National Interdisciplinary Climate Risk Assessment

2025

Metis Institute for Strategy & Foresight

adelphi RESEARCH

BND

PIK Potsdam Institute for Climate Impact Research

"We are already living in the climate crisis. This brings substantial security risks at global and national levels."

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Foreword

Dear readers,

droughts, floods, devastating storms and failed harvests.

The consequences of the climate crisis can already be felt all over the world.

Across the globe, they are aggravating conflicts over ever scarcer resources which are destabilising states and societies and forcing countless people to leave their homes. They are also having an ever greater impact on us in Europe.

That makes this crisis the biggest security challenge of our time.

A look at Somalia shows us how global warming is exacerbating existing conflicts. Between 2021 and 2023, this country in the Horn of Africa experienced the longest drought in its history. At the same time, Somalia was hit particularly hard when Russia's war of aggression against Ukraine resulted in a global explosion in grain prices, as this country – already blighted by crises – was importing 90% of its grain from Ukraine and Russia at that point. Conflicts over distribution escalated. The terrorist group al-Shabaab, which continues to control a sizeable share of the country, tried to exploit the emergency situation to expand its power and recruit young men as terrorists.

Multiple crises of this kind are not only to be found in the Horn of Africa. Around the world, the climate crisis is destroying fields of crops, causing price increases on the food markets and stirring up conflicts over grain or pasture land.

A mix of violence and climate crisis is forcing more and more people around the world to leave their homes.

In the future, such scenarios will occur even more frequently and drastically – this report makes that clear.

Scientists reckon that the rise in temperature of 2.7 degrees towards which we are heading at the moment would endanger around one third of the global population. For these people live in regions which would be uninhabitable under these conditions.

The better and more accurately we understand the complex links between the climate crisis, local conflicts and geopolitical upheavals, the more effectively we can deal with the impact of the climate crisis. The National Interdisciplinary Climate Risk Assessment is an important contribution towards this.

This publication spells it out: anyone thinking about security needs to think about climate as well.

Every tenth of a degree less in global warming makes our lives safer.

The connection between climate and security is also a fundamental aspect of the National Security Strategy adopted by the German Government in June 2023. In addition, the Federal Government Strategy on Climate Foreign Policy and the Federal Ministry of Defence's Strategy on Defence and Climate Change have created a key strategic basis which will enable us to systematically incorporate climate into our security policy. The aim of these strategies is to ensure that we utilise our instruments as effectively and proactively as possible.

For a modern 21st century security policy. For the security of our country.

Annalena Baerbock,
Federal Minister for Foreign Affairs
of the Federal Republic of Germany

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Foreword

It is the statutory mission of the Bundesnachrichtendienst (BND) to identify and analyse developments in the fields of foreign and security policy. Climate change has become an increasingly important factor, exacerbating already existing challenges for societies around the world. In order to create a realistic picture of the security risks the Federal Republic of Germany is facing, we have to take into account the manifold and far-reaching impacts of climate change as well as global climate-related policies. This is also referred to in the National Security Strategy, in which the Federal Government commissioned the BND and leading scientific institutions with an analysis of the impact of the climate crisis on national security.

The BND gladly accepted this task. We were able to contribute our own experiences and capabilities as well as to reveal valuable new perspectives by working together with renowned scientific institutions. This report is the result of excellent cooperation and close coordination between all parties involved. The assessments included in this report thus correspond to our joint situation picture.

For the BND, climate change with its impacts such as destabilization and migration is one of the five major threats our country is facing – the others being the aggressive expansion approaches of Russia, the geopolitical ambitions of China, increasing cyber threats as well as the still virulent international terrorism.

There are direct and indirect reciprocal effects between these five threats, as is shown in this report. Climate change impacts put more and more pressure on countries, and this has reached geopolitical dimensions. The current energy transition towards clean technologies, which is both inevitable and unstoppable, bears not only chances but also risks at a global level.

Even though there are indications that greenhouse gas emissions will slightly decline over the coming years, the remaining high level of emissions will continue to rapidly drive global warming. Due to cascading effects and the advancement of other threats, we have to assume that the world will be a less secure place in 2040. Germany has to prepare for this. For us, as intelligence service, this means that we will continue to contribute to the nexus of climate and security.

Dr. Bruno Kahl,
President of the
Bundesnachrichtendienst

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Introduction

This National Interdisciplinary Climate Risk Assessment outlines the risks to Germany's national security resulting from climate change up until 2040. In accordance with the National Security Strategy (2023), the Metis Institute for Strategy and Foresight at the University of the Bundeswehr Munich, the Potsdam Institute for Climate Impact Research and adelphi research, together with the Bundesnachrichtendienst (Federal Intelligence Service), prepared this analysis for the Federal Government. The Federal Government has set itself the task to "assess the impact of the climate crisis on our national security and then arrive at informed choices of action". It is not in the mandate of the authors of the National Interdisciplinary Climate Risk Assessment to systematically point up opportunities or to develop concrete recommendations for action in the same way.

Ensuring national security means protecting the population, the territory and the free democratic basic order of the Federal Republic of Germany. The National Security Strategy specifies peace, security, prosperity and stability, as well as a sustainable use of natural resources, as German interests. In this respect, climate change entails security risks.

