 2023 and gradually increasing in the following months (WMO, 2023).

[5] The El Niño Southern Oscillation (ENSO) is a natural variation of the circulation pattern in and over the Pacific Ocean, with strong impacts on the meteorological conditions on a global level. Extreme ENSO events can cause intense rainfall in regions usually dry or drought conditions in usually wet regions.

4. Regional risks and hotspots

For each of the following regions, a general assessment based on the INFORM Risk Index is followed by a thematic analyses. The focus lies on regional developments and trends with relevance for the next 1–3 years within SDC's priority countries and regions, and the main objective is to encourage readers to comprehend the systemic implications of climate risks.

4.1. Middle East and North Africa



The overall risks are mostly medium in the Middle East and North Africa, with the exceptions of Yemen, Iraq, and Syria where risks are considered very high. High risk levels are mostly a result of conflict risks, high vulnerability and lack of coping capacity – and less due to climate-related hazards (see INFORM Risk Index for country-level information). Nevertheless, countries with very high overall risks must be considered particularly susceptible to climate-related hazards given their underlying vulnerability and lack of coping capacity. The SDC priority countries of the Middle East and North Africa suffered setbacks in 2023 with risk increasing for the first time since 2019 (see Figure 3, p. 8).

Climate

Droughts and heatwaves are increasingly affecting the region. Coastal hazards and sea level rise are a concern for low-lying coastal cities and densely populated coastal areas of the Mediterranean. Due to strong climate hazards and high vulnerability, the Mediterranean region is considered a hotspot for highly interconnected climate risks (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends
Droughts: There is an upward trend in droughts affecting the region and aridity has been increasing over much of the region (IPCC, 2022). The drought	Increases in drought frequency and duration are projected in North Africa (IPCC, 2022), but no projections can be made for a 1–3-year period. With ongoing

Climate: Past and ongoing development	Climate: Trends
risk resulting from the interactions between probability of a drought event, the number of people in drought-prone areas and overall vulnerability is medium high or high in most of the region, especially in densely populated coastal areas such as in Egypt, Palestine and Lebanon (ERCC, 2019).	population growth in drought-prone areas, however, the drought risk is likely to increase in the short term.
Extreme heat: In recent decades, North African trends in mean near-surface temperatures along with the occurrence of heatwaves indicate an overall warming that is significantly beyond the range of changes due to natural variability (IPCC, 2022). Most recently, temperatures reached a record-breaking 48°C in Tunis in 2022 and several neighbourhoods were forced to evacuate as fire broke out in the south of Tunisia's capital. Neighbouring Algeria was also affected by extreme heat and wildfires (Carbon Brief, 2022).	Recent trends in extreme temperatures are likely to continue, and summer heatwaves in particular are expected to become more intense and frequent (IPCC, 2022). Short-term projections of heatwaves are not possible.
Coastal hazards: Flooding, storm surges and sea level rise in the Mediterranean are putting low-lying coastal areas at risk, in particular the Nile delta, which is home to 41% of Egypt's population (IPCC SCOCC, 2019). Given the high population density and the concentration of cities in coastal areas, sea level rise increases the risks to habitability of those cities (Lange, 2019).	The rate of sea level rise has accelerated, and continues to increase. Given the ongoing population growth in coastal areas, the coastal risks due to flooding, erosion and saltwater intrusion are expected to grow (IPCC, 2022). The eastern Nile Delta is a hotspot of coastal hazards as sea level rise interacts with significant land subsidence (IPCC, 2022).
Dust storms: Dust storms are a major climate-related challenge in the Middle East, such as in April and June 2022 where regions from Syria to Iran were affected (MEI, 2022). The Tigris-Euphrates alluvial plain is recognised as one of the most important dust source areas in the world and the frequency and intensity of dust storms have increased due to both land use and climate-related drivers in recent decades (IPCC, 2022). In North Africa, an even more important dust source area, dust events have decreased in recent decades (IPCC, 2022).	Dust storms are considered a key climate risk in parts of the Middle East but projections in changes in the frequency and intensity of dust storms remain uncertain (IPCC, 2022). Strong wind, a lack of vegetation, and absence of rainfall are key determinants of dust storms (IPCC, 2022), all of which could be affected by future climate change. In North Africa, dust loading and related air pollution are expected to decrease as wind speeds are expected to be reduced by climate change in many parts of the Sahara (IPCC, 2022).
Multi-hazard risk: Earthquake risk is elevated along the coast of Algeria and in the Near East (Silva et al., 2018). The Turkey-Syria earthquake in February 2023 has shown the devastating consequences of a strong earthquake affecting old buildings and the lack of enforcement of building standards (Naddaf, 2023).	No projections can be made for a 1–3-year period but exposure to other, non-climatic natural hazards (in combination with weak governance) could negatively affect a country's ability to cope with climate change.

Regional stability and socioeconomic development

Through its effects on crop productivity and water availability, climate change can function as a risk multiplier for conflict in fragile regions (IPCC, 2022). In the short term, non-climatic drivers of risk dominate the risk landscape and in the coming years, weak prospects of economic

growth and heavy reliance on food imports in North Africa and the Middle East affect people's ability to cope with future climate shocks. Overall stability might be further affected by a combination of non-climatic and climatic stressors.

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability: Yemen and Syria continue to rank among the most politically unstable and fragile countries in the world (highest alert levels on the Fragile States Index). Most of the other countries of the region fall in the category of warning or elevated warning (Fragile States Index, 2022). Major political, economic and societal transitions, frequently accompanied by armed struggles, are ongoing, and are turning the MENA region into a political, military and humanitarian hotspot (Lange, 2019). Climate is increasingly seen as a contributing driver to some conflicts in the region (IPCC, 2022).	High political instability may further affect people's ability to cope with possible future climate shocks in parts of the MENA region, which is already highly vulnerable and exposed to adverse climate conditions. As conflicts become more protracted, the resilience and coping capacities of the people caught up in them is eroded (FSIN, 2020). The decreasing availability of water and tensions over the allocation of water combined with rising inequalities, social protests and diminishing livelihoods increase climate-related security risks in North Africa (CASCADES, 2021).
Migration: Climate-related migration in Africa so far occurs mostly within countries or between neighbouring countries and not over larger scales (IPCC, 2022). Through its effects on food insecurity and land degradation, climate indirectly drives instability in the region (IPCC, 2022), and extreme climate events may directly contribute to migration decisions. A study of five MENA countries estimates that 10–20% of migration was associated with extreme climate events (IPCC, 2022). The most recent Global Report on Internal Displacement points to a further 456,000 conflict-induced internal displacements in 2021 in Syria, 377,000 in Yemen and 118,000 in Palestine (IDMC, 2022). Conflict-induced displacements far outweigh those by disasters in the region.	Given the various social, political, economic, environmental and cultural factors influencing the decision to migrate, assessments of future trends in environmentally induced migration are complex, but environmental factors are expected to increasingly affect migration decisions with climate change (IPCC, 2022). In the short term, ongoing conflict and violence are expected to remain the main drivers of internal displacement in the region. Still, given the fragility of some countries in the region, even comparably minor climate-related extreme events could cause displacement. In the longer term, climate change is expected to increase internal migration in the form of rural to urban movements (IPCC, 2022).
Economic development: Multiple shocks in recent years, most notably the COVID-19 pandemic and the war in Ukraine along with the repercussions of local challenges and conflicts have resulted in a cost-of-living crisis affecting the region's economies. The associated increases in energy, fertiliser and food prices and the depreciation of local currencies have severe consequences for the region's non-oil-producing countries of Lebanon, Syria and Yemen (United Nations, 2023). Inflation hits the poor much harder than the rich as they spend a disproportionate share of their budget on food and energy (World Bank, 2023).	Forecasts project the region's economies to grow by 3.0% in 2023 and by 3.1% in 2024, significantly lower than the growth rate of 5.8% in 2022 (World Bank, 2023). One driver behind this development is the war in Ukraine and the associated increases in food and energy prices that are projected to push a further 3.7 million people in the region into poverty, and 2.8 million into extreme poverty in 2023. The biggest economic hits are expected in countries that import both food and energy. Lebanon, Morocco, Palestine, Syria and Yemen are all impacted by 3–5 percentage points of GDP growth due to the war (United Nations, 2023).

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Urbanisation: The urban population is a relatively high 66% of total population, and annual growth rates in the MENA region are high (UNDESA 2019) The highest population densities and the major cities are concentrated along the Mediterranean coast (Lange, 2019). Urban vulnerabilities and exposure to climate change are increasing in the region, mostly due to flooding and drought-related water scarcity and heat stress (IPCC, 2022).	Rapid urbanisation and population growth in informal settlements will increase the exposure of people to the climate hazards of the region, most prominently to extreme heat (IPCC, 2022).

Water

The MENA region is one of the most water-constrained areas of the world (OECD–FAO, 2018), and many countries of the region are already below the water scarcity threshold set by the FAO (IPCC, 2022). Increasing droughts induced by climate change, along with population growth, and urbanisation will likely exacerbate the situation (IPCC, 2022). Widespread poor governance of transboundary water resources further contributes to the critical state of water resources in the region, and has led to countries overdrawing water from rivers and aquifers (CEIP, 2022).

Water: Past and ongoing development	Water: Trends
Water availability: Twelve out of the 17 most water-stressed countries in the world are in the MENA region (WRI, 2019). Past trends indicate increases in drought, particularly in the Mediterranean part of the region (IPCC, 2022). Countries such as Iraq, Egypt, and Morocco are heavily dependent on surface water for irrigated agriculture, and as a result of increasingly frequent and intense droughts may not meet farmers' irrigation needs. For countries that rely heavily on groundwater, the low precipitation levels and associated recharge of aquifers can lead to excessive use of groundwater at a cost to future generations (United Nations, 2022).	Climate change adds to existing pressures as droughts and aridity are projected to increase in most parts of the region, particularly the Mediterranean countries (IPCC, 2022). No specific projections can be made for a 1–3-year period, but climate change and poor governance of scarce resources will increasingly amplify existing stress on water availability and transboundary water resources such as Tigris-Euphrates river system and the Nile. In coastal regions between Egypt and Tunisia, the heavy reliance on groundwater means that saltwater intrusion in aquifers might be increasingly a concern (United Nations, 2022).
Water demand: Apart from climate change, water scarcity in the region is driven by rapid population growth, urbanisation, and changing lifestyles that result in over-extraction of water from aquifers, rivers and lakes (IPCC, 2022). Poor management of water resources is a major cause of water scarcity, with agriculture being the predominant user of unsustainably managed water. Two-thirds of the countries use groundwater in excess of recharge by renewable internal freshwater resources. This imbalance leads to depletion of aquifers. Water is heavily subsidised –	Demand for irrigation will most likely increase with drier conditions, putting additional pressure on scarce water resources. Climate change is projected to account for 22% of the increase in future water shortages in North Africa, while socioeconomic factors are projected to account for 78% (IPCC 2014). No specific projections can be made for a 1–3-year period, but water stress and water demand are expected to increase in almost all parts of the region (WRI Aqueduct 3.0 2019).

Water: Past and ongoing development	Water: Trends
about 2% of GDP is spent on subsidies in the MENA region (OECD–FAO 2018).	

Food

Climate change in the MENA region adds to the agricultural challenges of a water-constrained world. High dependence on rain-fed agriculture make countries in North Africa and the Middle East particularly vulnerable to climatic changes (IPCC, 2022). Low yields and a narrow scope for increases in arable area in the MENA region set limits on crop production resulting in a high dependence on imports for basic food to feed the rapidly growing population (OECD-FAO 2018).

Food: Past and ongoing development	Food: Trends
Agricultural production: Agricultural land and water are generally scarce in the Middle East and North Africa, and both rain-fed and irrigated land suffer from ongoing degradation caused by wind and water erosion and unsustainable farming practices. Land productivity and average yields of rain-fed crops are low compared to other regions (OECD–FAO, 2018). In 2022, aggregate cereal production was average in the Middle East and below-average in North Africa. The outcome in North Africa was a result of widespread drought conditions in Morocco, Algeria and Tunisia, which rely heavily on rain-fed agriculture (FAO, 2023). High drought risk for agriculture is currently observed in parts of Tunisia and Algeria (Global Drought Observatory, 2023).	In the longer term, climate change could lead to substantial yield declines for staple crops over much of the region, particularly in areas that rely on rain-fed agriculture (IPCC, 2022). In the short term, agricultural production is likely to be driven by other factors. Specific projections for the year are difficult, but in countries facing challenging economic conditions or conflict, such as Lebanon, Syria or Yemen, the high prices of imported agricultural inputs, in part a result of the war in Ukraine, could negatively affect yields (FAO, 2023).
Food prices and imports: Population growth and high levels of cereal consumption combined with limited climatic suitability for agriculture makes countries of the region heavily dependent on food imports and vulnerable to high global prices (United Nations, 2023). As a result, many countries spend a large share of their export earnings on food imports (OECD–FAO, 2018). Despite elevated prices and the uncertainty of global markets resulting from the war in Ukraine, imports in the region are sufficient (FAO, 2023) as exports from the Ukraine resumed after the Black Sea Grain Initiative, and other suppliers were able to step in (United Nations, 2023). Still, food inflation is high and could affect the poorest populations (FAO, 2023).	High dependency on food imports makes the region potentially vulnerable to adverse climatic conditions in other parts of the world. The OECD-FAO Agricultural Outlook (2022) expects demand from the region to grow, and for the countries of North Africa and the Near East to maintain a stable share of about a quarter of the world's traded grains.

Food: Past and ongoing development	Food: Trends
Food insecurity: Conflicts, political insecurity and economic crises continue to drive high food insecurity in a number of countries of the region. Shortfalls in aggregate food production and supplies are considered exceptionally high in Syria, where civil conflict and economic crises have pushed an estimated 12.1 million people into acute food insecurity. Widespread lack of access is reported in Lebanon due to the ongoing economic crisis in Yemen due to civil conflict and high food and fuel prices (FAO, 2023).	Many countries in the region have little domestic production and few import sources, and so will remain vulnerable to fluctuations in global food prices and associated impacts on food insecurity (United Nations, 2023). A recent World Bank report (2023) suggests that that one out of five people in the MENA region is likely to be food insecure in 2023. Reductions in crop yields and fishery landings associated with climate change may further reduce food supplies (IPCC, 2022).

Energy

Countries of North Africa and the Middle East heavily rely on fossil fuels for both their primary energy and electricity supply (OWID, 2022). Solar and wind power are increasingly being adopted and already provide notable shares of electricity supply in Morocco (17%), Jordan (23%), and Yemen (17%). Growing needs for cooling and desalination are challenging the energy systems (IEA, 2023).

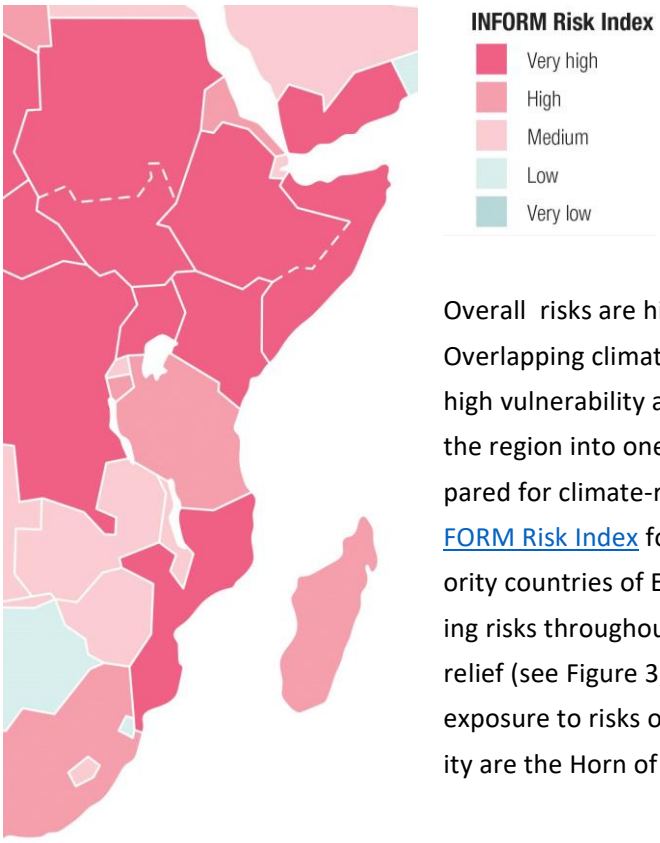
Energy: Past and ongoing development	Energy: Trends
Energy generation: Extreme heat and drought are adding to the challenges of energy systems but recent large-scale power outages were mostly associated with weak governance and the inability of countries with crippled economies to supply sufficient fuel (Washington Post, 2021). In 2021, reduced water flow in the Euphrates River led to power cuts due to depleted dam reservoirs in Iraq and Syria (IDMC, 2022). The region's worsening dust storms are also making it more difficult to deploy solar power generation at scale (MEI, 2022).	Many MENA countries are economically dependent on oil and gas production, and could come under growing pressure from global efforts to decarbonise the energy sector (IEA, 2023). The countries are expected to increasingly exploit their potential in solar and wind energy and to position themselves as producers and exporters of renewable electricity. Several pilot projects, however, including the Ouarzazate solar power plant and the Tunur Solr Project in Tunisia, have been shown to deplete scarce local water sources (Desmidth, 2022). Water scarcity could therefore not only affect hydropower generation but also the cooling and cleaning of thermal generation systems including coal-, gas- and petroleum-fired power plants and concentrated solar power plants (MEI, 2012).
Energy demand: Electricity demand in the region is increasing in response to burgeoning urban populations, growing economies, and increased energy consumption for cooling purposes (IPCC, 2022). In 2021, record-breaking heat increased demand to an extent that could not be met, resulting in widespread power outages (NPR, 2021). Furthermore, increasing investments in energy-intensive water desalination plants to satisfy demand for water increase demand for energy (MEI, 2012).	Observed changes are likely to persist and intensify as temperatures and cooling demands rise and countries rely on more energy-intensive methods to provide water (IEA, 2020).