This assessment is based on climate science as well as interdisciplinary knowledge from the social sciences. Thanks to large empirical databases and efficient models, climate researchers are now able to create forecasts and risk analyses that are backed by quantitative data. Strategic foresight, in contrast, involves imagining plausible future scenarios based on qualitative data. Both approaches are ways of "thinking ahead", i.e. the systematic analysis of the genesis and implications of anticipated future scenarios in order to identify needs, alternatives and options for action.

"The longer reaching the goals of the Paris Agreement is postponed, the smaller the room for manoeuvre will be and the more politically and economically expensive the change of course."

Unless explicitly indicated otherwise, this document covers a time frame from today until the year 2040. While this period of time exceeds the horizon of daily politics, present generations will still largely experience the relevant effects. Climate change is altering and interrupting complex natural and social systems. These processes are not linear. As our globalised world depends on the interaction of manifold systems, even relatively small climatic changes can have massive socioeconomic consequences until 2040.

The consortium of research institutes and the Bundesnachrichtendienst which is responsible for the National Interdisciplinary Climate Risk Assessment does not aim with this report to outline climate change, its impacts and the resulting risks to our society in their entirety. The document and its key statements deliberately reduce complexity and place emphasis on certain challenges. The report presents developments the interdisciplinary consortium considers likely and relevant with a view to Germany's security until the year 2040.

“Anyone thinking about security needs to think about climate as well. We are already living in the climate crisis.”

Key statements

The authors assess the following: **anyone thinking about security needs to think about climate as well. We are already living in the climate crisis.** Due to the inertia of the climate system, climate impacts and climate risks will unfold up until 2040 and far beyond, even if we are able to reduce greenhouse gas emissions globally at a much faster rate than currently predicted. The following key statements of the National Interdisciplinary Climate Risk Assessment deserve special attention:

- The frequency, intensity and simultaneity of climate change-induced **"once-in-a-century events"** will continue to increase worldwide until 2040. This is resulting in more weather-related disasters, also in Germany and the European Union (EU). → ***Natural science background, Chapter 1***

- The impacts of climate change are leading to growing **risks to human health, infrastructure and the economy. Immense adaptation and reconstruction costs** are having a negative effect on economic growth, consequently reducing the potential for investments. → ***Chapter 1***

- Climate impacts are increasing the risk of large-scale **crop failures** and of resulting price increases and **price shocks** on international markets. Climate change – in combination and interaction with additional factors – is reinforcing existing **resource scarcity** and **food insecurity**, which may force people to migrate. Particularly in countries with low incomes and high population growth, climate change has conflict-exacerbating effects (Fig. 5). → ***Chapter 2***

- The impacts of climate change are also leading – indirectly – to a global increase in **humanitarian crises** and **supply chain interruptions**, which also affect Germany and the EU. Together with other contributors, Germany and the EU therefore need to cooperate even more closely with other states at a strategic level and make more effective use of tools linked with foreign policy, development policy and economic policy, including stabilisation and climate financing. Otherwise, they could lose influence in world affairs. → ***Chapters 2, 4***

— New challenges are emerging for the entire range of military tasks. The destabilising effects of climate change are leading to an increase in conflicts in the international system. At the same time, **personnel, infrastructure and equipment are being exposed to ever more extreme climate conditions, such as exceptional heat and heavy rainfall**. Regions like the Arctic, where the ice is disappearing, are gaining strategic relevance for the North Atlantic Treaty Organization (NATO) and for rival actors, and this is bringing new challenges in the sphere of security and defence policy. → ***Chapters 2, 4***

— The **energy transition** is causing shifts in international trade that play a significant role in **21st century geopolitics**. **Risks** are arising **for exporters of fossil fuel**, especially for vulnerable African petrostates (Fig. 6). **Opportunities** are emerging **in the growing markets for clean energy technologies** and in the future trade with **hydrogen** and its derivatives. Germany is competing for market shares in clean energy technologies, in an international competition in which in particular China is partly using illegitimate means. Germany and the EU have repeatedly lost market shares. → ***Chapter 3***

— A failure of the international community to limit global warming in line with the Paris Agreement could cast doubt on the legitimacy and effectiveness of the **rules-based international order** that has been key in safeguarding peace and stability in the last few decades. Any such doubts would play into the hands of those who are already challenging the system of the United Nations and the entire rules-based order. → ***Chapter 4***

— A lack of confidence in the global implementation of the climate goals or the approach of irreversible tipping points could also tempt states to unilaterally apply **geoengineering**. This holds enormous **potential for international conflicts and extreme risks to the climate system**. → ***Natural science background, Chapter 4***

— The way the climate crisis is dealt with will further increase the **potential for political conflict within the EU**. On land, the Mediterranean region already exceeds the average global temperature increase. Southern EU Member States, in particular, will not only experience severe economic losses due to climate effects, but will also feel the consequences of political instability in their geographical vicinity. Tensions resulting from unequally distributed burdens might weaken cohesion within the EU as well as both its ability to act and its future viability. → *Natural science background, Chapter 5*

— The **impacts of climate change increase the pressure on all government systems**, as they slow down economic growth and force the introduction of reforms that (may) trigger fears of loss. As price increases due to carbon pricing disproportionately affect poorer population groups, **inequality** might be exacerbated if no social compensation mechanisms are in place. In Germany and Europe, the cost of decarbonisation and its (perceived) unfair distribution are already fuelling climate sceptic positions and provide **space for populism, right-wing and left-wing extremism, and disinformation campaigns**. → *Chapter 5*

— The governments of Germany and other EU Member States as well as the European Commission are facing a **dilemma**: on the one hand, there is pressure to take action in order to prevent disastrous global climate risks and to prove that progress on climate policy is compatible with economic success. On the other hand, ambitious climate policy will only be successful if it is acceptable from a domestic policy perspective. This dilemma must be solved under **time pressure**. **For the longer reaching the goals of the Paris Agreement is postponed, the smaller the room for manoeuvre will be and the more politically and economically expensive the change of course, because the climate crisis will worsen and absorb more and more political capital and financial resources.** → *Chapter 5*

The climate crisis

Humanity is already experiencing an era of climate extremes.

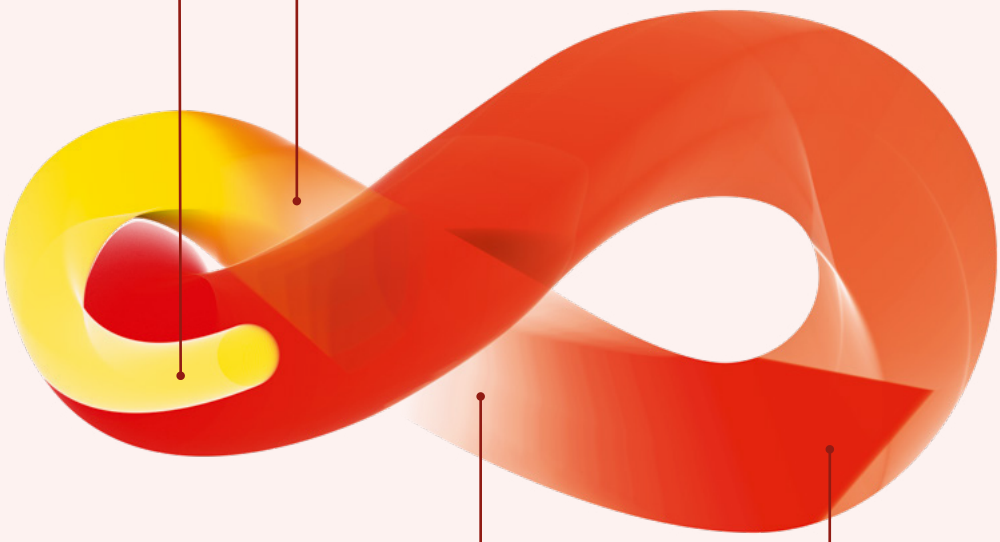
These are already leading to significant risks to life, health and prosperity. Climate change has multiple physical and socioeconomic impacts. These impacts entail risks that depend in their severity on the existing degree of resilience.

The following diagram illustrates these correlations, which together result in the "climate crisis". The climate crisis is depicted as an infinite loop in order to demonstrate that the process, including irreversible changes, will continue to accelerate as long as we fail to reduce greenhouse gas emissions.

"Reducing greenhouse gas emissions slows down the occurrence of climate impacts and resulting climate risks."

Climate change
Human-made changes in the earth's climate system – especially due to greenhouse gas emissions. Reducing greenhouse gas emissions slows down the occurrence of climate impacts and resulting climate risks.

Climate impacts
Biophysical and geophysical (e.g. drought, extreme weather, tipping points) and socioeconomic (e.g. price increases, supply chain issues, economic losses) impacts of climate change.



Socioeconomic resilience
The capacity of societies to cushion impacts of climate change.

Climate risks
Their severity results from the interaction of climate impacts and resilience. The greater the resilience, the less severe the climate impacts will be.

Fig. 1

Climate crisis: increasing climate impacts that meet little resilience create more climate risks

“Germany – like all landmasses – is warming faster than the global average. In spring 2024, temperatures in Germany were 3.1 °C above the average of the usual reference period.”

Climate change and climate impacts:

Natural science background

Humanity is already experiencing an era of climate extremes.[1] Record temperatures occur continually. For example, on 22 July 2024, the highest global average surface temperature in recent history was recorded.[2] Between January and September 2024, the global average temperature was 1.54 (±0.13) °C higher than that of the pre-industrial era.[3] By November, it was almost certain that 2024 would continue the trend and be the warmest year ever recorded.[4]

The Intergovernmental Panel on Climate Change (IPCC) concludes that it has been clearly demonstrated that there is a causal relationship between global warming and human activities.[5]

Average global warming is presently at +1,3 °C as compared to the long-term average.[6] The current global average temperature is the highest in the last 10,000 years,[7] i.e. the timespan during which human civilisation has flourished. Global warming is clearly accelerating: the warming rate of 0.18 °C per decade experienced since 1970 has nearly doubled over the past 15 years to around 0.3 °C per decade.[8]

Germany – like all landmasses – is warming faster than the global average.[9] In spring 2024, temperatures in Germany were 3.1 °C above the average of the usual reference period[10] and, unusually, exceeded 30 °C in early April already.[11] Each decade since 1950 has been hotter than the previous one.[12] In the decade until 2022, the average near-surface temperature in Germany was roughly 2.1 °C higher than the average when records began (1881–1910) (Fig. 2).