Health

People in the MENA region face a variety of climate-related health risks with impacts of extreme heat being of particular concern given the already high summer temperatures in the region. In the medium term, the number of additional deaths attributable to climate change will remain low compared to other regions, with heat, undernutrition, and diarrhoeal diseases causing the most fatalities (IPCC, 2022).

Health: Past and ongoing development	Health: Trends
Heatwaves: High ambient temperatures and heatwaves have numerous health impacts including increased mortality, most commonly involving cardiovascular and respiratory disease, stroke and non-communicable diseases (IPCC, 2022). Urban populations are particularly vulnerable to heat, and the number of high heat stress nights is about 10 times larger in urban than in rural areas of North Africa (IPCC, 2022).	Given the estimated increase in frequency, intensity and duration of heatwaves, negative health impacts are expected to increase in the future. With already high and increasing levels of urbanisation, the number of people exposed to extreme heat stress (due to urban heat island effect) is expected to further increase.
Undernutrition: Several countries of the region, mostly in the Middle East, face shortfalls in food supply and associated health consequences due to conflicts, political insecurity and economic crises (FAO, 2023). The prevalence of undernourished people is particularly high in Yemen at 41% of the population (FAO, 2022). Generally, the increase in food prices associated with the Russian invasion of Ukraine may have increased the risk of stunting by 17–24% in the developing MENA countries (World Bank, 2023).	Reduced crop yields and fishery landings associated with climate change may further decrease food supplies (IPCC, 2022). No prediction can be made for 1–3 years.
Foodborne and waterborne diseases: Higher temperatures and lack of water for hygiene increase the transmission of diarrhoeal disease agents (IPCC, 2022), but the reasons for an outbreak are often multifactorial. The ongoing cholera epidemic in Syria and Lebanon is likely a result of both physical damage to critical water infrastructure due to the war and falling groundwater levels due to prolonged drought (PLOS, 2023).	Yemen and recently affected countries such as Syria and Lebanon are of particular concern for the next 1–3 years as Yemen already has a very high burden of disease without any climate-related drivers (OWID, 2019). Drought events could further increase transmission risk as they affect access to safe water and sanitation, particularly in rapidly expanding urban areas and informal settlements without adequate water and sanitation infrastructure (IPCC, 2022).

4.2. East Africa and Southern Africa



Overall risks are high to very high in most of the region. Overlapping climate-related and non-climatic stressors, high vulnerability and lack of coping capacity are turning the region into one of the most vulnerable and least prepared for climate-related hazards in the world (see INFORM Risk Index for country-level information). SDC priority countries of East and Southern Africa faced increasing risks throughout the last years, with a recent slight relief (see Figure 3, p. 8). Potential hotspots where the exposure to risks overlaps with high levels of vulnerability are the Horn of Africa and Mozambique.

Climate

As a climatologically diverse region, East and Southern Africa faces a range of climatic hazards. Throughout much of the region, increases in extreme temperatures, drought conditions, heavy rainfall events and severe tropical cyclones can be observed and may negatively affect human and natural systems (IPCC, 2021).

Climate: Past and ongoing development	Climate: Trends
Heavy rainfall and flooding: In the past year, heavy rainfall and flooding affected many countries of the region, including Sudan (AfricaNews, 2022), Ethiopia (Reliefweb, 2022), Kenya, Tanzania (FloodList, 2022), Rwanda (FloodList, 2022) and Malawi (FloodList, 2022). Heavy rainfall and flooding associated with tropical cyclones is considered separately below.	The frequency and intensity of heavy rainfall events are projected to increase in all parts of the region (IPCC, 2022) with consequences for pluvial and riverine flooding risk. No projections can be made for a 1–3-year period, but if a strong El Niño develops (see forecast here: WMO), drier than usual conditions would affect the southern parts of the region whereas wetter than usual conditions and increased risk of heavy rainfall would persist in the continental parts of the northern part of the region (WMO, 2022). Risks may increase as a result of compound events, such as drought followed by heavy rainfall resulting in flooding. The impacts

Climate: Past and ongoing development	Climate: Trends
	of such compound events are not yet well understood (IPCC SRCCL, 2019).
Droughts and aridity: Northern parts of the region experienced a drying trend in recent decades but mean precipitation trends are generally mixed without much agreement on the sign of change. Still, drought frequency has doubled from once every six years to once every three years in East Africa and has also increased in Southern Africa (IPCC, 2022). The Horn of Africa, with the most affected countries being Somalia, Ethiopia, and Kenya, is currently experiencing a severe multi-year drought that can be linked to a persistent La Niña event (WMO, 2023	Both increases and decreases in rainfall are projected in the region depending on location and season, with drought frequency, duration and intensity increasing in Somalia, Tanzania, South Sudan, Sudan and over large parts of Southern Africa and decreasing in Kenya, Uganda, and the Ethiopian Highlands (IPCC, 2022). Severe drought events in the past may affect people's ability to cope with future shocks as countries and regions are still recovering from past events. Seasonal forecasts point to a sixth consecutive year with poor rain for the Horn of Africa (WMO, 2023). Recent predictions show weakening La Niña conditions (see here: WMO El Niño/La Niña Updates). While a shift to El Niño could mean some relief for the Horn of Africa, it usually translates into more drought-like conditions in the southern parts of the region such as most recently in 2016 (WMO, 2016).
Extreme heat: Across East and Southern Africa, increasing extreme temperatures and associated increases in heat stress for the population and exposed economic sectors such as agriculture and construction are observed (IPCC, 2022).	Projections point to a further increase in extreme heat indices in all parts East and Southern Africa (IPCC, 2022) but no projections can be made for a 1–3 year period.
Coastal hazards: Flooding, storm surges and sea level rise are concerns for low-lying coastal cities in East and Southern Africa including Mombasa, Dar-es-Salaam and Maputo (IPCC 2014).	With sea level rise, rapid urbanisation in coastal cities and growing population in informal settlements, the number of people at risk is expected to increase in the short and longer terms.
Tropical cyclones: The severe cyclones affecting Mozambique, Malawi and Madagascar in early 2022 caused destruction and fatalities, mostly due to heavy rainfall and associated flooding. The consecutive nature of the storms and increased vulnerability due to conflict, drought and climate change are responsible for the particularly destructive impacts (World Weather Attribution, 2022). In early 2023, tropical cyclone Freddy, potentially the longest-lasting tropical cyclone on record, made landfall several times and affected Mozambique, Madagascar, Zimbabwe, and Malawi with heavy rainfall and flooding (WMO, 2023).	Tropical cyclones are projected to become less frequent in the region but more intense with higher wind speeds (IPCC, 2022). In the short term, the intense cyclones of recent years will negatively affect people's ability to cope with future shocks as countries are still recovering.

Regional stability and socioeconomic development

In East and Southern Africa, climatic changes such as increasing temperatures and changing rainfall patterns have reduced economic output to a larger extent than in other world regions, with the largest impacts in countries that heavily depend on hydropower and agriculture (IPCC,

2022). At the same time, non-climatic drivers of risk are shaping the risk landscape of the region and potentially exacerbating the risks associated with more frequent and intense extreme events due to climate change, especially in the Horn of Africa.

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability and conflict: East African countries continue to rank among the most politically unstable and fragile countries worldwide, with particularly high risks in Somalia, South Sudan and Sudan (very high alert/alert category in the latest Fragile States Index, 2022). In Southern Africa, instability and fragility is more diverse and ranges from alert levels (Zimbabwe and Mozambique) to levels of warning. Many factors explain the instability and conflicts but there is increasing evidence that climate variability influences human security (IPCC, 2022). Studies have linked high temperatures with violent conflict in Sudan and South Sudan, Kenya, and other East African countries while drought has been shown to have influenced conflicts in Somalia, Uganda, Sudan, Ethiopia and Kenya (IPCC, 2022).	High political instability will possibly affect people's ability to cope with possible future climate shocks especially in regions – such as the Horn of Africa – already highly vulnerable and exposed to adverse climate conditions. The scarcity of water may fuel existing tribal conflicts in Ethiopia, Kenya, Uganda and Sudan (Factbook ECC platform, 2021). Several multinational disputes over transboundary water bodies, including the conflict over access to and rights over the Nile water resources among its eleven riparian countries, and the transboundary water disagreements between South Africa and Namibia, remain unresolved (Factbook ECC platform, 2021). Conflicts are, however, generally based on a variety of interconnected causes of which water is considered to be one, but rarely the most decisive factor (IPCC, 2022https://www.ipcc.ch/report/ar5/wg2/).
Migration: Climate-related migration currently occurs mostly within countries or between neighbouring countries (IPCC, 2022). According to the latest IDMC GRID report (2022) on internally displaced people, a larger share of recent displacements were related to conflict: 5.1 million in Ethiopia, 2.7 million in DRC, 549,000 in Somalia, and 429,000 in South Sudan, making the region a hotspot of internal displacement due to conflict. A further 888,000 people in DRC, 506,000 in South Sudan and 271,000 in Somalia were displaced by disasters. Most of these disasters are climate sensitive, but the potential for migration is determined by the context where climate change occurs (Adger et al., 2015).	Given the various social, political, economic, environmental and cultural factors influencing the decision to migrate, assessments of future trends in environmentally induced migration are complex. Generally speaking, climate change is expected to increase internal migration in the form of rural to urban movements (IPCC, 2022), but in the short term, ongoing conflict and violence are expected to be the main drivers of internal displacement in the region.
Economic development: There is high confidence among scientists that climate change is already reducing economic growth in the region (IPCC, 2022), but other drivers have been dominating the economic development and associated impacts on poverty in the region in recent years. Global shocks such as COVID-19 and the war in Ukraine have affected the region through their effects on energy, fertiliser and food prices with particularly severe consequences for the poorest populations that spend a high share of their income on these goods (United Nations, 2023).	The modest outlook of economic growth translates into a slower path of poverty reduction (World Bank, 2023). With 55–62% of the sub-Saharan workforce employed in agriculture (IPCC, 2022), the region remains vulnerable to climatic impacts.

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Urbanisation: Africa's cities are the most rapidly growing cities in the world (AFDB, 2022), and associated urban vulnerabilities and exposure to climate change have increased in the region, mostly with regard to flooding and drought-related water scarcity (IPCC, 2022).	Rapid urbanisation and growing populations in informal settlements will continue to increase the exposure of people to climate hazards such as flooding and sea level rise (IPCC, 2022).

Water

There is significant subregional variability in water-related climate impacts but compounded stress on water resources is generally high in the region, especially in the dry areas in the Horn of Africa and parts of Southern Africa. In the Horn of Africa (and in wider parts of East and Southern Africa) weak state institutions and low cooperation among countries limit the sustainable governance of water resources (SIPRI, 2020).

Water: Past and ongoing development	Water: Trends
Water availability: Much of the region experiences high hydrological variability (IPCC, 2022). Precipitation deficits, droughts and extreme precipitation changes have been reported in the last few years. Changes in river flows are mixed, with decreases in associated water availability reported for Southern Africa and increases reported in East Africa due to increasing rainfall in mountainous regions (IPCC, 2022). Groundwater resources are diverse across the region. Many countries of the region have considerable groundwater storage but low levels of recharge – meaning that excessive groundwater pumping will ultimately come at a cost to future generations (United Nations, 2022).	Given the region's projected precipitation patterns, water availability will likely continue to decrease in Southern Africa while more run-off is predicted for parts of East Africa (IPCC, 2021). Water availability in the next 1–3 years will strongly depend on the El Niño/La Niña trends. If a strong El Niño develops (see forecast here: WMO), Southern Africa can expect reduced water availability (WMO, 2022). Improving energy infrastructure could support the development of groundwater to improve resilience to drought (United Nations, 2022).
Water demand: The main drivers of water demand in the region are population growth, urbanisation, agricultural growth, and land use change (IPCC, 2022). Across the region, per capita water withdrawals for agriculture and household consumption has been on the rise in recent decades but generally, data on water demand in the regional is scarce (OWID, 2018). Only 3% of the total cultivated land in sub-Saharan Africa is currently under irrigation (United Nations, 2022).	No specific projections can be made for a 1–3-year period, but water demand is expected to increase in almost all parts of the region with already high to extremely high water risks (WRI Aqueduct 3.0, 2019). Demand-related factors such as population growth, urbanisation, agricultural growth and land use change, will likely have a more profound effect than climate change in the short term.

Food

Given the high reliance on livestock and rain-fed crop production and the high intra- and inter-seasonal climate variability of the region, food production systems in East and Southern Africa

are highly vulnerable to climatic changes (IPCC, 2022). Drivers of food insecurity are diverse across the region, with droughts, conflicts and economic turmoil as key factors for food insecurity among the countries (FAO, 2023).

Food: Past and ongoing development	Food: Trends
Agricultural production: In sub-Saharan Africa, 95% of the cropland is rain-fed making it heavily dependent on rainfall and vulnerable to droughts, changing precipitation patterns and rising temperatures (IPCC, 2022). There is high confidence among scientists that climate change is already reducing agricultural productivity – including fish stocks and crop and livestock productivity – in the region (IPCC, 2022). In 2022, cereal output was near or above average in East and Southern Africa, with shortfalls in countries such as Somalia, Kenya, and Ethiopia being offset by good harvests in other parts of the region (FAO, 2023).	While agricultural forecasts for 2023 point to satisfactory crop conditions in Southern Africa (though drought and high temperatures curtail yield prospects in parts of Mozambique and Zimbabwe), the forecasts do not point to an above-average rainy season in 2023 in the drought-struck countries of East Africa (FAO, 2023). Furthermore, the high prices of fertiliser could limit yields to lower than normal levels (FAO, 2023). The effect of climate change on crop production in the region varies from crop to crop and within the region. For livestock production, impacts of climate change are mostly negative with projections for decreased fodder availability, increasingly erratic rainfall, high heat stress and increased prevalence of diseases (IPCC, 2022).
Food prices and imports: Prices for food commodities remain elevated (and exceptionally high in South Sudan and Sudan) but have partly recovered or at least stopped rapidly rising until recently, reflecting prices at the international level (FAO, 2023). In almost all countries, currency weakness and high global food prices have increased import bills (FAO, 2023).	Though less dependent on food imports than countries of North Africa and the Middle East, the region will continue to be affected by high global food and fertiliser prices because of limited budgetary flexibility (EEAS, 2022). Factors other than climate change will likely dominate developments on prices and imports at the regional scale in the coming years.
Food insecurity: Almost all countries of the region require external assistance for food. Shortfalls in aggregate food production and supplies are considered exceptionally high in Somalia and Kenya, with 6.5 million and 5.4 million people facing acute food insecurity. These numbers are at least 50% higher than in the previous year and are attributed to consecutive poor rainy seasons and heightened conflict in Somalia. Widespread lack of access to food is reported in several other countries of the region, with reasons including climate-related weather extremes in Burundi, Malawi, South Sudan, Ethiopia and Djibouti, and economic challenges and high food prices in Zimbabwe, Burundi, DRC, South Sudan and Eritrea, as well as conflict in DRC, South Sudan and Ethiopia (FAO, 2023).	Seasonal forecasts point to a sixth consecutive year with poor rain for the Horn of Africa (WMO, 2023). Elevated food prices, a slowdown in economic growth and households' capacity to pay for food, and locally reduced harvests will likely drive further food insecurity across the region (FAO, 2023). Apart from its impacts on crop and livestock production systems, climate change will also affect food security through its effects on marine and freshwater fisheries in the region (IPCC, 2022).

Energy

With the exception of South Sudan, Eritrea, and Somalia, the countries of East and Southern Africa rely more on renewable energy resources for the generation of their electricity than other world regions. Hydropower is widespread in the region whereas solar and wind power are yet to be adopted at scale (OWID, 2022). Overall electricity access and access to clean fuels and technologies remains very low compared to other world regions (OWID, 2020, IEA, 2022).

Energy: Past and ongoing development	Energy: Trends
Energy generation: In recent years, tropical cyclones and hydrological extreme events such as droughts and floods have affected energy systems in the region (IPCC, 2022). Some countries exhibit a high reliance on hydropower and the 2015–16 El Niño-induced drought in Southern Africa has disrupted energy generation in Malawi, Tanzania, Zambia and Zimbabwe, leading to power outages and energy shortages that were felt throughout the economy (IPCC, 2022). Other examples of recent climate-related effects on energy systems are power outages due to a tropical cyclone in Mozambique in January 2021 (with impacts on the electricity network and reduced output of coal power plants due to wet coal). Hydropower plants in Uganda were affected by flooding and debris blocking turbines in April 2020 (IEA, 2022).	Projected changes in river flows are highly uncertain in the region but generally speaking, the expected increase in the frequency, duration and intensity of drought in countries dependent on hydropower (such as Sudan and most countries of Southern Africa) (IPCC, 2022) indicates that the electricity supply would be vulnerable in a severe drought in a river basin with crucial hydropower plants. Weak governance of transboundary water resources and large hydropower plants generally increases risks along the water-energy-food nexus. Apart from impacts on hydropower, climate change also poses risks for Africa energy infrastructure through its effects on the availability of cooling water for thermal power plants and the consequences of sea level rise for energy assets in coastal areas. One-sixth of Africa's liquified natural gas capacity is at risk of coastal flooding (IEA, 2022).
Energy access and demand: Electricity demand is growing in response to burgeoning urban populations, growing economies, and increasing demand for cooling in response to an increase in heat stress (IPCC, 2022). Across the region, the use of inefficient fuels for cooking is prevalent with only one out of five people in sub-Saharan Africa having access to clean fuels for cooking. Several countries, including South Sudan, Burundi, Malawi, Rwanda, and Somalia, have the lowest rates of access to clean fuels and technologies globally (IEA, 2022).	Challenges related to governance and administrative capacity could limit access to energy in the region (IEA, 2022). In many African river basins, hydropower infrastructure is being expanded in tandem with irrigation infrastructure, likely compounding the overall risk along the water-energy-food nexus if future rainfall patterns and river flow regimes develop negatively (IPCC, 2022).