Temperature anomaly in ten-year periods
Germany — Reference period 1881–1910

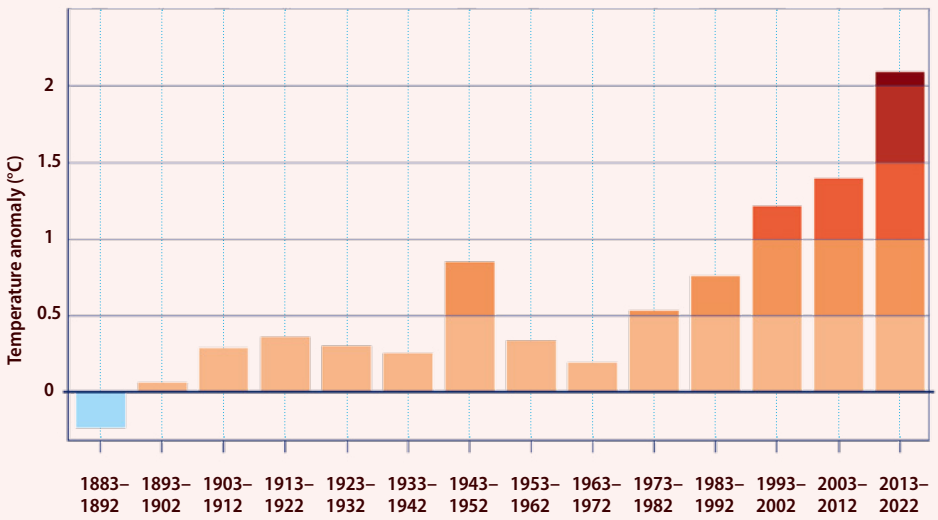


Fig. 2:

Warming trends — Germany 1881–2022[13] | Source: DWD

In Europe, land areas in the Mediterranean region in particular are warming 20 % faster than the global average. This is resulting in a higher demand for water in this region, which already suffers from water shortages, while at the same time, owing to climate change, there is a decline in rainfall[14] and an increase in wildfires.[15]

Average global warming is expected to exceed the levels of the usual reference period by at least 1.5 °C by 2040.[16] Current climate policies will lead to roughly 2.7 °C warming above pre-industrial levels by the end of the century.[17] Even higher temperature increases are possible.[18] Even if global development was pursued in a more sustainable manner, and global emissions thereby decreased significantly, the 1.5 °C target of the Paris Agreement would be exceeded, at least temporarily (Fig. 3). Thereafter, average global warming would still remain at or around this temperature threshold for decades to come.[19]

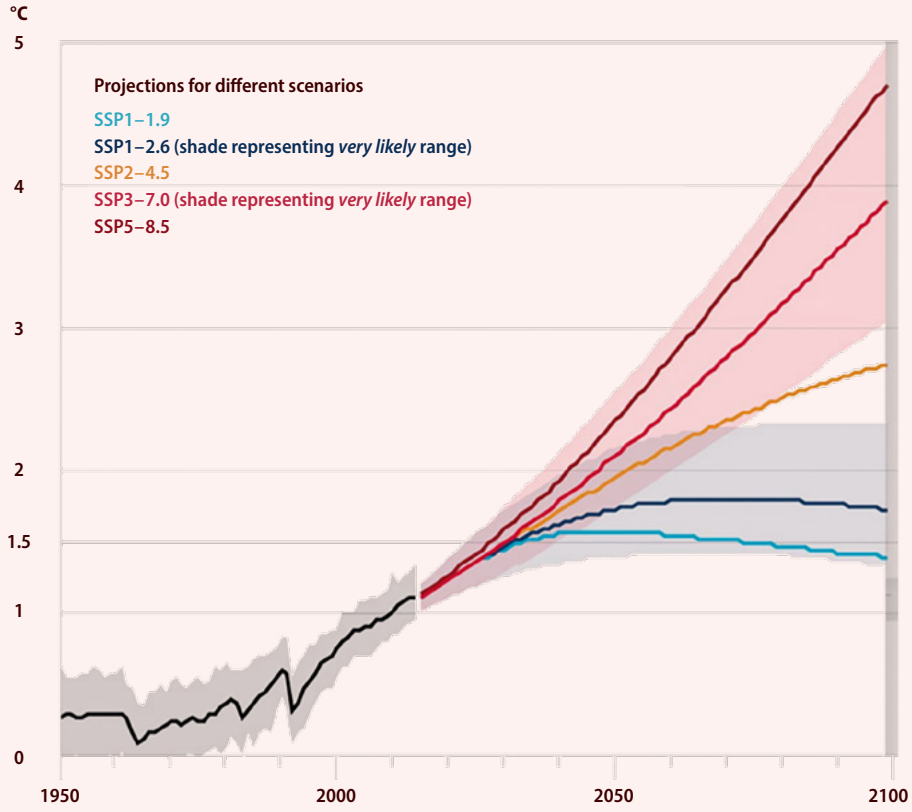


Fig. 3:

Global temperature changes, depending on pathways chosen (IPCC, 2023).[20] SSP means Shared Socioeconomic Pathways.[21] SSP1 (blue): sustainable, optimistic pathway. SSP5 (brown): fossil-driven, pessimistic pathway. The probability of occurrence (esp. after 2040) depends on the policy choices made.[22] | Source: IPCC

We are already living in the climate crisis, i.e. human-induced climate change with its geophysical and socioeconomic consequences and resulting risks. The crisis is already directly affecting Germany.

The impacts of climate change particularly involve an increase (frequency and intensity) in extreme weather events, including floods, heat waves, dry spells and droughts. All of these are relevant for Germany, both directly and indirectly.