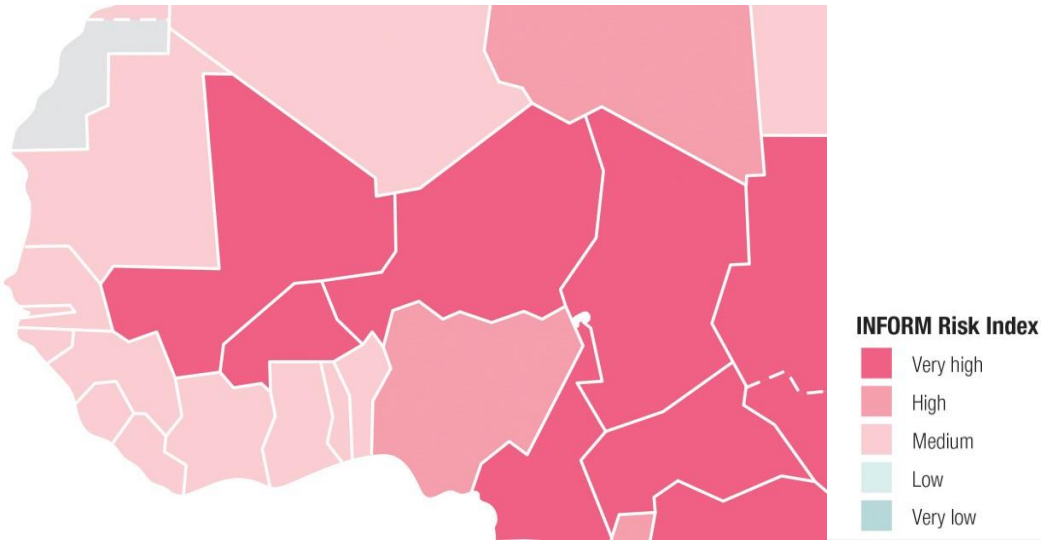
Health

Climate variability and change affect the incidence and geographic range of sub-Saharan Africa's high health burdens, particularly among the elderly, pregnant women, individuals with underlying conditions including immune-compromised individuals (e.g. from HIV) and young children. Risks for most health outcomes are projected to increase with climate change (IPCC, 2022). In the medium term, the number of additional deaths attributable to climate change in East Africa will be higher than in most world regions, with undernutrition causing a high share

of predicted fatalities, followed by diarrhoeal disease. In Southern Africa, fatal health consequences due to climate change are expected to remain relatively low (IPCC, 2022).

Health: Past and ongoing development	Health: Trends
Malnutrition: Africa experiences the greatest impacts of climate change on food insecurity and malnutrition worldwide. Currently, more than 250 million Africans are undernourished, mostly in central and East Africa (IPCC, 2022). Millions of children suffer from wasting and are in need of treatment – 4.2m in Ethiopia, 2.6m in Sudan, 1.3m in South Sudan and 1.2m in Somalia (WFP, 2022). The prevalence of undernourishment is particularly high in East Africa, with an increase from 28% in 2019 to 30% in 2021 (FAO/IFAD/UNICEF/WFP/WHO, 2022).	In the short term, the elevated prices of food, the slowdown in economic growth and households' capacity to pay for food, and locally reduced harvests will likely drive further malnutrition across the region (FAO, 2023). Improvements in reducing the rates of undernutrition may be negatively affected, and potentially reversed, by climate change impacts that affect agricultural production, global food prices, livestock, and fisheries. Apart from crop failure, declines in fish catch due to ocean warming and negative effects of heightened levels of CO_2 on the nutritional quality of staple crops could further contribute to malnutrition in the region (IPCC, 2022).
Foodborne and waterborne diseases: Africa has the highest mortality rates due to diarrhoeal diseases in the world and climatic drivers have increased transmission rates (IPCC, 2022). Since mid-2021, the world has faced an increase in cholera outbreaks, and the East and Southern Africa region is a hotspot (WHO, 2023). Malawi is currently particularly affected (ECDC, 2023). Reasons for the outbreaks are diverse but climate-related factors such as heavy rainfall and drought are considered drivers of cholera transmission (WHO, 2023). Cholera incidence increased threefold in El Niño-sensitive regions of Africa during past El Niño events (IPCC, 2022).	The rapid urbanisation and associated limitations in sanitation infrastructure contribute to an increased risk in disease transmission in the coming years (IPCC, 2022). Apart from flooding and tropical cyclones, water scarcity in times of drought and the associated reduced hand washing of vulnerable populations could also lead to increased transmission rates (IPCC, 2022).
Vector-borne diseases: Changes in rainfall and temperature affect the incidence of vector-borne diseases such as malaria, dengue, zika, and Rift Valley fever. Outbreaks of malaria are often associated with increased rainfall as flooding enables mosquitos to spread, and with droughts where the open storage of water near settlements enables mosquitos to spread (IPCC, 2022). Malaria suitability has expanded into higher elevations in the region (IPCC, 2022). Of the many countries in the region reporting recent malaria cases, DRC, Uganda, Mozambique and Tanzania were among the most affected (WHO, 2022). So far in 2023, reports of dengue were rare in the region with some cases in Sudan (ECDC, 2023).	Compared to other health impacts, increases of vector-borne diseases related to climate change are projected to remain lower in the short term. Malaria prevalence, however, is projected to increase, particularly in DRC, Tanzania and Uganda, and will move further southward and into higher elevations (IPCC, 2022). The risk of dengue fever is expected to increase in Southern Africa (Ryan et al., 2019). Outbreaks of Rift Valley fever are strongly linked to El Niño events, with strong effects expected in East Africa (Anyamba et al., 2019).
Heatwaves: Increased levels of mortality on days with high temperatures and overall increasing heat-related mortality have been recorded in the region, with causes of death often associated with cardiovascular disease (IPCC, 2022, Lancet Countdown, 2022).	With the projected increase in frequency, intensity and duration of heatwaves, negative effects on human health are likely to increase. Elderly people and children under 5 years are considered most vulnerable (IPCC, 2022).

4.3. West Africa



Overall risks are very high in the region's SDC priority countries with the exception of Benin – where risk is considered medium. Dominant risk drivers are conflict, high vulnerability and lack of coping capacity, with climate-related hazards less important (see INFORM Risk Index for country-level information). Nevertheless, the countries with very high overall risks must be considered particularly susceptible to climate-related hazards given their underlying vulnerability and lack of coping capacity. Risks have risen sharply in SDC priority countries of West Africa and are the highest among all the regions assessed (see Figure 3, p. 8).

Climate

The region is a climate risk hotspot and is projected to face compounding risks from climate change, with increasing drought episodes and heavy precipitation events being particularly critical for the highly vulnerable population of the region (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends
Extreme heat: Across the region, both mean temperature and temperature extremes are increasing. Heatwaves have become hotter, longer, and cover larger areas (IPCC, 2022). In 2022, the Central African Republic was faced with a particularly severe heatwave that led to wildfires (Carbon Brief, 2022).	Compared to higher latitude countries, the region will face unprecedented temperatures earlier in the century (IPCC, 2022). No specific projections can be made for a 1–3-year period but the region's cities are particularly vulnerable due to urban heat island effects.

Climate: Past and ongoing development	Climate: Trends
Heavy rainfall and flooding: Extreme precipitation leading to pluvial and riverine flooding has been increasing in West Africa in recent decades and due to rapid urbanisation, the population exposed to flooding has increased by more than 50% since 2000 (IPCC, 2022).Between May and October 2022, large parts of West Africa including Mali, Niger, Chad, and Benin experienced pluvial and riverine flooding. Some countries experienced the most deadly floods in their history. Even though climate change has increased both the likelihood and frequency of such events, the rainfall amounts leading to the floods were not unusual given the historical record (World Weather Attribution, 2022).	The frequency and intensity of heavy rainfall events are projected to increase throughout the region, with consequences for pluvial and riverine flooding risk (IPCC, 2022). No projections can be made for a 1–3-year period, but recently affected countries should be considered particularly vulnerable to future shocks, especially as recent floods in the region were devastating despite rainfall amounts not being unusual given the historical record.
Droughts and aridity: Multi-year droughts have become more frequent in West Africa (IPCC, 2022) and the risk of drought is particularly high in the Sahel (IPCC SRCCL, 2019). Although erratic rainfall played a crucial role in the recent food security crisis in the region, chronic vulnerability, not unusual rainfall, was the main driver (World Weather Attribution, 2022).	While projections for general aridity are unclear, increases in drought frequency and duration are projected in the western Sahel, potentially translating in elevated drought risk for areas of Mali and Burkina Faso. Central Sahel (Niger, Chad) in turn is expected to face positive trends in precipitation (IPCC, 2022).

Regional stability and socioeconomic development

Climate interacts with various drivers of conflict, instability, and socioeconomic development. Existing instabilities and conflicts in the Sahel may affect people's ability to cope with future climate shocks. Some countries of West Africa, namely Mali, Niger, and Chad, are ranked among the countries with the highest observed economic impacts due to climate change in recent years (IPCC, 2022).

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability and conflict: West African countries continue to rank among the most politically unstable and fragile countries worldwide, reaching alert levels on the Fragile States Index, (2022) in almost all countries of the region. Many factors explain the incidence of conflicts but climate change is increasingly seen as a contributing driver of conflict risk in the region (IPCC, 2022, Mbaye & Singé, 2022).	High political instability may affect people's ability to cope with possible future climate shocks in the whole Sahel region, which is already highly vulnerable and exposed to adverse climate conditions.
Migration: Climatic conditions influence migration decisions (IPCC, 2022), but in recent years, reasons other than climate change were the dominant drivers of migration in the region. According to the latest Global Report on Internal Displacement (2022),	Climate change is expected to increase internal migration in the form of rural to urban movements (IPCC, 2022) but given the various social, political, economic, environmental and cultural factors influencing the decision to migrate, assessments of future trends in

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
1,580,000 people remain displaced due to conflict in Burkina Faso, 326,000 in Mali, 224,000 in Niger, and 392,000 in Chad, by far outweighing displacements by natural disasters.	environmentally induced migration are complex. In the short term, ongoing conflict and violence are expected to be the main drivers of internal displacement in the region.
Economic development: In recent years, the share of population living in extreme poverty declined, with Niger remaining as a regional hotspot of extreme poverty (OWID, 2019). The global crises of recent years, however, have weakened the growth prospects of the region's economies, especially because of the effects on energy, fertiliser and food prices, with particularly severe consequences for the poorest populations (United Nations, 2023). On top of these global risks, adverse weather conditions remain critical and there is high confidence among scientists that climate change is reducing economic growth in the region (IPCC, 2022).	Economic growth is expected to pick up in 2023 in West Africa but more people are expected to be pushed into extreme poverty in 2023 as a consequence of the COVID-19 pandemic and the war in Ukraine, reversing hard-won gains in poverty reduction (United Nations, 2023) With 55-62% of the sub-Saharan workforce employed in agriculture (IPCC, 2022), many people remain vulnerable to climatic impacts.
Urbanisation: The countries of the region have been experiencing accelerated urbanisation (OECD, 2021), and associated urban vulnerabilities and exposure to climate change are increasing in the region, mostly regarding flooding and drought-related water scarcity (IPCC, 2022).	The populations of Burkina Faso, Chad, Mali, Mauritania and Niger could double in the next 20 years, resulting in an increase of 80–160 million inhabitants by 2040 (UN-DESA, 2019). The rapid urbanisation will increase the exposure of people to climate hazards (IPCC, 2022).

Water

West Africa is generally faced with highly variable hydrology (IPCC, 2022). Projections do not point to a clear pattern for the region but compared to North Africa and Southern Africa, this region is not likely to experience reduced overall water availability but rather increased hydrological variability at short or interannual time scales (IPCC, 2022).

Water: Past and ongoing development	Water: Trends
Water availability: Much of the region experiences high hydrological variability (IPCC, 2022), as reflected in precipitation deficits, droughts, and seasonal declines of river flows. In 2022, water availability was higher than average thanks to relatively favourable weather conditions with higher than average precipitation in most of the region, with the exception of southern Mali (WASP Index, 2023). The countries of the Sahel have large groundwater resources which provide a buffer for periods of drought but given the limited precipitation levels and associated groundwater recharge in some subregions, excessive use of groundwater ultimately comes at a cost to future generations (United Nations, 2022).	Mean rainfall projections show a decrease in western Sahel and an increase in central Sahel, but there is low agreement among climate models on whether the climate will become wetter or drier in specific river basins, partly a result of insufficient research and rain gauging stations in the region (IPCC, 2022). General water scarcity is likely going to be less of an issue than high seasonal variability (WRI Aqueduct 3.0, 2019). Shallow aquifers in the Sahel which respond more quickly to seasonal and yearly changes in rainfall, may experience a decline in groundwater recharge to the extent that prolonged drought and other precipitation anomalies become more frequent with climate change (IPCC 2014).

Water: Past and ongoing development	Water: Trends
Water demand: Water demand is critical for driving water scarcity in the region, with demand increasing due to population growth, urbanisation, agricultural growth, land use change and over-extraction of water from rivers and lakes (IPCC, 2014). Information on water demand is generally scarce, but data suggest that water withdrawals per capita have been on the rise in recent decades (OWID, 2018). Currently, only 3% of the total cultivated land in sub-Saharan Africa is under irrigation (United Nations, 2022).	Water demand is expected to further increase due to population growth, urbanisation, agricultural growth and land use change (IPCC, 2014), factors that overlay and impose particular pressure on water resources in cities such as Niamey, Niger (IPCC, 2022). No specific projections can be made for a 1–3-year period.

Food

Climate variability and change already have significant impacts on agriculture – the predominant livelihood in the region. Crop production and livestock systems are almost entirely reliant on the region's erratic rainfall, making food security and associated livelihoods extremely vulnerable to climate trends.

Food: Past and ongoing development	Food: Trends
Agricultural production: Crops and/or livestock are the principal livelihoods for more than 70% of the population in Niger, Burkina Faso, Mali and Chad, and for more than 50% in Senegal and Mauritania (USAID 2018). Both cereal production and livestock systems are heavily dependent on rainfall and are vulnerable to droughts, changing precipitation patterns, and rising temperatures. In 2022, cereal output of West Africa was above the five-year average due to favourable weather conditions and subsidised agricultural inputs. Production shortfalls were local and mostly attributed to intensifying insecurity in the central Sahel region as well as the widespread flooding across West Africa (FAO, 2023). Multiple stressors such as rangeland degradation, fragmentation of grazing areas and in-migration of non-pastoralists into grazing areas are putting pressure on livestock systems and are interacting with climate change (IPCC 2014).	Regional weather forecasts point to favourable conditions in the Sahel countries, but persisting conflicts in parts of Burkina Faso, Mali, Niger, Nigeria and the Lake Chad region could undermine local agricultural production (FAO, 2023). Given the high climate variability of the region and its dependence on rain, the vulnerability of agricultural production systems will remain very high in the coming years (IPCC, 2022). Apart from crop production, climate change is expected to impact the availability of wild-harvested food plants and the health of livestock through various drivers including heat stress and shifts in the range of pests and diseases (IPCC, 2022).
Food prices and imports: Prices of food are still above the previous year levels in early 2023 in most countries of the region, most notably in Chad, Mali, and Burkina Faso. Apart from disruptions due to local conflicts and localised production shortfalls, the region is affected by the high prices in global markets due to the war in Ukraine (FAO, 2023)	Though less dependent on food imports than countries of North Africa and the Middle East, the region will continue to be affected by the high global food and fertiliser prices because of limited budgetary flexibility (EEAS, 2022).
Food insecurity: Almost all countries of the region require external assistance for food (FAO, 2023). The 2022 food insecurity crisis in Burkina Faso, Chad,	Acute food insecurity is projected to worsen significantly in 2023, with the peak lean season expected between June and August. Relevant drivers are worsening

Food: Past and ongoing development	Food: Trends
Mali, and Niger was driven by chronic vulnerabilities and drought conditions. Civil insecurity was among the primary drivers of most food crises in the region (FAO, 2023). Further drivers of vulnerability were the heavy reliance on rain-fed agriculture and pastoralism; high food, fertiliser and energy prices associated lingering COVID-19 impacts; and the war in Ukraine and other socioeconomic factors (World Weather Attribution, 2022).	insecurity and the associated displacement of people, and the inability of aid organisations to deliver essential humanitarian assistance (FAO, 2023). Due to the heavy reliance on rain and the tense socioeconomic situation, even small shifts in rainfall could limit food supply in the Sahel (World Weather Attribution, 2022).