According to the National Meteorological Service of Germany (Deutscher Wetterdienst, DWD), the average number of hot days (with a daily maximum air temperature of at least 30 °C) in Germany has tripled since 1950; 14-day-long heat waves have occurred very frequently since the 1990s – Hamburg, for example, did not experience any before 1994, but has seen six since then.[23] This goes hand in hand with droughts.[24]

There is an increased likelihood not only of heat, water scarcity and, consequently, faster-spreading wildfires.[25] The number of heavy rainfall events is rising globally[26] as well, as a warmer atmosphere can hold more water vapour.[27] In Germany, too, heavy rainfall events are occurring more often,[28] increasing the frequency of disastrous precipitation events, as seen in the Ahr Valley in 2021 or in Bavaria in 2024.[29]

The wet-bulb temperature, or, put simply, the combination of heat and humidity, becomes threatening to health and life the closer it is to body temperature. If the two are the same, the human body is no longer able to sufficiently cool down by sweating. Around the globe, dangerous wet-bulb temperature zones already occur more frequently at local level than originally expected.[30] This effect of extremely humid heat will occur more often regionally as global warming progresses[31] and will involve consequences for human productivity, health and life, as well as the habitability of affected areas. World regions with less extreme temperatures will become more attractive as places of refuge. These include Germany and other parts of the European Union.

In addition to a generally increasing number and intensity of climate change-induced extreme events, global warming also threatens to trigger interlinked climate tipping points which would change the earth system irreversibly and permanently. An average global warming of more than 2° C entails far more risks for an initial tipping point triggering additional ones.[32] There is still some uncertainty with regard to the occurrence of this dynamic, but it would have potentially disastrous effects on the biosphere and thus on humanity.[33] The systems affected by tipping points include the Atlantic meridional overturning circulation (AMOC), which includes the Gulf Stream system;[34] if this system was weakened or even interrupted, Europe would face extreme winter cold and more winter storms, among other things. There is a chance that the AMOC tipping point may be passed and the system will start to collapse by the middle of the century.[35] That would entail enormous consequences for social, political, economic and technical systems in the following decades.

"Current climate policies will lead to roughly 2.7 °C warming above pre-industrial levels by the end of the century. Even higher temperature increases are possible."

“A 2022 study commissioned by the Federal Government calculated that, in 2000–2021, damage following extreme weather – including drought, heat and wildfires – amounted to EUR 145 billion in Germany, with an average of around 1,400 deaths per year.”

Chapter 1

Increase in economic, financial and health-related burdens

Climate change already directly affects Germany and the EU [36] and threatens lives, infrastructure and the economy. [37] On the one hand, European countries have to deal with the costs and decreasing welfare. On the other, impaired economic growth and high adaptation costs lower the potential for investments in national and European resilience and security.

1.1 Growing economic and infrastructural risks due to weather-related disasters

An increase in the intensity and frequency of extreme weather events threatens infrastructure, including critical infrastructure, entailing economic losses and risks to life and limb.

Extreme weather events include storms, heavy rainfall and associated floods. The latter are a danger near water courses, as seen in the 2021 flood in the Ahr Valley, but also at locations that have so far been considered safe. [38] Others are widespread heat or fire events, which affect railways and roads and may interfere with air traffic due to smoke development. Extreme weather may also interrupt power supplies, directly endangering human lives.

According to the European Environment Agency, the total economic losses in the EU due to weather and climate-related events (in all 32 Member States of the European Economic Area) amounted to between EUR 450 billion and 520 billion (in 2020 prices) over the period from 1980 to 2020. Only a quarter to a third of those losses were covered by insurance. [39] A 2022 study commissioned by the Federal Government calculated that, in 2000–2021, damage following extreme weather – including drought, heat and wildfires – amounted to EUR 145 billion in Germany, with an average of around 1,400 deaths per year. [40]

There is a high degree of uncertainty around forecasts in this field. However, if the number of extreme weather events grows, increasing financial damage must be expected. A 2018 study suggests that damage to critical infrastructure in Europe due to extreme weather events will increase sixfold by the middle of the century (as compared with the 1981–2010 reference period). [41]

The economic consequences of climate change have been the subject of scientific discussion for some time. There is broad consensus that climate impacts adversely affect economic growth.[42] The U.S. Framework for Climate Resilience and Security puts the global damage and losses caused by climate change and extreme weather in 2023 at USD 287 billion.[43] Given a global average temperature rise of 3 °C, a recently published meta-analysis estimates relative gross domestic product losses of 7.1 to 12.6 % due to catastrophic and non-catastrophic damages.[44]

1.2 Drought adversely affects economy and food production

Long periods of drought and irregular rainfalls are damaging the European economy. In the past few years, low water levels in Europe's rivers have repeatedly restricted inland navigation, with repercussions for economically and militarily relevant supply chains, regional fuel supply and industrial production, among other things.[45] Water shortages force shutdowns of fossil and nuclear power plants when there is not enough cooling water or if water levels in rivers are too low to transport fuel to the plant. In addition, the electricity generation capacities of hydroelectric power plants might be interrupted.[46]

Agriculture and forestry are facing growing challenges as well.[47] With the shifting of climate zones, the physiological tolerance of various species (plants, animals, insects, microorganisms) will be exceeded. Biodiversity will shrink and plants will be increasingly susceptible to insect pests, leading to failures in agriculture and forestry. A 2021 study estimates the direct economic losses to agriculture in the EU (and UK) due to climate change-induced drought at approx. EUR 12.2 billion annually if average warming reaches 2 °C (as compared to roughly EUR 9 billion per year in the 1981–2020 reference period).[48] Costly adaptation measures or farm closures might create socioeconomic follow-up costs, especially in less favoured regions.