Energy

The region's countries rely on biomass and fossil fuels for energy supply, with most electricity produced by oil-based power plants (IEA, 2022). Reliance on hydropower is therefore less common than in other parts of Africa (with the notable exception of Mali) and other sources of renewable energy have yet to be adopted at scale (OWID, 2022). Overall electricity access and access to clean fuels and technologies remains very low compared to other world regions (OWID, 2020, IEA, 2022).

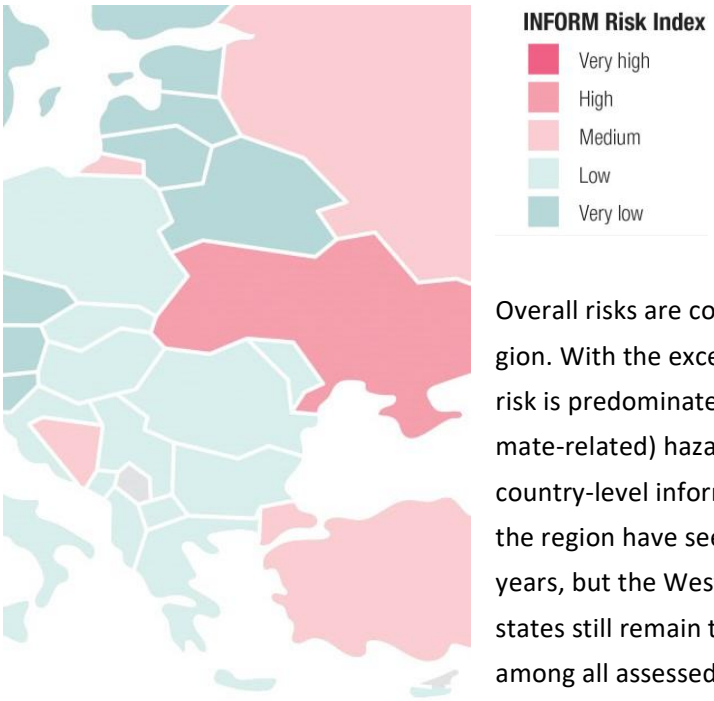
Energy: Past and ongoing development	Energy: Trends
Energy generation: Drought has led to power shortages in the past (Al Jazeera, 2016), but reports on climate-related disruptions in West African energy systems are generally rare. This is no surprise given the low rates of electricity access in the region. In 2020, less than 20% of people had access to electricity in Burkina Faso, Niger and Chad (OWID, 2020).	Climate change poses risks for West Africa energy infrastructure through its effects on cooling water availability for thermal power plants (IEA, 2022). In Mali, the development of hydropower and irrigation infrastructure in tandem could compound the overall risk along the water-energy-food nexus if future rainfall and river run-off patterns were to develop negatively (IPCC, 2022).
Energy access and demand: The region exhibits some of the lowest energy access rates on the African continent (IEA, 2022) and energy consumption per capita is one tenth of the global average (IEA, 2022). Across the region, the use of inefficient fuels for cooking is prevalent with only one out of five people in sub-Saharan Africa having access to clean fuels for cooking. Several countries with the globally lowest rates of access to clean fuels and technologies, including Mali, Niger and Benin, are located in the region (IEA, 2022). Electricity is gaining increasing importance and has grown steadily in recent decades but still cannot meet demand and Sahel cities are often faced with power cuts (IEA, 2022).	The countries of the region are among the hottest countries in the world (IEA, 2022). Energy demand, including the demand for cooling is expected to increase in response to economic growth and increasing heat stress (IPCC, 2022). In the longer term, hydropower plants in western Sahel, such as Mali's critical Manantali plant, could be increasingly affected by lower levels of rainfall as a result of climate change (IEA, 2022). Improving energy infrastructure could support the development of groundwater to improve resilience to drought (United Nations, 2022).

Health

Increased risk of food insecurity, infectious disease and health impacts of heat are pressing climate-related challenges in West Africa and projected to increase with climate change in the region (IPCC, 2022). In the medium term, the number of additional deaths attributable to climate change in West Africa will be higher than in most world regions, with malnutrition causing a high share of predicted fatalities, followed by diarrhoeal diseases (IPCC, 2022).

Health: Past and ongoing development	Health: Trends
Malnutrition: Africa is the region where climate shocks and stressors have the biggest impact on acute food insecurity, malnutrition and undernutrition. The Sahel, where the food system relies heavily on rainfall that is variable, is particularly affected. Among the millions of children suffering from wasting and in need of treatment are the 1.9m in Chad, the 1.7m in Nigeria, the 1.6m in Niger, and the 1.2m in Mali (WFP, 2022). The prevalence of undernourishment in West Africa rose from 10% to 14% between 2019 and 2021 (FAO/IFAD/UNICEF/WFP/WHO, 2022).	Improvements in reducing the rates of undernutrition may be negatively affected and potentially reversed by climate change impacts (UNEP 2018). In the short term, however, the relevant drivers for food insecurity and associated malnutrition consequences are non-climatic (FAO, 2023).
Foodborne and waterborne diseases: The countries of the Sahel have the highest mortality rates attributable to diarrhoeal diseases in the world (OWID, 2019). High land and sea temperatures, heavy rainfall events, droughts and tropical cyclones have increased the transmission of diarrhoeal disease agents (IPCC, 2022).	Apart from climatic extreme events, inadequate water and sanitation infrastructure in rapidly expanding urban areas, and informal settlements increase the vulnerability to diarrhoeal diseases. Increased water scarcity and the associated reduced hand washing among vulnerable populations could lead to increased transmission rates (IPCC, 2022).
Vector-borne diseases: Even though the malaria mortality rate declined in the whole region between 2000 and 2019 (WHO 2020), West Africa still exhibits the highest malaria death rates in the world (OWID, 2019). Past malaria outbreaks were often associated with increased levels of rainfall (IPCC, 2022). Many countries of the region reported recent malaria cases, and Burkina Faso, Niger, Mali, and Benin were among the most affected (WHO, 2022).	Projecting the impact of climate change on malaria in West Africa remains challenging, but malaria prevalence could be reduced in the region as the environmental suitability for the malaria vector decreases (IPCC, 2022). Other vector-borne diseases, however, the dengue virus in particular, could increase as urban-adapted mosquitos that transmit the virus expand in the region (IPCC, 2022). Large increases in suitable conditions for dengue are predicted in the Sahel, largely due to more favourable temperatures and increased rainfall (Messina et al., 2019). Disease dynamics are highly uncertain and depend on the specific region.
Heatwaves and dust storms: Increased levels of mortality on days with high temperatures and an overall increase of heat-related mortality have been recorded in the region, with causes of death most often associated with cardiovascular disease (IPCC, 2022, Lancet Countdown, 2022). Furthermore, dust storms have severe health impacts in West Africa, both through cardiorespiratory and infectious diseases such as bacterial meningitis (IPCC, 2022).	The projected increase in frequency, intensity and duration of heatwaves means that negative effects on human health are likely to increase. The associated risk of bacterial meningitis could increase with climate change in some parts of West Africa (IPCC, 2022). No projections can be made for a 1–3-year period.

4.4. Western Balkans and new EU member states



Overall risks are considered low in most of the region. With the exceptions of conflict-affected areas, risk is predominately driven by natural (in part climate-related) hazards (see INFORM Risk Index for country-level information). SDC priority countries in the region have seen an increase in risks in recent years, but the Western Balkans and new EU member states still remain the region with lowest overall risks among all assessed regions (see Figure 3, p. 8).

Climate

High climate variability and the occurrence of extreme events such as heatwaves, droughts, and heavy precipitation are affecting this region. Europe is warming at a faster pace than any other continent in the world (WMO, 2022), and observed increases in frequency and intensity of weather extremes can already be attributed to climate change (IPCC, 2022). While current economic damages are mainly related to river floods and storms, heat and drought are expected to become major drivers of risk in the future (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends and future changes
Extreme heat and wildfires: Increased frequency and duration of heatwaves has been reported in the Western Balkans region (RCC, 2018). Particularly affected economic sectors are construction, agriculture and manufacturing (IPCC, 2022). The latest report on wildfires in Europe (European Commission, 2022) points to the threat of wildfires intensifying through both an expansion of affected areas and a longer duration of the fire season.	Studies expect increasing frequency, intensity and duration of heat extremes throughout the region, but particularly towards the central and southern parts of including countries of the Western Balkans (IPCC, 2022). Apart from health impacts, extreme heat is expected to cause rutting and pavement blow-ups in roads, resulting in disrupted transportation (IPCC, 2022). Weather conditions that could lead to wildfires (so called fire weather) are also projected to increase in the region (IPCC, 2021).
Droughts and aridity: Mean precipitation is observed to be decreasing in the southern parts of the region (particularly in the Mediterranean countries) while	Climate change will increase the likelihood of concurrent extremely dry and hot warm seasons in the region (IPCC, 2022). The Western Balkans expect variable

Climate: Past and ongoing development	Climate: Trends and future changes
increasing in the northern parts (IPCC, 2022). In 2022, Moldova experienced an abnormally dry year (FAO, 2022) with fire hazard conditions, which are expected to increase throughout the region and could have particularly severe consequences (including fire-related air pollution episodes) in newly fire-prone areas where fire management capacity is low (IPCC, 2022).	changes in annual precipitation with increases in northern Serbia and decreases towards the south, including the coastal areas (RCC, 2018). No projections can be made for a 1–3-year period, but ongoing drought events such as in Moldova may affect people's ability to cope with future shocks.
Heavy rainfall and flooding: Heavy precipitation events are trending upward across the region with flood hazards increasing accordingly, particularly in central and northern parts of the regions and in small catchments and cities with impervious surfaces (IPCC, 2022). The Western Balkan region has observed an associated increase in flood risk (RCC, 2018), especially in the Drin River Basin in Albania, Kosovo, Montenegro and North Macedonia (GIZ 2019). As in previous years, the region has been hit by heavy floods with Albania, Montenegro and Serbia affected in 2022 (Balkan Insight, 2022). The economic sectors most affected by floods are manufacturing, utilities and transportation (IPCC, 2022).	Europe is one of the world regions with the largest projected increase in flood risks, particularly in winter and spring (IPCC, 2022). In the Western Balkans, land transport infrastructure will be at risk from the increase in flood frequency and intensity, soil erosion and landslides (RCC 2018). Increasing heavy precipitation events are also expected to increase shallow landslides in the Carpathian Mountains. Specific projections for the next 1–3 years are not possible.

Regional stability and socioeconomic development

Various non-climatic drivers of risk are shaping the climate risk landscape of the region, and potentially exacerbate the risks associated with more frequent and intense extreme events due to climate change expected in the region.

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends and future changes
Political instability and conflict: Bosnia and Herzegovina, Serbia, North Macedonia, Moldova and Ukraine face elevated warnings in the latest Fragile States Index (2022). In Ukraine, the war has directly affected people's ability to cope with extreme climate events. Most of the remaining countries of the Western Balkans and the new EU members states are considered stable – a good basis for coping with adverse climate change impacts.	The war in Ukraine will further impact the stability of some of the region's countries and the region in general. Political instability will possibly affect people's ability to cope with possible future climate shocks in the affected countries with potential ripple effects in other countries in the region.
Urbanisation: Exposure to extreme heat and flooding will increase with urbanisation (IPCC, 2022). Urban development is projected to increase over Europe but especially rapidly in Eastern Europe, with the magnitude of these increases depending on population growth, economic growth and land use planning policies (IPCC 2014).	Increasing urban development is posing additional threats to human systems and will exacerbate the impacts of climate change in the next 1–3 years.
Economic development: Economic conditions and	While the Ukraine economy will continue to be

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends and future changes
governance and social readiness have generally improved in all countries. Over the last 20 years, living standards have increased six-fold in Bosnia and Herzegovina, and nearly three-fold in Albania and in Serbia. (World Bank 2018). COVID-19 and the war in Ukraine, however, have led to rising food and energy prices, as well as tightening finances, negatively affecting the coping ability of people and countries, and reversing some of the progress made in recent years (United Nations, 2022).	severely disrupted by Russia's invasion (GDP: -36% in 2022 (United Nations, 2023)), the economies of the other countries of the region are expected to grow in 2023. This will accelerate the accumulation of assets exposed to climate change, but adaptation capacity will also increase. Because rural, low-income households have the least capacity to adapt, the depopulation of rural areas could accelerate.
Migration: Small-scale climate-induced displacement due to flood and drought events are regularly observed in Europe (IPCC, 2022). The latest Global Report on Internal Displacement (2022) reports no large-scale climate-related events, and the number of people displaced by natural disasters are dwarfed by those forced to flee due to the Russian invasion of Ukraine, with 8.16 million refugees recorded across Europe in April 2023 (UNHCR, 2023).	The war in Ukraine will dominate the region's main migration movements over the coming years, but specific short-term projections are not possible. Refugees should generally be considered as particularly vulnerable to extreme weather events.

Water

Water availability is unevenly distributed in Europe with risks related to water scarcity and drought affecting the Mediterranean region to a larger extent than the northern parts of the region (IPCC, 2022).

Water: Past and ongoing development	Water: Trends and future changes
Water availability: Increases in droughts have already been observed in the southern and central parts of the region (IPCC, 2022). Water scarcity is generally expected to be more severe in southern Europe and has the potential to lead to cascading impacts in sectors from agriculture, forestry and livestock farming to shipping and energy (IPCC, 2022). The Western Balkans have faced negative impacts on water resources, especially due to decreased average river discharge and problems with drinking water quality and supply during summer (RCC 2018). In 2022, south-eastern and Eastern Europe experienced severe drought (European Commission, 2022).	The IPCC (2022) has high confidence that mean precipitation will decrease and that hydrological, agricultural and ecological drought will increase in the Mediterranean, including the Southern Balkan countries, and makes similar projections for continental Europe. No specific projections can be made for a 1–3-year period, but severe droughts are already possible, as the record-breaking 2022 summer drought in central Europe has shown (Carbon Brief, 2022).
Water demand: In recent years, the rapid development of hydropower plants has increased pressure on rivers in the Western Balkans region (River Watch, 2022).	Water demand for irrigation is projected to increase across most of Eastern Europe, with particularly severe consequences in regions that face both increasing water demand and successive dry climatic conditions with climate change (IPCC, 2022). In the Western Balkans, environmentalists are concerned about the planned

Water: Past and ongoing development	Water: Trends and future changes
	increase in hydropower as it may threaten the environment and freshwater sources and exacerbate the impacts of climate change (Global Voices, 2019).

Food

The region shows trends toward more intense and longer meteorological droughts, and crop suitability is likely to change throughout Europe with ongoing climate change (IPCC, 2022). At present, the repercussions of the conflict in Ukraine on global food markets are the primary driver of food insecurity, but climate extremes might exacerbate the situation in the coming years (WFP, 2022).

Food: Past and ongoing development	Food: Trends
Agricultural production: Climate change already has an observed adverse effect on crop productivity in Europe including on wheat and barley, mainly due to heat stress and drought conditions (IPCC, 2022). In 2022, cereal crop production in Europe is estimated to be 9 percent below the previous five-year average due to rainfall shortages and higher than average temperatures (FAO, 2022). Severe moisture deficits persist particularly in Moldova, where severe drought affected crops and livestock in 2022 (FAO, 2022). Agricultural production is particularly important in Albania where it contributes about 18% of gross domestic product (World Bank, 2021).	For the next 1–3 years, the ongoing war in Ukraine is likely to be the primary driver of reductions in agricultural production in the region. For the 2023 season, a 40% decrease of wheat plantings in Ukraine is forecasted (FAO, 2022). In the longer term, heat and drought stress are expected to decrease the profitability of farming in the southern parts of the region and lead to abandonment of farmland (IPCC, 2022).
Food prices and imports: Despite easing market conditions for basic foodstuffs towards the end of 2022, food prices remain at elevated levels and are likely to affect import-dependant countries such as Albania and other Western Balkan countries (OECD-FAO, 2022).	High dependency on food imports makes the region potentially vulnerable to adverse climatic conditions in other parts of the world, including in Ukraine and Russia, and will continue to affect the Western Balkans in the coming 1–3 year period.
Food insecurity: Before the war in Ukraine, the countries in Europe with the highest prevalence of severe food insecurity in the total population were Albania at 7.7 %, North Macedonia at 6.0%, and Moldova at 4.9% (FAO, 2022). In Ukraine, the United Nations Office for the Coordination of Humanitarian Affairs estimates that 17.7 million people were in need of humanitarian assistance and protection in early 2023 (UN OCHA, 2023). These countries are the most vulnerable to climate impacts on food security in the region.	Household income and livelihoods largely affect economic access to food, and high market prices of basic food items will likely continue to limit economic access in the coming years.

Energy

There is high confidence that the energy sector in Europe already faces impacts from climate extremes as high temperatures provoke demand surges while straining supply and transmission (IPCC, 2022). A predominant share of countries' primary energy supply is still provided by fossil fuels, but with the exceptions of Kosovo, Moldova and Belarus, most countries have made progress in increasing the share of electricity from low-carbon sources (OWID, 2022).