1.3 Heat waves damage health and productivity

As climate warming progresses, excess cold-related mortality (especially due to cold-related viral infections) will decrease, while excess heat-related mortality will rise. In the European Economic Area, heatwaves with extreme temperatures are the cause of 85 % of all deaths due to extreme weather.[49] Sustained periods of hot temperatures are becoming a growing threat to Europe's comparatively old and thus vulnerable population. Even temperatures that are not per se life threatening lead to higher mortality if the wrong actions are taken and no heat protection measures are in place. Assuming the Atlantic meridional overturning circulation (AMOC) does not change, however, Germany and the northern European regions will likely benefit from the overall decline in cold-related mortality, while southern Europe in particular will see a significant increase in heat-related mortality.

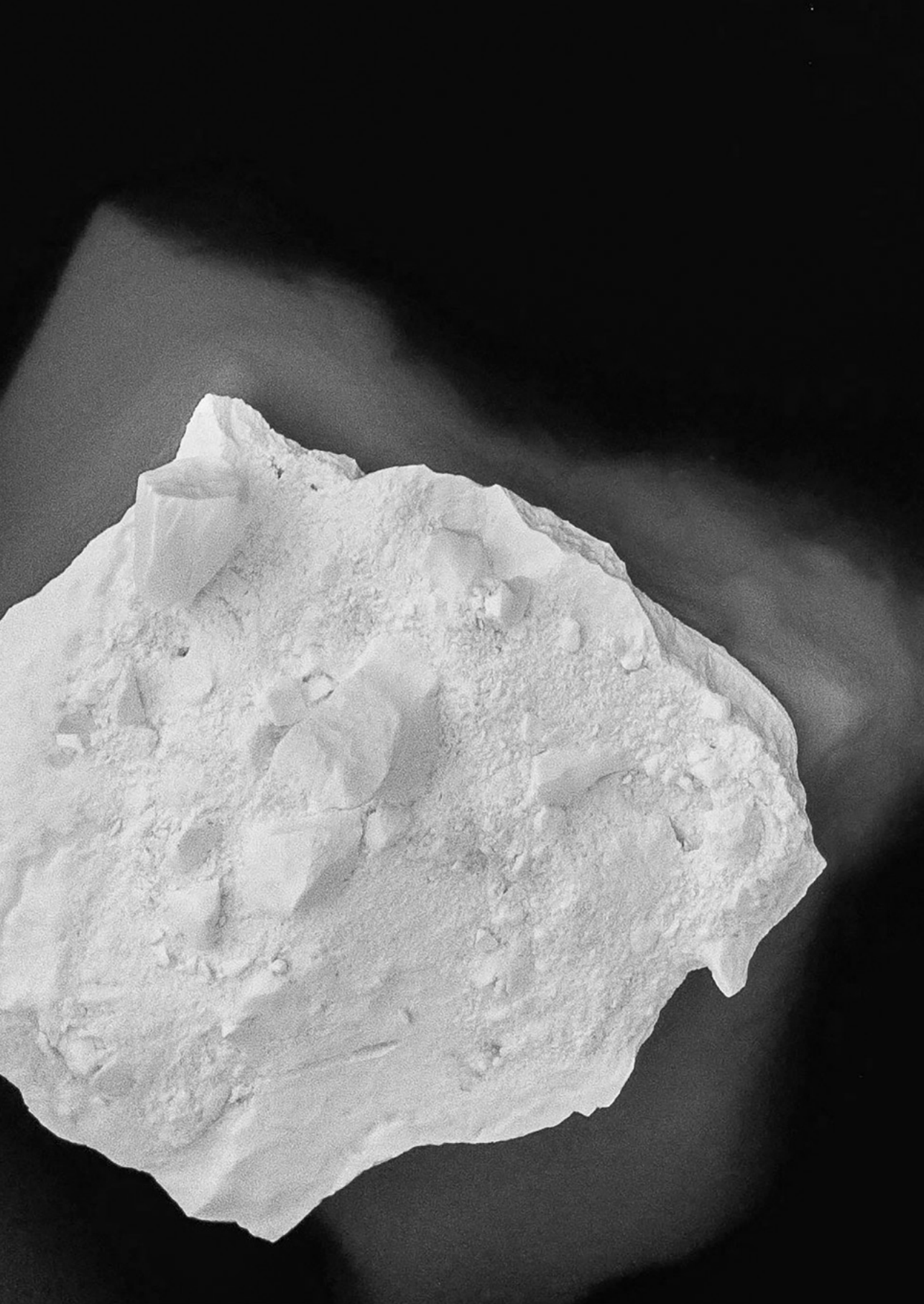
"Biodiversity will shrink and plants will be increasingly susceptible to insect pests, leading to failures in agriculture and forestry."

Strong heat reduces physical and cognitive performance as well as quality of life (outdoor activities need to be limited). This has a negative impact on companies' productivity.[50]

1.4 New health risks posed by disease vectors and zoonoses

Due to changing climate conditions, disease vectors are starting to circulate in new areas. This applies, for example, to mosquito and tick species which are migrating to new regions as temperatures rise, are active over longer periods of the year, and may also be able to multiply more efficiently and settle more permanently.[51] Dengue fever, Zika virus or West Nile fever infections may occur in parts of Europe where this was not possible before.

Climate change is contributing to the collapse of complex ecological chains in particularly biodiverse regions. As humans advance further into unexploited areas, the risk of zoonoses, i.e. diseases that spread to humans from wild animals that are pushed out of their natural habitats, is increasing as well.[52]



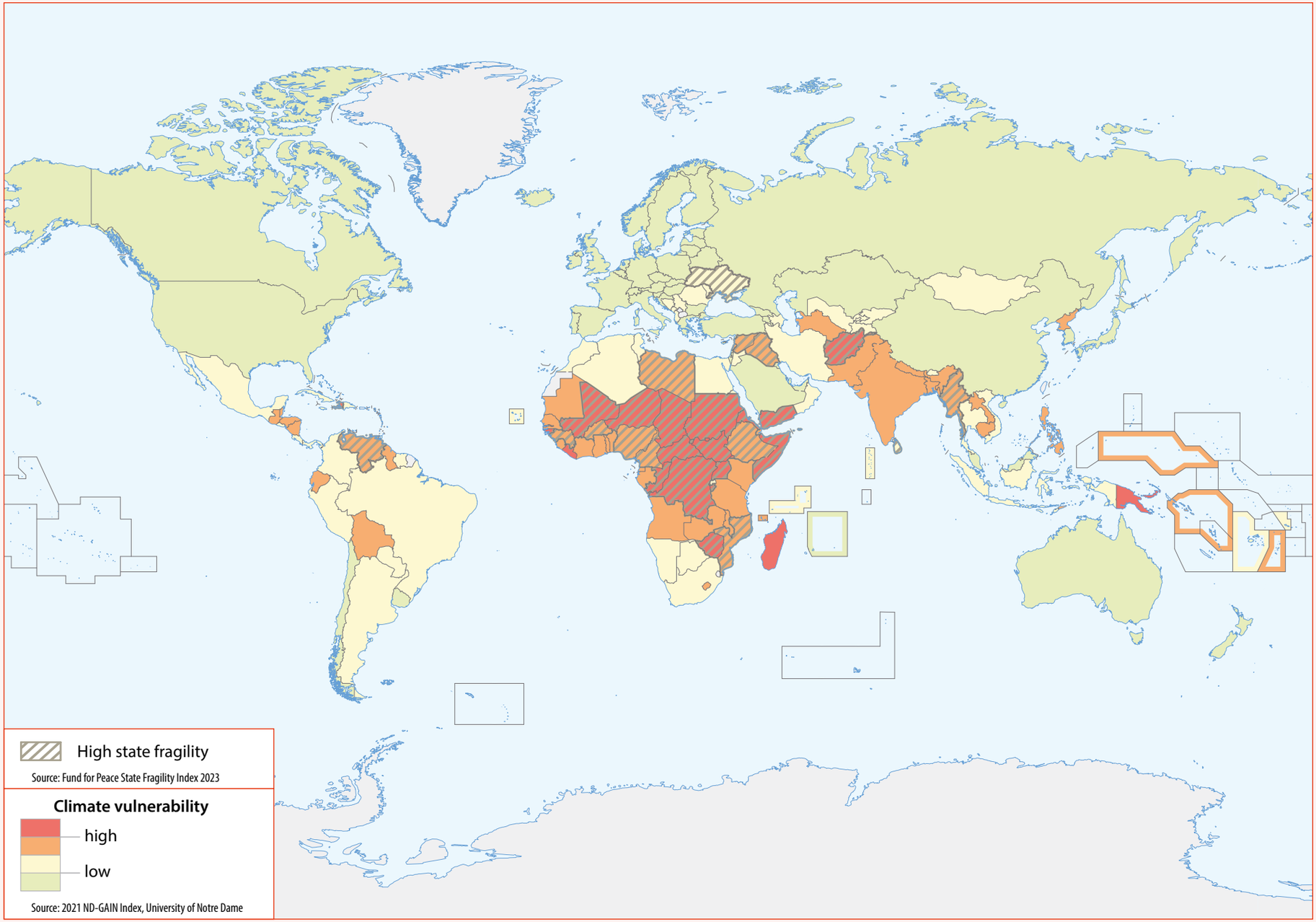


Fig. 4

High climate vulnerability and fragility make it more difficult to adapt to climate change and cope with extreme weather events

Chapter 2

Climate change increases risks of conflict worldwide

Many countries are hit even harder by climate impacts than those in Europe, primarily because they have fewer resources to mitigate and adapt to climate risks. Numerous less developed countries in Europe's wider neighbourhood are among those most vulnerable to climate change.[53]

Climate vulnerability, i.e. the vulnerability of human (and ecological) systems, results from the type and degree of the emerging climate impacts and the systems' sensitivity and adaptability. Fragility describes the weakness of government and social systems with regard to their basic functions when it comes to safeguarding (especially physical, constitutional and socioeconomic) security.