Energy: Past and ongoing development	Energy: Trends and future changes
Energy generation: Significant reductions and interruptions of power supply have been observed during exceptionally dry and/or hot years over the recent 20-year period in Europe, particularly due to water-cooling constraints on thermal power plants and reduced efficiency of steam and gas turbines (IPCC, 2022). In 2022, both Serbia and Albania reported reliance on expensive electricity imports due to water scarcity (Reuters, 2022, Balkan Green Energy News, 2022). High energy costs and severe drought in the region, however, had negative impacts on agriculture and hydropower generation, impeding growth momentum towards the end of the year (UNECE, 2023).	The Western Balkans, particularly Kosovo and North Macedonia, have high shares of existing thermal (mostly coal) power plants that are cooled with freshwater and located in high water-stress areas (IEA, 2021, Turner et al., 2017). Albania is almost entirely dependent on hydropower, making its electricity sector highly vulnerable to droughts (CEE, 2021). Increased flooding risks due to heavy precipitation might affect hydropower generation in the central and northern parts of the region (IPCC, 2022).
Energy distribution and demand: Heatwaves are threatening the stability of networks (IPCC, 2022). In 2021, heat and wildfires affected electricity transmitters and power lines in Greece, and in previous years affected transmitters and power lines in Albania and Montenegro (eKathimenerini, 2021).	Peak electricity demand is expected to increase in the southern parts of the region due to additional cooling demand in summer. Increased demand and water-cooling constraints for thermal power will continue to challenge electricity networks (IPCC, 2022). Transmission and distribution might also be increasingly affected by heightened flooding, landslide and wildfire risks as extreme weather events become more frequent and intense (IPCC, 2022).

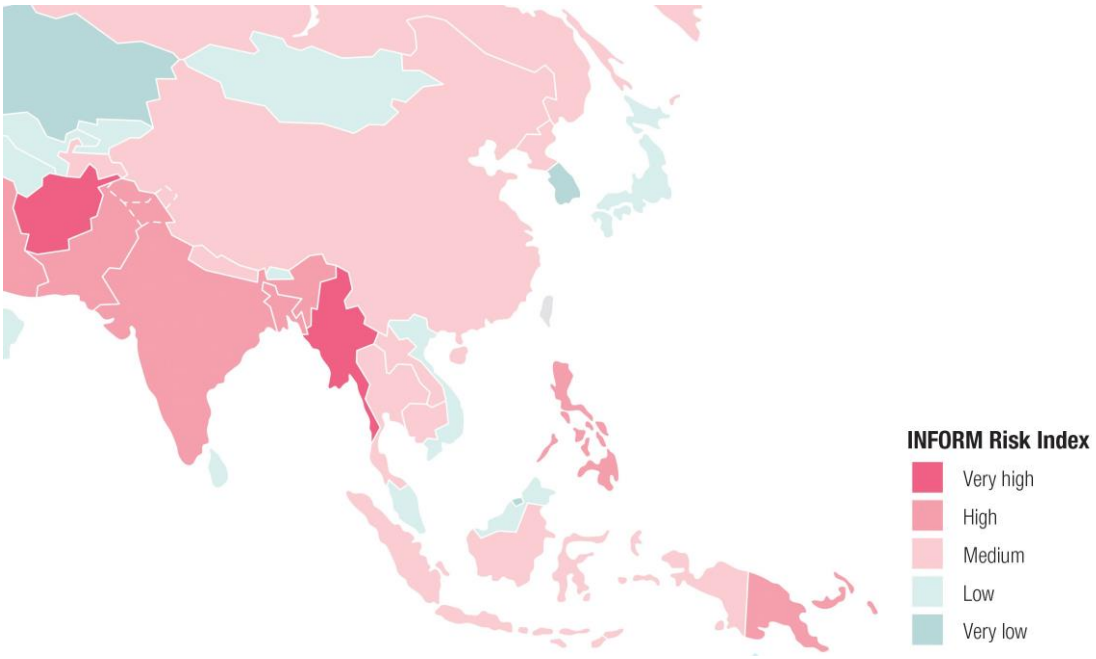
Health

The increase in heatwaves is expected to have the greatest climate change impact on health. The number of additional deaths attributable to climate change in the region will still be lower than in the other regions in the medium term, with almost all additional fatalities expected to occur due to heat (IPCC, 2022).

Health: Past and ongoing development	Health: Trends and future changes
Heatwaves: The region has already experienced health effects of heatwaves with particularly severe consequences for elderly people, children, pregnant women and socially isolated people as well as those with low physical fitness (IPCC, 2022). Extensive evidence shows the impacts of heatwaves in the form of	No specific projections can be made for a 1–3-year period but forecasts call for an increase in frequency, intensity, and duration of heatwaves with impacts on human health throughout the region but particularly in southern Europe including the Western Balkans (IPCC, 2022). Even heatwaves of lower intensity can have

Health: Past and ongoing development	Health: Trends and future changes
changes in mortality and morbidity. In 2010, many Eastern European cities recorded extremely high temperatures resulting in an increase in daily mortality (UNEP, 2018).	severe impacts in regions where people are not used to high temperatures. Energy-poor households that cannot afford air conditioning in the southern and central parts of the region are expected to be most affected (IPCC, 2022).
Other health threats: South-eastern European cities have been temporarily ranked among the most polluted in the world in terms of air quality, particularly during the winter heating period when pollution is higher and local meteorological conditions amplify health risks (IVL, 2021). Elevated sea surface temperatures in semi-enclosed seas such as the Baltic and Black Seas increase the risk of toxic algal blooms and the transmission of infectious marine bacteria such as vibrio (IPCC, 2022).	Climate-related changes in health threats are not relevant in a 1–3 year outlook. As temperatures increase, the West Nile virus is expected to expand into the southern and central parts of the region (IPCC, 2022).

4.5. South Asia and South East Asia



Overall risks are medium to high in most of the region. Regional hotspots are Afghanistan and Myanmar, where overall risk is considered very high due to natural and conflict-related drivers, high vulnerability and lack of coping capacity. In the remaining SDC priority countries and regions, the risk is predominately driven by vulnerability, lack of coping capacity and natural (in part climate-related) hazards (see INFORM Risk Index for country-level information). Considering the region as a whole, the INFORM Risk Index has been fairly stable in recent years, but the risk level remains high (see Figure 3, p. 8).

Climate

South Asia and South East Asia are historically affected by heavy precipitation events and flooding, heatwaves, droughts and tropical cyclones. Changes in the intensity of heavy precipitation events and extreme temperatures are observed with climate change (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends
Heavy rainfall and flooding: Heavy precipitation events and related flooding have, with the exception of high mountain areas, further increased in intensity due to climate change (IPCC, 2022). In early 2022, flooding was widespread across South Asia with affected countries including Pakistan, Afghanistan, Nepal, and Bangladesh (FloodList, 2022, ReliefWeb,	Future increases in precipitation extremes and flood frequency are very likely in the monsoon regions of South Asia and South East Asia, with an associated large increase in flood frequency projected (IPCC, 2022). No projections can be made for a 1–3-year period, but recently affected countries of South Asia are perceived as particularly vulnerable to future shocks.

Climate: Past and ongoing development	Climate: Trends
2022, Dhaka Tribune, 2022), and particularly severe in Pakistan, with 33 million people affected, 1.7 million homes destroyed, and 1,500 people dead (World Weather Attribution, 2022).	Rohingya refugees in Cox's Bazar camps will continue to be highly vulnerable. If a strong El Niño develops (see forecast here: WMO), drier than usual conditions would affect most of the region between June and the end of the year (NOAA, 2016), potentially reducing the risk of heavy precipitation.
Extreme heat: Heat stress is already significant in large parts of this warm and humid region. The number of hot days and warm nights has been observed to increase in all of Asia, with large cities being warmer by more than 2 °C due to urban heat island effects, further worsening heat stress for urban populations (IPCC, 2022). The heatwave in India and Pakistan in early 2022 was the hottest March since records began 122 years ago (World Weather Attribution, 2022).	Temperature increases associated with climate change will cause strong, more frequent and longer heatwaves across Asia but particularly in South Asia (IPCC, 2022). No projections can be made for a 1–3-year period but if a strong El Niño develops (see forecast here: WMO), warmer than usual conditions would affect most of the region between December and February (WMO, 2022), potentially increasing the risk of heatwaves such as in 2022.
Droughts and aridity: Droughts regularly affect parts of South Asia and South East Asia but historical trends in drought conditions remain unclear (IPCC, 2022). In recent years, an exceptionally long-lasting La Niña event brought above-average rainfall to South East Asia (WMO, 2022).	Rainfall is expected to decrease in South East Asia. In South Asia, annual and summer monsoon precipitation is expected to increase but could exhibit enhanced interannual variability (IPCC, 2021). Severe drought events in the past may affect people's ability to cope with future shocks as countries and regions are still recovering from past events. If a strong El Niño develops (see forecast here: WMO), drier than usual conditions would affect most of the region between June and the end of the year (NOAA, 2016), potentially increasing the risk of drought.
Tropical cyclones: There are no significant trends in the number of tropical cyclones affecting the region, but some studies indicate an increase of the most extreme tropical cyclones in recent decades (IPCC, 2022). Overall, tropical cyclone activity was below average in recent years, but Typhoon Noru caused severe damage in South East Asia in 2022 (NOAA, 2022).	No projections can be made for a 1–3-year period, but recently affected countries are perceived as particularly vulnerable to future shocks through tropical cyclones and associated storm surges.
Coastal hazards: South Asia is generally considered among the world regions with the largest adaptation deficits in coastal protection (IPCC, 2022). The region is highly exposed to sea level rise, and excessive groundwater withdrawals in coastal cities and agricultural regions exacerbate the situation (IPCC, 2022). Particularly affected are river deltas, such as in Bangladesh, where the negative impacts of sea level rise and riverine flooding collide.	Future rates of sea level rise are expected to exceed those of recent decades but sea level rise is generally considered a slow onset risk with no abrupt changes in the coming 1–3 years. Still, highly populated deltas in Asia are highly vulnerable in the next 1–3 years.
Glacier melting and hazards: With glaciers and permafrost melting, landslides, flash floods and debris flow events have become more frequent in the mountainous parts of the region (IPCC, 2022). Glacial lake outburst floods (GLOFs) are also of concern.	There is high confidence that glacial mass and permafrost areas will continue to decline in Asia (IPCC, 2021). Glacier collapses and surges associated with GLOFs are projected to increase in mountainous countries and

Climate: Past and ongoing development	Climate: Trends
	could threaten the security of downstream communities (IPCC, 2022).
Multi-hazard risk: South Asia and South East Asia are exposed not only to climate hazards but also to earthquakes and volcanic eruptions. Of the eight megacities most vulnerable to disaster-related mortality, four – Karachi, Kolkata, Manila, and Jakarta – are located in South Asia or South East Asia (IPCC, 2022).	No projections can be made for a 1–3-year period but exposure to other, non-climatic natural hazards could negatively affect a country's ability to cope with climate change.

Regional stability and socioeconomic development

Compared to previous years, the constraints on economic activity and the losses of income caused by COVID-19 and the war in Ukraine have increased vulnerability to climatic hazards (United Nations, 2022).

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability and conflict: Afghanistan and Myanmar rank at the high alert level of political instability and are among the countries that have worsened the most in the latest Fragile States Index (2022). The remainder of the countries face warnings of political instability with the exception of Mongolia, which is considered stable.	Climate change has complex interactions with drivers of conflict and instability, but its exact relevance is unclear. High political instability will possibly affect people's ability to cope with possible future climate shocks especially in regions already highly vulnerable and exposed to adverse climate conditions and fragile political conditions such as in Afghanistan or Myanmar.
Migration: Increased climate variability and extreme events are already driving migration in some of the regions' countries (IPCC, 2022), but the latest Global Report on Internal Displacement (2022) indicates that most people remain displaced due to conflicts and violence, and not due to natural disasters. The most displacements were recorded in Afghanistan, followed by Myanmar.	Short-term projections are not possible, but the pressure from the ongoing cost-of-living crisis and other socioeconomic factors may exacerbate the risk of migration in the next 1–3 years. Given that South Asia and South East Asia are among the regions with highest displacement numbers due to climate-related hazards in the past decade (mostly due to storms and floods), further migration triggered by climatic events are very likely (Migration Data Portal, 2022).
Economic development: The regions' economies have achieved remarkable economic growth in recent decades but were recently faced with weakened demand for exports due to the global economic downturn amid COVID-19 and the war in Ukraine (United Nations, 2023). High food price inflation affected people experiencing poverty and food insecurity (World Bank, 2023), and increasing evidence suggests that climate change is already causing economic loss and damage in the region (IPCC, 2022).	Regions still recovering from COVID-19 – and now facing further pressure from high food and energy prices – can expect economic growth to slow in 2023. Average GDP growth in South Asia is expected to decline from 5.6% in 2022 to 4.8% in 2023, and from 5.4% in 2022 to 4.2% in 2023 in South East Asia (United Nations, 2023). Given the withdrawal of pandemic-era food programmes and local climate-related impacts on food production, poverty in the region will not fall as quickly as previously expected (World Bank, 2023).
Urbanisation: Major trends in urbanisation and urban area expansion increase exposure to heat stress and floods (IPCC, 2022). Low-lying coastal zones and flood	Laos, Bangladesh and Cambodia are among the countries most rapidly expanding their infrastructure. Associated risks, mostly related to flooding and storms, will increase correspondingly. Urbanisation and climate

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
plains, where half of Asia's urban population lives, are of particular concern (IPCC 2014).	change will also continue to interact to drive urban heat island effects across the region's cities (IPCC, 2022).

Water

South Asia is one of the most water-stressed regions in the world, and adequate water supply is also a major challenge in parts of South East Asia (WRI Aqueduct 3.0, 2019). Most of the region's water challenges result from ineffective governance, political tensions and population growth and other demand-related factors, with climate change likely acting as a major stress multiplier (IPCC, 2022). An increase in drought stress with climate change is of particular concern in interior areas of South Asia that are arid or semi-arid and dependent on water originating in the Hindu Kush Himalayan region (IPCC, 2022).

Water: Past and ongoing development	Water: Trends
Water availability: The Hindu Kush Himalayan region is the water tower for many South Asia and South East Asia countries, serving as the source for ten major river systems (Wester et al., 2018). Water stress is relatively higher in the western region of the Hindu Kush Himalayan region and downstream areas in Pakistan and northern India compared with other regions. The Indus River faces a particularly severe risk (IPCC, 2022). Parts of the region, including agricultural hotspots of South Asia and urban centres of South East Asia, rely on increasingly stressed groundwater resources (United Nations, 2022).	Projected impacts of climate change on water availability in Asia differ substantially across river basins and seasons. Surface water availability is expected to be affected by the loss of glacier storage in the future but in the short term, stream flows are expected to increase due to melting of glaciers in the Hindu Kush Himalayan region (IPCC, 2021). In the short-term, water insecurity is expected to be rising in agricultural and urban regions where intensifying groundwater use, deteriorating water quality and climate change interact (IPCC, 2022, United Nations, 2022).
Water demand: Scientists have high confidence that water demand in most Asian countries is increasing because of increases in population, irrigated agriculture and industry (IPCC, 2022). The region's countries already have some of the highest proportions of irrigated agricultural to total cultivated land in the world (United Nations, 2022).	Climate change impacts on inland waters will interact with population growth, economic development, dam construction, pollution and land use changes. No specific projections can be made for a 1–3 year period, but water demand is expected to increase in almost all parts of the region with already high to extremely high water risks (WRI Aqueduct 3.0, 2019).

Food

Agriculture is and will continue to be among the most vulnerable economic sectors in Asia. Projected changes in the temperature and precipitation extremes put water and therefore crop production at severe risk, particularly in agricultural-based economies, notoriously vulnerable mountainous areas and flood-prone deltas (IPCC, 2022).

Food: Past and ongoing development	Food: Trends
Agricultural production: Agriculture in the region is vulnerable to climatic variations such as droughts, changing precipitation patterns and rising temperatures, but data on impacts are relatively sparse (IPCC, 2022). In 2022, total regional cereal production was well above average and made up for reduced harvests in several countries (FAO, 2022). An April 2023 analysis reports that the risk of drought impacts is low in most of the region with the exception of northern Laos (Global Drought Observatory, 2023).	Climate change effects on crop production vary from region to region and crop to crop, and providing a regional overview is difficult (IPCC, 2022). Studies indicate that agricultural production in the northern part of the Indian subcontinent might increasingly face heat stress (IPCC, 2022). Saltwater intrusion is projected to decrease total arable areas and thus food production in low-lying parts of Asia, such as those in Bangladesh and the Mekong River Delta (IPCC 2014). Aquaculture, an important source of animal protein in the region's coastal countries, is considered highly vulnerable to marine heatwaves (IPCC, 2022). If a strong El Niño develops in the coming years (see forecast here: WMO), substantial loss in crop and fisheries production could be triggered (IPCC, 2022).
Food prices and food insecurity: The high food and energy prices, in combination with many households still recovering from COVID-19, have led to increasing numbers of people facing acute food security in the region, particularly in Afghanistan, Pakistan, Bangladesh, Sri Lanka and Cox's Bazar (WFP, 2022, FAO, 2022). While most food crises were primarily driven by political instability and economic crises, climate shocks played an exacerbating role in drought in Afghanistan and severe monsoon floods in Pakistan (WFP, 2022, FAO, 2022).	Domestic prices of wheat and rice are still above average but reflect softening international prices in recent months in some countries (FAO, 2022). Still, food insecurity in Afghanistan, Pakistan, Bangladesh, Sri Lanka and Myanmar is likely to persist due to ongoing conflicts and economic crises, and the situation remains vulnerable to climatic shocks. In Mongolia, climate change is expected to increasingly affect livestock production systems, an important component of food security in the country (IPCC, 2022).

Energy

The region still relies heavily on fossil fuels for electricity supply with the exception of countries – including Afghanistan, Nepal, Myanmar and Laos – that rely on hydropower. Other renewable energy sources do not yet play a dominant role in the countries' electricity supply (OWID, 2022).

Energy: Past and ongoing development	Energy: Trends
Energy generation: In 2022, severe floods in Pakistan damaged 22 power plants, resulting in outages and load shedding (IEA, 2022). Heavy precipitation led to the 2018 collapse of the Xe-Pian Xe-Namnoy dam in Laos, and to the 2021 glacial lake outburst flood resulting in the collapse of India's Dhauliganga hydropower plant (IEA, 2021). Heat and prolonged drought have negatively affected hydropower and thermal power plants that require water for cooling (including coal-, gas- and petroleum-fired power plants) (IPCC, 2022). And heavy rains affected coal mines and	Studies suggest that hydropower capacity on the Indian subcontinent and mainland South East Asia is expected to decrease due to climate change (IEA, 2021). Projections also show that the annual usable capacity factor of fossil fuel based power plants in South East Asia, South Asia, and Mongolia decrease with climate change due to water scarcity (IPCC, 2022). Countries that mostly rely on a single energy source for electricity supply might be particularly affected if a certain climatic condition such drought or heavy precipitation affects the generation of energy. (Bangladesh relies on natural gas, and Afghanistan, Nepal and Laos rely on

Energy: Past and ongoing development	Energy: Trends
contributed to a 2021 power crisis, as India struggled to meet electricity demands (AP, 2021).	hydropower.) In the Mekong River basin of South East Asia, the rapid development of hydropower projects will affect regional food security through effects on aquatic ecosystems (IPCC, 2022).
Energy access and demand: Many people in the region still lack access to electricity, most notably 54 million people in Pakistan, 16 million in Myanmar, and 14 million in India (IEA, 2022). The lowest rates of access to clean fuels and technologies for cooking are reported in Laos at 8.5%, Bangladesh at 25.0%, Myanmar at 31.3%, Afghanistan at 33.2%, Nepal at 34.8%, and Cambodia at 36.8% (World Bank, 2020). The demand in energy is not only increasing due to population growth and rising living standards, but also due to increasingly extreme temperature variations that drive the energy demand for cooling (IPCC, 2022). During the heatwave in early 2022, India had to cut power as it could not meet electricity demand (AP, 2022).	More frequent heatwaves are expected in all of Asia and will continue to drive energy demand for cooling (IPCC, 2022). As a consequence of climate change, desalination, underground water pumping and other energy-intensive methods are increasingly deployed for water supply, and might further increase energy demand in some locations (IPCC, 2022).

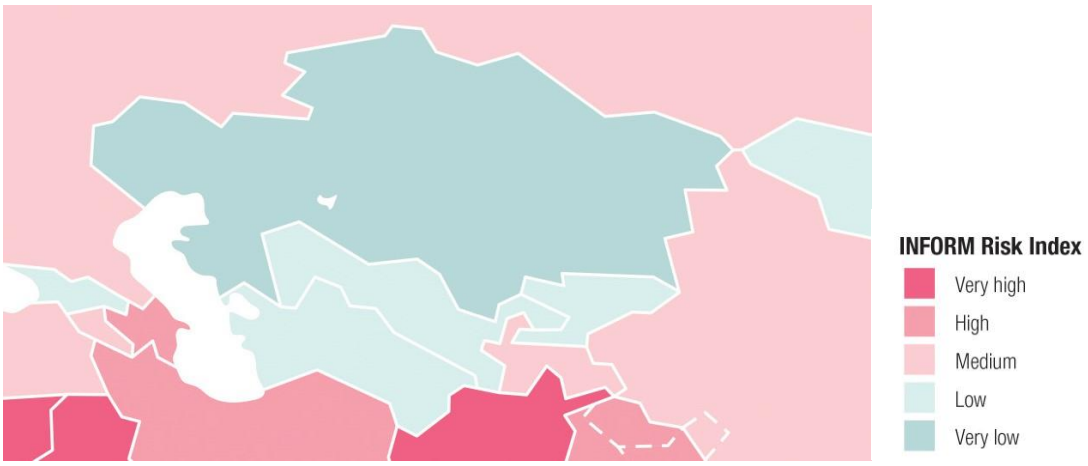
Health

Climate variability and change affect the incidence and geographic range of health challenges in South Asia and South East Asia. In the medium term, the number of additional deaths attributable to climate change in South Asia will be among the highest of all world regions, with undernutrition closely followed by diarrhoeal disease and heat causing the largest shares of climate-related fatalities. Estimates for South East Asia are significantly lower, with undernutrition and diarrhoeal disease predicted to be the most relevant causes (IPCC, 2022).

Health: Past and ongoing development	Health: Trends
Malnutrition: South Asia is among those regions where climate shocks and stressors had the biggest impact on food insecurity, particularly in Afghanistan, Pakistan, Bangladesh, Sri Lanka and Cox's Bazar (WFP, 2022, FAO, 2022). The prevalence of undernourishment is particularly high in South Asia, with an increase from 13% in 2019 to 17% in 2021 (FAO/IFAD/UNICEF/WFP/WHO, 2022).	Scientists have high confidence that floods, droughts, and heat stress will affect food availability and prices, resulting in increased undernourishment in South Asia and South East Asia (IPCC, 2022). Negative impacts of the COVID-19 pandemic and recent geopolitical tensions will most likely exacerbate existing risks regarding malnutrition due to higher food prices, food insecurity resulting from the reduction in global food supplies and trade, and hunger due to falling incomes. High salt consumption and associated hypertension could increasingly become an issue in coastal areas affected by sea level rise and salt water intrusion (IPCC, 2022).
Foodborne and waterborne diseases: Climate change is affecting water-borne diseases such as cholera, diarrheal diseases, leptospirosis, and typhoid fever by increasing the frequency of floods and high	No specific projections can be made for a 1–3-year period but waterborne diseases such as diarrhoea, leptospirosis and typhoid fever can increase after flooding events (IPCC, 2022). If a strong El Niño develops (see

Health: Past and ongoing development	Health: Trends
temperatures (IPCC, 2022). Outbreaks of cholera are currently affecting Afghanistan and the Rohingya refugee camp in Bangladesh (ECDC, 2023).	forecast here: WMO), drier than usual conditions would affect most of the region (NOAA, 2016), potentially affecting disease outbreaks by increasing concentrations of pathogens during droughts (IPCC, 2022).
Vector-borne diseases: Climate change is affecting vector-borne diseases such as dengue fever and malaria in tropical and subtropical Asia by increasing the frequency of floods and high temperatures (IPCC, 2022). In early 2023, cases of dengue were reported in Bangladesh, Cambodia, and Laos (ECDC, 2023). Malaria prevalence is often influenced by non-climate variability factors, but studies from India and Nepal have found correlations with rainfall (IPCC, 2014). Malaria cases fell by 76% from 2000 to 2021 in the region. Myanmar is the country with the most reported recent cases of malaria in the region (WHO, 2022). So far in 2023, cases of dengue were reported in Bangladesh, Cambodia and Laos (ECDC, 2023).	Projections point to decreasing climate suitability for malaria and dengue in the longer term (IPCC, 2022), but climate variability is likely to be more relevant for the next 1–3 years. Most of the mosquito-borne diseases in South Asia and South East Asia respond to El Niño conditions, which lead to higher disease incidence (IPCC, 2022). Increased dengue and chikungunya activity in the region, for example, were linked to drought conditions associated with the last strong El Niño event in 2015–16 (Anyamba, 2019).
Heatwaves: Associations between high temperatures and mortality have been shown for many countries of the region. Heat stress is already a risk, particularly in coastal areas that are both hot and humid (IPCC, 2022). The heat-related mortality for people over 65 has increased between 2000–04 and 2017–21, particularly in Indonesia at +227%, the Philippines at +295%, Sri Lanka at +228%, and Nepal at 225% (Lancet Countdown, 2022). People over the age of 65 and newborns are particularly vulnerable to heat stress and heat stroke, but other populations also face health impacts from increases in hours spent working outdoors under heat stress risk (Lancet Countdown, 2022). Apart from direct heat effects, heatwaves are associated with poor air quality, which further increases the burden of both cardiovascular and respiratory diseases (USAID, 2020).	Increasing impacts due to heat – heat-related morbidity and mortality, losses in labour productivity, and challenges in mental health and well-being – are predicted in both South Asia and South East Asia, with the globally largest absolute increase of heat-related deaths predicted for South Asia (IPCC, 2022). With an ageing population, the number of people at risk will increase, especially among those with cardiovascular and respiratory disorders. Continuing urbanisation will increase the urban heat island effect. No specific projections can be made for a 1–3-year period but if a strong El Niño develops (see forecast here: WMO), warmer than usual conditions could affect the region (WMO, 2022), potentially increasing the risk of heatwaves such as during the last strong El Niño event in 2015 and 2016.

4.6. Central Asia and South Caucasus



Overall risks are low to medium in the region (with the exception of Azerbaijan – where risk is considered high). Risk is predominately driven by vulnerability and conflict in the South Caucasus and by natural (in part climate-related) hazards in Central Asia (see INFORM Risk Index for country-level information). SDC priority countries in Central Asia and South Caucasus have seen fluctuations in the INFORM Risk Index in recent years, but risk levels are lower than in other regions assessed (see Figure 3, p. 8).

Climate

Upward trends in extreme heat, heavy precipitation events, and aridity have been observed in the region (IPCC, 2021) and most adverse impacts are expected to grow as climate change progresses (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends
Droughts and aridity: Decreasing precipitation and increasing evapotranspiration are observed in Central Asia, contributing to frequent drought conditions (IPCC, 2022). Current precipitation anomalies show generally dry conditions persisting in the west of the region around the Caspian Sea and the South Caucasus (IRIDL, 2022).	Projections regarding the future development of drought events are uncertain, but overall aridity is expected to increase in the region (IPCC, 2021). No projections for specific droughts can be made for a 1–3-year period. Apart from water scarcity, drier conditions will also increase the risk of sand and dust storms containing poisonous salt (UNCCD, 2021).
Heavy rainfall and flooding: Across the region, heavy precipitation and pluvial flood events have increased in recent years (IPCC, 2022), and associated mudflows already occur frequently across the region (USAID 2018).	There is high confidence that heavy precipitation events, landslides, and river floods will become more frequent in western and eastern Central Asia (IPCC, 2021). Changes in precipitation, such as snowfall being replaced by rainfall because of warming, result in river flow increasing in winter, increasing the risk of

Climate: Past and ongoing development	Climate: Trends
	winter floods (USAID 2018). Forecasts of 1–3 years are not possible.
Extreme heat: There are obvious upward trends in extreme heat across the region (IPCC, 2021). In early 2022, Central Asia, a region that is generally unused to extreme heat, was affected by a particularly hot spring with temperatures reaching midsummer levels (PreventionWeb, 2022). Across the region, impacts of extreme heat are strongest at low elevations, becoming less pronounced with increasing elevation (USAID 2018).	Projections point to continued increases in extreme heat conditions across the region (IPCC, 2021) but a 1–3-year forecast of heatwaves is not possible.
Glacier melting and hazards: Clear evidence from observations shows that glaciers are retreating throughout Central Asia and the Caucasus (IPCC, 2021). There is also an associated danger of glacier lake outburst floods (GLOFs) with estimates pointing to nearly 100,000 people in Central Asia facing the threat of GLOFs (GLOFCA, 2023).	The shrinking of glaciers in Central Asia and the Caucasus is expected to continue and to influence downstream river run-off (IPCC, 2022). In the short term, this can cause increasing water flow and flooding, including GLOFs which are expected to increase further as new dangerous glacier lakes form while the surrounding slopes destabilise in response to warming (GLOFCA, 2023). Glacier retreat is progressing at a high pace, and is intensifying already critical conditions in the regions. The negative impacts for downstream regions are likely to be high, but no projections can be made for a 1–3-year period.
Multi-hazard risk: Earthquake risk maps show elevated risk in parts of Central Asia, with most risk accumulating in the countries' largest cities and in a hotspot located in the Ferghana Valley, which encompasses territory of Uzbekistan, Kyrgyzstan and Tajikistan (Silva et al., 2018).	Exposure to other, non-climatic natural hazards could negatively affect a country's ability to cope with climate change.

Regional stability and socioeconomic development

Climate has complex interactions with various drivers of conflict and instability, such as water scarcity or food insecurity, but its exact relevance is difficult to assess. The main climate-related challenges for the region are conflicts due to water availability and high food and energy prices that undermine the resilience of the most vulnerable in society. Relations between Central Asian states have been shaped by long-running water disputes related to the overuse and mismanagement of the scarce water resources in the region (Factbook ECC platform, 2021).

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability and conflict: Countries in Central Asia and South Caucasus mostly rank in the middle for political stability and fragility (Fragile States Index, 2022). Warnings are in place for all assessed countries of the region. Examples from 2022 include the unrest	Most of the conflict situations are expected to continue over the next few years with the population increasingly vulnerable due to the aftermath of the COVID-19 pandemic and the continued development of Russia's war in Ukraine (ICDS, 2022). In the medium

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
in Kazakhstan due to high fuel prices (International Crisis Group, 2022) and the Armenia–Azerbaijan clashes, which revealed the volatility of these countries' dispute over the Nagorno-Karabakh enclave (International Crisis Group, 2023). In Central Asia, the clashes between Kyrgyzstan and Tajikistan in 2021 were the most intense episode of violence in the area since the end of the Soviet Union (IDMC, 2022).	and long terms, water scarcity could have serious repercussions for food security and associated potential for civil conflict (IPCC, 2022), such as in previous disputes over water resources in the Ferghana Valley shared by Kyrgyzstan, Tajikistan and Uzbekistan (PeaceLab, 2021). Within the Syr Darya and Amu Darya transnational river systems, reductions in flow could exacerbate competition for water among multiple users.
Migration: The evidence that increased climate variability and extreme events are driving migration is robust, but non-climatic socioeconomic drivers are generally considered more relevant (IPCC, 2022). According to the latest report on internal displacement (IDMC, 2022), recent displacements in the region occurred mostly in Tajikistan and Kyrgyzstan, in part due to border clashes that were related to scarce water resources.	No projections can be made for a period of 1–3 years, but pressure from the impacts on livelihoods of COVID-19 and the ongoing geopolitical turmoil in the region may exacerbate the risk of migration.
Economic development: The region has drastically reduced poverty over the past decades (OWID, 2019), but the countries were hit by the economic consequences of the war in Ukraine as they are highly dependent on energy exports and remittances from Russia (United Nations, 2022). The impact of corn and wheat price inflation has reduced real household incomes by an estimated 7.7% in Armenia, 5.5% in Georgia, 5.2% in Kyrgyzstan, 4.9% in Tajikistan, 4.2% in Azerbaijan, and 2.4% in Uzbekistan compared to the global average of 1.6%) (United Nations, 2022).	Further poverty reduction is likely to stall due to the war in Ukraine, the ongoing cost-of-living crisis and remnants of COVID-19 impacts (IMF, 2022). Kyrgyzstan and Tajikistan are highly dependent on the Russian economy, and inflation and reduced remittances from Russia are expected to negatively affect these countries where remittances contribute 10–30 per cent of GDP. (WFP, 2022, IMF, 2022). Countries with these characteristics are most at risk from rising poverty rates in 2023 (IMF, 2022).

Water

Central Asia and South Caucasus have unevenly distributed water resources, and water disputes and mismanagement have shaped relations among the countries. Climate change, increasingly arid conditions and climatic changes in mountainous areas bring challenges for agriculture and energy and other sectors that depend heavily on precipitation and water from rivers.

Water: Past and ongoing development	Water: Trends
Water availability: Central Asia faced a rainfall deficit in 2022 (WMO, 2022), and medium drought risk in agriculture persists in large areas of Turkmenistan and parts of Uzbekistan (Global Drought Observatory, 2023), which generally are the most water-stressed countries in the region (IPCC, 2022). Water infrastructure is generally poorly governed and maintained	Future water availability is mainly driven by hydro-climatic variability, glacier retreat due to temperature increases and human activities such as agriculture and dam construction. Central Asia is among the regions where expected reductions in river flows due to glacier retreat is expected to be highest (Huss and Hock 2018). Unsustainable agricultural practices and

Water: Past and ongoing development	Water: Trends
(FAO, 2022), and access to water is unequally distributed in Central Asia, with mountainous upstream countries (Kyrgyzstan and Tajikistan) using water for electricity generation in winter while downstream countries (Kazakhstan, Turkmenistan, and Uzbekistan) require water to be released from dams in summer months for irrigation purposes. Water availability is therefore currently a question of countries' willingness to cooperate rather than physical scarcity (SIC-ICWC, 2021, PeaceLab, 2021), and competing demands for water for hydropower and irrigation between upstream and downstream countries has raised geopolitical tensions (IPCC SROCC, 2019). In the South Caucasus, Azerbaijan is most affected by inconsistent rainfall and is dependent on transboundary water resources (AVIM, 2022).	increasing aridity are expected to further affect water supplies (IDMC, 2022), potentially exacerbating the problems of water shortages and distribution (IPCC, 2021). Finally, large infrastructure projects that alter river flows may exacerbate the negative impacts of climate change in countries depending on water supply originating in upstream countries. For example, Tajikistan's Roghun Dam will become the world's tallest dam, and will double the country's energy production (Webuild, 2023).
Water demand: Growing demand for water is driven by soaring populations, the increasing per capita domestic use due to urbanisation and economic growth, irrigation of cash crops (UNESCAP, 2022, IPCC, 2014), and the deployment of hydropower (EU Parliament, 2018). The relevance of changes in water demand has been strikingly highlighted by the shrinking of the Aral Sea in response to the extraction of water for the irrigation of cotton plantations, other human-induced changes and climate change (Global Surface Water App, 2021).	Most of the regions' populations are expected to grow further, particularly in Uzbekistan (OWID, 2022), likely increasing the demand for water for irrigation and other uses. Future changes in water demand are particularly crucial as countries of the region already operate at medium to critical levels of water stress (OWID, 2019).

Food

With overall aridity in Central Asia and South Caucasus expected to increase (IPCC, 2021), pressure on food systems might increase in the coming years, particularly in areas where irrigated agriculture is widespread.

Food: Past and ongoing development	Food: Trends
Agricultural production: Adequate water supply is a particular challenge in Central Asia's food systems with approximately 80% of the limited arable land irrigated and with irrigation infrastructure generally poorly governed and maintained (FAO, 2022). In 2022, cereal production (mostly wheat) was at average levels in the region, with reduced harvests recorded in Armenia and Turkmenistan, in part due to reduced levels of rainfall (FAO, 2022). In the South Caucasus, Azerbaijan is most affected by inconsistent rainfall and dependant on irrigation for agricultural production using transboundary water resources (AVIM, 2022, OWID, 2019).	Climate change is exacerbating the negative impacts of land degradation through its impacts on accelerated desertification, land degradation and salinisation (UNESCAP, 2022). In the coming months, the below-average precipitation levels expected in the eastern part of the region may be insufficient for crop establishment and filling reservoirs for irrigation (FAO, 2022). In the medium term, increasing aridity and droughts could negatively affect agricultural production, increase already high water demands for irrigation, and exacerbate the existing water crisis and human-induced desertification.

Food: Past and ongoing development	Food: Trends
Food prices and imports: The mountainous countries of Kyrgyzstan and Tajikistan are generally more dependent on food imports than the other Central Asian countries (SIC-ICWC, 2021). The level of these imports makes these countries highly vulnerable to international food markets, a vulnerability that can severely affect the food security of their populations (FAO 2018). Domestic retail prices of wheat have increased sharply since the inception of the war in Ukraine and have remained at elevated levels (FAO, 2022). The high food prices are particularly critical for in countries such as Azerbaijan, Kyrgyzstan, and Tajikistan where low-income families spend as much as 60–70% of their incomes on food (IMF, 2022).	Russia's war against Ukraine will continue to dominate developments and uncertainty in food markets in the coming years (FAO-OECD, 2022).The region's high dependency on food imports makes it potentially vulnerable to adverse climatic and non-climatic developments in other parts of the world, and therefore to potentially increasing food prices. In early 2023, domestic food price inflation continued to be high in the region, and high fertiliser prices have become a significant bottleneck for agricultural production in low-income countries (World Bank, 2023). The positive trends of pre-pandemic years and achievements made regarding land reforms, agricultural diversification and harmonisation of trade policies have been reversed due to the structural problems in the global economy (ADB 2020, World Bank, 2023).
Food insecurity: No major food crises were reported in the region in 2022 (WFP, 2022), but the prevalence of undernourishment in the total population is of particular concern in Georgia at 7.6%, Tajikistan at 8.6%, and Kyrgyzstan at 5.3% (FAO, 2022).	Evidence points to a increases in the prevalence of undernourishment in the South Caucasus and Central Asia as a consequence of COVID-19 and other developments (FAO, 2021). The war in Ukraine has added further challenges and will dominate developments of food insecurity in the coming years, highlighting the interlinkages of stressors on food systems (FAO-OECD, 2022). In the longer term, projected drought risk could affect food security in the region (Carrão et al. 2016).

Energy

The region's share of primary energy is heavily dominated by fossil fuels with the exceptions of Kyrgyzstan, Tajikistan, Armenia and Georgia, all countries that rely on hydropower for electricity generation (OWID, 2022). Gas resources in the Caspian Sea and Central Asia have gained increasing attention among European countries looking to secure alternative supplies (GRID-Arendal, 2017), while untapped renewable energy potential is also increasingly deployed (Emerging Europe, 2022). The shifting of irrigation water storage to hydropower development has increased the risk of water shortages in agriculture (IPCC, 2022).

Energy: Past and ongoing development	Energy: Trends
Energy generation: Extreme weather events, melting glaciers and heatwaves already affect the region's ageing energy system (OSCE, 2022, OSCE, 2017). In 2018, for example, heavy use of air conditioning amidst a heatwave in the Azerbaijani capital of Baku caused a nationwide power outage (Radio Farda, 2018). Kyrgyzstan and Tajikistan rely on hydropower, and are particularly dependent on water availability for their energy supply (FES, 2022, Eurasia Net, 2022).	The retreat of glaciers and changes in snow cover will affect hydropower generation by making water supplies less predictable (OSCE, 2022). In both the South Caucasus and Central Asia, coordination along the water-agriculture-energy nexus between upstream and downstream countries will be critical (GRID-Arendal, 2017). All countries have ample opportunity to develop renewable energy potential (SIC-ICWC, 2021, Emerging Europe, 2022). Rural areas in the region are not yet

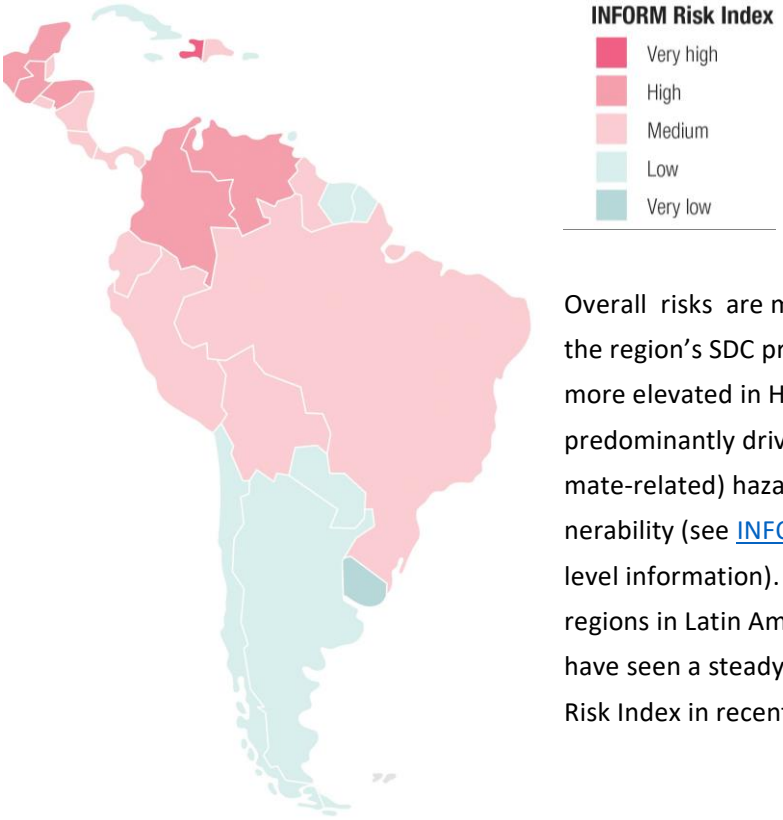
Energy: Past and ongoing development	Energy: Trends
	served by national grids and small-scale, decentralised solutions could be implemented (OSCE, 2022).
Energy transmission: Transmission and distribution lines and substations often date back to the Soviet era and are characterised by high losses and frequent network failures and need to undergo modernisation to withstand the challenges of climatic changes such as increased frequency of extreme weather events (OSCE, 2022, SIC-ICWC, 2021).	Extreme weather events will continue to affect the energy sector, and transmission infrastructure is likely to face disruptions, but specific projections for the next 1–3 years are not possible.
Energy demand: Energy demand is generally expected to increase in the region due to population growth and economic development (SIC-ICWC, 2021). Current peak demand is in winter (SIC-ICWC, 2021, OSCE, 2022), but energy demand for cooling in summer is rising. In the summer of 2022, increased electricity demand depleted Kyrgyzstan's main hydropower reservoir when reservoirs should have been filling up to prepare for winter peaks in demand (FES, 2022, Eurasia Net, 2022).	With populations growing and increased risk of hot summers, the changes in electricity demand could add significant pressure on energy systems that rely on a small number of hydropower reservoirs (FES, 2022).

Health

Climate-related health impacts for Central Asia are low compared to the other world regions, but hunger presents major challenges and is projected to increase. Furthermore, heatwaves will become more frequent as climate change progresses.

Health: Past and ongoing development	Health: Trends
Malnutrition: Poverty and hunger present major challenges across the region, particularly in Georgia, Tajikistan, and Kyrgyzstan where undernourishment is still prevalent among 5–9% of the population (FAO, 2022). Impacts to the agriculture sector from increased drought, flooding and desertification could increase crop failures, decrease food security and significantly impact human health and nutrition.	No specific projection can be made for a 1–3-year period, but developments associated with the war in Ukraine and global prices for food and fertilisers could exacerbate the risk of undernourishment.
Heatwaves and air pollution: An increase in the number of hot days is being observed in the region, increasing the risk of cardiovascular diseases and other heat-related health impacts (IPCC, 2022). Health impacts can be particularly severe among populations that are generally unused to extreme heat such as in Central Asia. Apart from heat, air pollution must generally be considered in a wider health context as some Central Asian cities are frequently ranked among the most polluted in the world during the winter heating period when pollution is higher and meteorological conditions amplify health risks (IVL, 2021).	There is high confidence that extreme heat in western and eastern Central Asia will intensify with climate change (IPCC, 2021) but a 1–3-year forecast is not possible. Across the region, impacts of extreme heat are expected to be strongest at low elevations, becoming less pronounced with increasing elevation (USAID 2018).

4.7. Latin America and the Caribbean



Overall risks are medium to high in most of the region's SDC priority countries and even more elevated in Haiti (very high). Risks are predominantly driven by natural (in part climate-related) hazards and relatively high vulnerability (see INFORM Risk Index for country-level information). SDC priority countries and regions in Latin America and the Caribbean have seen a steady increase in the INFORM Risk Index in recent years (see Figure 3, p. 8).

Climate

High climate variability, extreme events and droughts are affecting parts of Latin America and the Caribbean, resulting in impacts such as flooding, declining crop yields, glacier retreat and unevenly distributed water availability in some parts of this climatologically diverse region. The El Niño phenomenon is the dominant driver of weather conditions in the region. Climate change will increase pressures on water availability, and will threaten water, energy, and food security (IPCC, 2022).

Climate: Past and ongoing development	Climate: Trends
Heavy rainfall and flooding: Rainfall extremes and in particular the occurrence of flash floods and landslides have increased in intensity and frequency in Central and South America (IPCC, 2022). Some recent examples include floods in Bolivia and Colombia in March 2023 (FloodList, 2023, FloodList, 2023) and several countries of Central America in September 2022 (Floodlist, 2022).	Risk of flooding and landslides in urban and rural areas due to extreme precipitation is expected to increase in most of Central and South America but particularly in urban centres in northern parts of the South American continent (IPCC, 2022), but no projections can be made for a 1–3-year period. Climate change will exacerbate the situation as decreases in snow and ice that contribute to flooding risk are expected (IPCC, 2022). If a strong El Niño develops (see forecast here: WMO),

Climate: Past and ongoing development	Climate: Trends
	wetter than usual conditions could affect parts of Ecuador, Colombia and Peru, increasing the risk of heavy precipitation and flooding (WMO, 2022).
Extreme heat: Increases in extreme heat are observed throughout Central and South America (IPCC, 2022). Climate change made the record breaking heatwave in 2022 that affected parts of the continent (mostly Argentina, Bolivia, Chile, Paraguay, and Uruguay) 60 times more likely to occur (World Weather Attribution, 2022).	Across the continent, predictions of increases in extreme heat are robust and will put urban populations at risk (IPCC, 2022). If a strong El Niño develops (see forecast here: WMO), warmer than usual conditions could affect Central America and the Caribbean as well as most coastal areas of South America during certain months of the year (WMO, 2022).
Droughts and aridity: Extreme droughts were reported in several subregions in recent years, but the role of climate change remains uncertain in many cases (IPCC, 2022). In central South America, a drought has been ongoing since 2019, in part driven by the persisting La Niña conditions (World Weather Attribution, 2023). The Central America Dry Corridor is one of the most susceptible regions in the world to climate change and variability with 10.5 million people living in an area with increasingly erratic rainfall patterns (IPCC, 2022). In the Amazon basin, deforestation, fire, climate change and other processes are exacerbating the risk of savannisation due to feedbacks in the climate system (IPCC, 2022).	Drought conditions are expected to increase in most parts of the region (IPCC, 2022). Apart from the detrimental environmental effects including biodiversity loss and soil erosion, the ongoing deforestation in large parts of the region could increase the drought risk because much of the rain that falls in a rainforest is linked to evapotranspiration from trees. Deforestation has caused an estimated 4% of the recent observed drying, with the south-western part of the Amazon being most strongly affected (Staal et al., 2020). If a strong El Niño develops (see forecast here: WMO), drier than usual conditions could affect large parts of the Caribbean and Central America (WMO, 2022).
Tropical cyclones: A significant increase in intensification rates of storms affecting Central America has been observed in the Atlantic basin (IPCC, 2022), but 2022 has been a below-average year in terms of storm activity compared to previous years (Munich Re, 2022). Increases in tropical cyclones and rainfall in combination with relative sea level rise exacerbate coastal hazards. In the Latin America and Caribbean regions 6–8% of the population live in areas that are at high or very high risk of being affected by coastal hazards (IPCC SROCC, 2019). In 2022, tropical storm Julia affected more than 1.6 million people in Central America and Colombia (ReliefWeb, 2022). In March 2023, a highly unusual cyclone formed in the south-eastern Pacific and affected Peru and Ecuador (ReliefWeb, 2023).	Projections indicate that there will be fewer tropical cyclones affecting Central America, but particularly intense cyclones will become more frequent (IPCC, 2022). If a strong El Niño develops (see forecast here: WMO), tropical cyclone activity would likely be higher than usual in the Pacific basin and lower than usual in the Caribbean (NOAA, 2014). Further near-term projections are difficult, but generally speaking, regions that were hit by storms in the recent past may struggle to cope with further shocks as people are still recovering.
Glacier melting and hazards: Global warming is negatively affecting glaciers across the Andes, and their retreat in synergy with changing snow and permafrost impacts the occurrence, frequency, and magnitude of glacier lake outburst floods, ice and rock avalanches, debris flows and lahars from ice-capped volcanoes (IPCC, 2022).	The glaciers in the Andes show some of the highest glacier mass loss rates worldwide and are expected to continue melting (IPCC, 2022). The risk of glacial lake outburst floods is particularly high in the Andes (Taylor et al., 2023).
Multi-hazard risk: Earthquakes are a threat in almost all of the Andes, with hotspots located in highly	No projections can be made for a 1–3-year period but exposure to other, non-climatic natural hazards could

Climate: Past and ongoing development	Climate: Trends
populated areas. Central America and large parts of the Caribbean are also facing elevated levels of risk (Silva et al., 2018).	negatively affect a country's ability to cope with climate change.

Regional stability and socioeconomic development

Climate risks in Latin America and the Caribbean are amplified by inequality, poverty and population growth (IPCC, 2022) by affecting people's ability to cope with future climate shocks, especially in Central America, Haiti, Venezuela and Bolivia.

Regional stability and socioeconomic development: Past and ongoing development	Regional stability and socioeconomic development: Trends
Political instability and conflict: Latin American countries continue to rank mostly in the middle on political stability and fragility indicators with the exceptions of Haiti and Venezuela, which both face fragility alerts (Fragile States Index, 2022).	Political and economic instability may trigger increases in food prices and further political instability, and possibly affect people's ability to cope with future climate shocks (FSIN 2020).
Migration: Many drivers of migration are climate sensitive, but the potential for migration is determined by the context in which climate change occurs (Adger et al., 2015). Still, there is evidence that climate change has already prompted internal and international migrations in South and Central America (IPCC, 2022). The most recent Global Report on Internal Displacement (2022) points to storms and floods as the most prominent drivers of recent displacements in the region. Notable exceptions are Colombia and El Salvador, where most of internal displacements occurred due to conflict and violence.	The Andes, north-eastern Brazil and the northern countries of Central America are most sensitive to climate-related displacements, typically through droughts, tropical storms, heavy rains, and floods (IPCC, 2022). The various social, political, economic, environmental and cultural factors influencing the decision to migrate make the assessment of environmentally induced migration a complex endeavour.
Economic development: The COVID-19 pandemic has affected poverty in the region, with approximately 19 million people falling into poverty and setting back previous gains by seven years or more (World Bank, 2023). Poverty and inequality are generally highest in Central America where approximately 40% of the population live in poverty and inequality coefficients are even higher than in South America, which is also considered a very unequal region of the world (IPCC, 2022). Urban development has been rapidly increasing in many parts of the region and informal settlements, often located in highly exposed areas are particularly affected by climate impacts (IPCC, 2022).	Regional growth and related gains in poverty reduction are expected to decelerate sharply in 2023 due to remnants of COVID-19 impacts, the war in Ukraine, and tightening of global monetary and financing conditions (United Nations, 2023).The slow economic growth in the near term will limit poverty reduction, and limited access to resources might reduce people's ability to adapt to climate impacts. Subsistence farmers and the urban poor in Central America and northern South America are considered to be particularly vulnerable (IPCC, 2022).

Water

The melting of glaciers, the changes in snow cover and prolonged droughts all affect the seasonal availability of water, making water scarcity a key risks for the region (IPCC, 2022).

Unevenly distributed water availability combined with high water stress are resulting in high water risks in parts of the region such as the west coast of South America, parts of Argentina and Uruguay, the Andes, the Caribbean and parts of Central America (WRI Aqueduct 3.0, 2019).

Water: Past and ongoing development	Water: Trends
Water availability: Central and South America have high but unevenly distributed availability of water resources. Water availability is of concern in the Central America Dry Corridor (including Nicaragua and Honduras), which relies on groundwater resources (United Nations, 2022). Water availability is also of concern in semi-arid and glacier melt-dependent regions of South America (IPCC, 2022). Global warming is affecting glaciers across the Andes with consequences for the seasonal distribution of stream flows. In the tropical Andes most glaciers have already passed peak water (IPCC, 2022) meaning that annual run-off has already started to decline.	Increasing water scarcity and competition over water are projected for the region, but the development of drought intensity and frequency remain in question in some subregions (IPCC, 2022). No specific projections can be made for a 1–3-year period, but the risk of unevenly distributed water availability is expected to increase, and reductions in river flow due to glacier volume loss are expected in the Andes region (IPCC, 2021).This will pose growing challenges for water users, especially for many cities and metropolitan areas already facing high water stress.
Water demand: Increases in population and higher demands from agriculture, mining and hydropower affect the availability of water (IPCC, 2022). Particularly high water risks are identified for the west coast of South America, parts of Argentina and Uruguay, the Andes, the Caribbean and parts of Central America (WRI Aqueduct 3.0, 2019).	Water demand is expected to increase with rapidly growing irrigated agriculture, accelerated urbanisation, and population growth leading to higher water risks in the future. Mining activities are particularly exposed due to their high water and energy needs, with surrounding communities often lacking the power to access water resources depleted by mining (IPCC, 2022). No specific projections can be made for a 1–3-year period.

Food

The risk of food insecurity is a key risk for the whole region (IPCC, 2022) but especially in Central America, Haiti and Venezuela, with climate shocks being among the key drivers of acute food insecurity both in the aftermath of a disaster and in the long run.

Food: Past and ongoing development	Food: Trends
Agricultural production: Agriculture in the region is heavily dependent on rain-fed systems for both subsistence and export crops and is vulnerable to climatic variations such as droughts, changing precipitation patterns and rising temperatures. Overall cereal production is currently at an all-time high in the region and offsets below average agricultural production in some areas (FAO, 2022), but increasing variability in precipitation and changes in stream flows associated with glacier retreat have already compromised rain-fed agriculture in some parts of the region (IPCC, 2022). Parts of the Caribbean and central	The cereal production forecast for the region is currently at an all-time high as large maize plantings in response to strong export demands offset drought impacts in the agriculturally important region of central South America (FAO, 2022). Climate change implications on future food production and food security are uncertain and crop-specific. Suitable areas for basic grains are expected to contract in some regions, including Central America and the South America Monsoon subregion where agriculture is highly dependent on rain (IPCC, 2022). No specific projections can be made for a 1–3-year period but current risk of drought-

Food: Past and ongoing development	Food: Trends
South America are currently experiencing severe drought conditions (Global Drought Observatory, 2023, World Weather Attribution, 2022).	related impacts are elevated in Cuba, Honduras and Haiti (Global Drought Observatory, 2023).
Food prices and imports: Among all world regions, the cost of food imports in recent years grew most quickly in Latin America and the Caribbean (United Nations, 2022). Cereal imports have been increasing in Central America as food consumption increases with population growth, as reflected in increased wheat demand for consumption and increased maize demand by the feed industry for ramping up meat production (FAO, 2022).	Prices of wheat, maize and beans are above previous year levels (FAO, 2022) reflecting high global food prices with mixed trends and relief in some countries.
Food prices and food insecurity: Among all world regions, the cost of food imports in recent years grew most quickly in Latin America and the Caribbean (United Nations, 2022). The Caribbean faces the highest proportion of people experiencing hunger (16%) compared to Central America and South America (8% each) but hunger has been increasing in Central and South America while remaining approximately constant in the Caribbean (FAO, 2022). More than 3 million refugees and migrants from Venezuela remain in need of food assistance, and people facing acute food insecurity in Haiti and Guatemala are estimated at 4.7 and 3.2 million respectively (FAO, 2022).	Prices of wheat, maize and beans are above previous year levels reflecting high global food prices with mixed trends and relief in some countries (FAO, 2022). In Haiti, worsening insecurity and difficult macroeconomic conditions are likely to persist while high food inflation levels could further exacerbate the vulnerability of the populations of Guatemala and Venezuela migrants and refugees in the coming years (FAO, 2022). Apart from non-climatic drivers, past climate-related disasters such as tropical storm Julia, which affected more than 1.6 million people in Central America and Colombia, will further aggravate conditions of vulnerable households (ReliefWeb, 2022).

Energy

Climate change has already impacted energy systems in the region and will continue to do so at an increasing rate (IPCC, 2022). Countries' current electricity supply strategies are diverse, but overall less dependent on fossil fuels than other world regions. Fossil fuels are still highly relevant for electricity supply in large parts of the Caribbean and Bolivia. Hydropower provides significant shares of electricity in Colombia, while other renewable energy sources are yet to be scaled to predominant shares of supply (OWID, 2022).

Energy: Past and ongoing development	Energy: Trends
Energy generation: Energy generation has already been compromised in the wider region of Latin America due to heat, increased precipitation variability and glacier retreat (IPCC, 2022). Regional examples include power cuts as a result of the 2022 heatwaves in Argentina and Paraguay (World Weather Attribution, 2022) and Brazil's 2016–17 water crisis, which affected hydropower energy generation (IPCC, 2022). Floods have recently affected the Callahuanca	Hydroelectric infrastructure is expected to be impacted by reduced water availability as well as heavy precipitation events leading to floods that affect operations (IPCC, 2022). The regional mean hydropower capacity is expected to decline in the future, with impacts most pronounced in Central America (IEA, 2021).

Energy: Past and ongoing development	Energy: Trends
hydroelectric power plant in Peru, causing blackouts (IEA, 2021).	
Energy demand: As in other world regions, extreme heat and urban heat islands increase the energy consumption for cooling purposes (IPCC, 2022).	Energy demand will continue to increase while climate change will alter energy demand patterns. Energy needs of large-scale mining activities could impose hardships on communities in the surrounding areas during times of scarcity and could strain valuable water resources (IPCC, 2022).

Health

Changes in weather and climatic patterns are negatively affecting human health in the region through climate-sensitive infectious diseases and heat. El Niño has profound impacts on several vector-borne and waterborne diseases in the region (World Bank, 2014). In the medium term, the number of additional deaths attributable to climate change in the region will be significantly lower than in other regions with most additional fatalities expected to occur due to heat and vector-borne diseases (IPCC, 2022).

Health: Past and ongoing development	Health: Trends
Vector-borne diseases: Climate change and variability affect climate-sensitive infectious diseases in the region including vector-borne diseases such as mosquito-borne dengue fever, malaria, leishmaniasis, chikungunya, and zika, and the rodent-borne orthohantavirus and chapare virus (IPCC, 2022). The zika virus outbreak in 2016 was in part driven by drought conditions that led to increased use of household water storage, which in turn allowed vectors to expand their range (IPCC, 2022). Most of the recent cases of malaria were reported in Venezuela, Colombia and Nicaragua (WHO, 2022), while most of the cases of the dengue were reported in Bolivia, Peru, Colombia and Nicaragua (ECDC, 2023).	Higher temperatures increase the geographical range of some vectors (including higher elevations and latitudes), leading to an expansion of suitable areas for vector-borne diseases (IPCC, 2022). Trends in the next 1–3 years, however, will likely be dominated by climate variability, most notably El Niño/La Niña events that have been related to increased transmission of dengue, leptospirosis and chikungunya (IPCC, 2022).
Foodborne and waterborne diseases: The climatic variables of temperature and rainfall are correlated with the incidence of diarrhoeal diseases in the region, such as significant increases in the incidence of diarrhoea in communities of the Amazon River after flooding events (IPCC, 2022). An outbreak of cholera is currently affecting Haiti (ECDC, 2023).	If a strong El Niño develops (see forecast here: WMO), wetter than usual conditions could affect parts of north-western South America, increasing the risk of heavy precipitation and associated water-borne diseases in the affected areas (WMO, 2022). Poor sanitation conditions increase vulnerability (IPCC, 2022).
Heat: Throughout the region, past trends show increasing extreme heat (IPCC, 2021). The number of additional days of heatwave exposure is particularly high in the tropical regions of Central America and northern South America (IPCC, 2022).	Heatwaves are predicted to increase in frequency, intensity and duration, with consequences for human comfort and health in this already warm and humid part of the world. Major tropical cities and people with inadequate housing are expected to be particularly affected (IPCC, 2022).

Annexes

Annex 1: Sources

Overview of sources for the CC foresight analysis

Source, year	Title	Content relevant for CC foresight Analysis	Links
Climate			
IPCC, 2022	Sixth Assessment Report Climate Change 2022: Impacts, Adaptation, and Vulnerability, incl. regional factsheets	Observed climate trends, projections, vulnerability and impacts per sector and key risks by region.	https://www.ipcc.ch/report/ar6/wg2/
IPCC, 2021	Sixth Assessment Report on Climate Change 2021: The Physical Science Basis, incl. regional factsheets	Comprehensive assessment of the current evidence on the physical science of climate change.	https://www.ipcc.ch/report/ar6/wg1/
IPCC, 2019 (SROCC)	IPCC Special Report on the Ocean and Cryosphere in a Changing Climate	Observed regional impacts from changes in oceans and the cryosphere. Relevant updated information for high mountain areas and coastal areas.	https://www.ipcc.ch/srocc/
IPCC, 2019 (SRCCL)	Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems	Relevant updated information on risks to land-related systems from climate change. Some regional and country information available throughout the report, but no specific regional analysis.	https://www.ipcc.ch/srccl/
IPCC, 2012 (SREX)	IPCC Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation	Evaluation of the role of climate change in altering characteristics of extreme events and assessment of experience with a wide range of options used by institutions, organisations, and communities to reduce exposure and vulnerability, and improve resilience, to climate extremes.	https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/
ND-GAIN (yearly)	ND-GAIN Country Index	Country data on the ND-GAIN Index and its elements providing a good overview of overall vulnerability and readiness to adapt to climate change.	https://gain.nd.edu/our-work/country-index/
WMO (regular update)	WMO El Niño/La Niña update	Regular update on short-term El Niño probabilities (a few months ahead). Relevant in a short-term perspective given that El Niño is the most important driver of climate variability and can trigger extreme weather events and disasters in various parts of the globe.	https://community.wmo.int/en/activity-areas/climate/wmo-el-ninola-nina-updates

Source, year	Title	Content relevant for CC foresight Analysis	Links
World Weather Attribution (new events added regularly)	Real-time attribution analysis of extreme weather events	Insight on the extent to which human-induced climate change plays a role in the magnitude and frequency of extreme weather events.	https://www.worldweatherattribution.org/
Regional stability and socioeconomic development			
European Commission (biannual)	INFORM Risk Index	A suite of quantitative, analytical products to support decision-making on humanitarian crises and disasters.	https://drmkc.jrc.ec.europa.eu/inform-index/
IDMC (yearly)	Global Report on Internal Displacement	Annual data on new displacements by conflicts and disasters including regional overviews and country spotlights	https://www.internal-displacement.org/global-report
The Fund for Peace (yearly)	Fragile States Index	Measuring fragility: Risk and vulnerability in 178 countries. A composite indicator for regional stability with no link to climate.	https://fragilestatesindex.org/
World Bank (biannual)	Regional economic updates	Regional economic updates for world regions	https://www.worldbank.org/en/topic/development/publication/world-bank-regional-economic-updates
Water			
WRI (last update in 2019)	WRI Aqueduct Water Risk Atlas	Global to local water risk and its components (physical and non-physical risks) including future scenarios for 2030–40.	www.wri.org/aqueduct
Global Drought Observatory (regular update)	Database of drought events	Updated information on global drought including drought reports for affected countries. Mostly short-term (monthly perspective), no projections.	https://edo.jrc.ec.europa.eu/gdo/
Food			
FAO (every 3 months)	FAO Crop prospects and food situation – Quarterly global reports	Quarterly global reports with regional reviews on cereal production incl. short-term forecasts (early warning). Regular updates on countries requiring external food assistance and on low-income food deficit countries.	www.fao.org/giews/reports/crop-prospects/en/
FAO (biannual)	FAO Food Outlook - Biannual Report on Global Food Markets	Biannual update on production, trade and demand of different food products incl. short-term forecasts. Not much regional information.	www.fao.org/giews/reports/food-outlook/en/
FAO, IFAD, UNICEF, WFP and WHO	Regional overview of food security and nutrition (various regions)	Series of regional updates on food security and nutrition with climate variability and extremes being important elements.	accessible via www.fao.org

Source, year	Title	Content relevant for CC foresight Analysis	Links
(various years)			
FAO (annual)	The State of Food security and Nutrition in the World 2022	Report on progress towards ending hunger, achieving food security and improving nutrition with in-depth analysis on related challenges.	https://www.fao.org/publications/sofi/2022/en/
WFP (annual)	Global report on Food Crises	Country and regional information on food insecurity and its main drivers incl. forecasts of acute food insecurity.	https://www.wfp.org/publications/global-report-food-crises-2022
OECD–FAO (various years)	OECD–FAO Agricultural Outlook	Assessment of ten-year prospects for agricultural and fish commodity markets at national, regional and global levels. Each report with a regional focus.	www.agri-outlook.org/
Energy			
IEA (annual)	World Energy Outlook	Trends in energy demand and supply, and consequences for energy security, environmental protection and economic development.	https://www.iea.org/topics/world-energy-outlook
IEA (annual)	Tracking SDG7: The Energy Progress Report	Assessments of achievements in the global quest for universal access to affordable, reliable, sustainable, and modern energy by 2030.	https://www.iea.org/reports/tracking-sdg7-the-energy-progress-report-2022
Our World in Data (regular update)	Energy and Energy Access	Consolidated information from multiple sources on energy-related topics	https://ourworldindata.org/explorers/energy
Health			
ECDC (European Centre for Disease Prevention and Control)	Surveillance Atlas of infectious diseases	Surveillance of various diseases such as cholera, dengue, chikungunya, etc.	www.ecdc.europa.eu/en/home
WHO (yearly)	World Malaria Report	Regional information on progress and challenges due to malaria.	https://www.who.int/teams/global-malaria-programme/reports
The Lancet Countdown (yearly)	Lancet Countdown on Health and Climate Change	Data on the evolving health profile of climate change, including country-specific, regional and income group level data.	https://www.lancetcountdown.org/data-platform/

Annex 2: Methodology for the climate foresight

The challenges in assessing future climate risks

The CC foresight is a short- to medium-term analysis of climate-related risks with a perspective of 1–3 years. The climate-related risks are assessed with regard to direct climate risks and in the context of the political and socioeconomic environment, water, food security, energy security, and health. Challenges include:

- In general, no specific weather or climate predictions can be made with a time horizon of 1–3 years. Extreme events are uncertain per se, and projections are limited to a probability that they may occur. Recurring events such as monsoons or El Niño/La Niña phenomena have a certain circularity over the years, and under specific circumstances predictions can be made for timespans of several months. Slow onset events (e.g. sea level rise, glacier retreat) occur gradually, and we can expect no substantial changes within a 1–3-year period.
- The 1–3-year perspective is below the time horizons of climate change assessments (2030 and beyond). High frequency and intensity of climate extremes in the present or recent past and a projected increasing frequency and intensity of such events in the future (IPCC perspective 2030) does not mean that frequency and intensity of such events will be necessarily higher in the short term. We can assume, however, that current extremes and related damages have an implication in the short-term risk environment as they may negatively influence vulnerability in upcoming years and the ability to cope with future shocks as people are still recovering from past events (e.g. current extreme drought influencing agricultural yields and food security in the near term or recovery from tropical cyclones lasting for years).

Assumptions and methodological implications

- The current risk situation and hotspots are strongly influencing the risk situation in the next 1–3 years, hence it is crucial to identify and understand the current risk situation and hotspots.
- The climate-related risks not only depend on the climate signal (intensity, frequency of climate-related hazards, changes in variability, etc.), but to a large extent on exposure and vulnerabilities of people and ecosystems, on the ability to address those risks (readiness, adaptive capacity, etc.) and on other non-climatic drivers. An analysis of climate risks therefore calls for the consideration of relevant non-climatic factors. The INFORM Risk Index, summarising a country's exposure related to humanitarian crises and disasters (including climate-related hazards) while considering underlying vulnerabilities and coping capacity, is in our view a good base for describing current climate-related risk on a general level and in a comprehensive manner.

- In the short- and medium-term (1–3-year) perspective, changes of such non-climatic factors (e.g. land use changes, political turmoil, population increase, etc.) are more relevant for the whole risk situation than any changes on the climate side, and are the main drivers influencing the capability to cope with climatic change events if they occur.
- To a certain extent we can analyse past or current events or trends to make a rough forecast of near-term risks. This is the case of current extremes, where we assume that they have a longer-term effect on future risks (e.g., extreme droughts or floods, damaging tropical cyclones).
- Climate variability is more relevant for our time horizon than projected climate change and hence it is important to understand current variability. Nevertheless, we consider the IPCC Sixth Assessment Report and IPCC special reports as important information sources to identify relevant current risks and impacts and observed changes by region. Projected trends can give an indication of potential future changes that in some cases might be relevant in the short term (especially the case for gradual changes such as glacier retreat).
- Surveys on perception of risks are interesting sources of information for assessing future risks as they have a forward-looking perspective by nature. There are, however, very few such data sources (e.g. the WEF Risk Report).