Climate vulnerability and government and social fragility overlap and correlate significantly. Both are ultimately an expression of weak governance, i.e. political, administrative, socioeconomic and / or social institutions which do not take appropriate decisions and which are, in particular, unable to resolve (distribution) conflicts in a constructive manner. The challenges posed by climate impacts and risk factors attributable to social and government fragility – including existing resource scarcity, low public revenue, corruption, subsistence farming, population growth, legal uncertainty, lacking efficiency and legitimacy of state activity, etc. – frequently reinforce each other (Fig. 8): climate impacts such as displacement and loss of livelihood due to a lack of good governance, for example, lead to conflicts in host areas, and government fragility impedes adaptation measures that could reduce vulnerability. This increases the risk of a negative spiral of failing states in which vulnerability and fragility reinforce each other.

An increase in the number of failing states would indirectly affect the security of Germany and Europe. Displacement and the lack of prospects make alternative offers from militant groups more attractive and consequently strengthen their potential.

"Resource scarcity, supply chain interruptions and price increases adversely affect the European economy and may cause tensions at domestic political level which ultimately diminish society's overall resilience."

This increases the insecurity on Europe's periphery and the risk of cascading effects like terrorist activity or regional causes of migration. More frequent humanitarian crises tie up more financial, diplomatic and, in the worst case, military resources in Europe and its partner countries, at the expense of other priorities.[54] State collapses and conflicts also affect global trade.[55] Resource scarcity, supply chain interruptions and price increases adversely affect the European economy and may cause tensions at domestic political level which ultimately diminish society's overall resilience.[56]

2.1 Extreme weather events increase risks to global food security

The climate change-induced increase in extreme weather events is leading to regional crop failures, causing global shortages and price increases. According to the Food and Agriculture Organization of the United Nations (FAO), global food production needs to be expanded by 50 % by 2050 in order to feed the growing world population.[57] At the same time, however, the IPCC expects climate change to have a negative impact on global harvests.[58]

On the one hand, increasing levels of CO_2 in the atmosphere do encourage plant growth. Also, climate zones are expected to shift due to climate change, making more farmland available in polar regions. On the other hand, however, models simulating future developments tend towards a decrease in average crops; in particular, this is caused by the shortage of water and / or the shift of rainfall patterns leading to more severe droughts and locally restricted heavy rainfalls that are of little use. Between 1981 and 2010, the average crop yield of corn, wheat and soy bean already decreased slightly due to climate change. [59]

Due to the decreasing availability and quality of food, the IPCC expects the number of people suffering from hunger to increase. [60] Expert studies have quantified this risk based on models. [61] An analysis published in summer 2024 estimates that, by 2050, food production will decrease by between 6 % and 14 %, depending on the scenario, and that an additional 556 million to 1.36 billion people might face "severe food insecurity". [62]

Regional crop failures also cause global shocks to food security. [63] Climate change favours extreme weather phenomena, such as irregularities in the jet stream course. This increases the likelihood of simultaneous regional bread basket failures. [64] Starting in 2040, the wheat cultivation areas affected by extreme water scarcity might increase massively – to a third of all global cultivation areas (by comparison: 1961 to 1990 approx. 10 %). [65] Simultaneous failures make it more difficult to mitigate local food shortages through international trade. They also increase the volatility of world market prices. This can trigger sudden price explosions resulting in many people not being able to afford as much food as before, if any at all. [66]

Rising sea temperatures reduce fishing catches, as fish populations are shrinking or retreating to still colder regions. [67] 12 % of the world population depends on fishery. [68] Declining fish populations threaten their livelihood and are linked with an increase in piracy, for instance off the coast of East Africa or in the South China Sea. [69] Migrating fish stocks can also lead to conflicts over access to sea regions that are rich in fish. [70] This is already a cause of tensions between states today. [71]

Bottlenecks in the global food market have far-reaching consequences. So far, this has affected the EU only indirectly: as the EU exports more agricultural products than it imports, food security is relatively high. [72] Germany's self-sufficiency degree for grain, potatoes, milk and meat exceeds 100 %, for example, while it imports more than 50 % of the consumed vegetables, fruit, pulses and eggs. [73] Larger regional crop failures will therefore be felt more strongly in Germany, too, in the future, in the form of higher prices. Climate change-induced food price increases have already been seen for olives (oil) and cocoa (chocolate), for example.

Failed harvests and price increases pose significant challenges above all to countries that are dependent on imports. [74] This applies in particular to countries which, due to water scarcity and drought, cannot grow enough food themselves. Nearly all countries in North Africa, the Middle East and the Gulf region already have a grain import dependency of between 50 and 100 %. [75]

The susceptibility of import-dependent countries became clear when food prices skyrocketed in 2007/08 and 2010/11. Droughts and subsequent bottlenecks in the world market (not least because traditional grain exporters halted their exports) led to massive price increases. This resulted in protests against the high prices for food imports as well as protests against the currency and debt crises which were a consequence of the (initial) continuation of food import subsidies. This dilemma for poorer, import-dependent states contributed significantly to the destabilisation of numerous states in the wake of the so-called Arab Spring. [76]

Many states with large-scale agricultural exports introduce export controls in response to increasing prices, in order to secure a lower cost of living for their own population. The effects are not linear: the World Bank estimates that the prices for corn, for example, increased by more than 6 % in 2022 after 2.5 % of global exports were suspended, while the relative effects on rice and grain prices were significantly less.[77] As of July 2024, 16 states have banned the export of certain agricultural products, and restrictions (mostly export taxes, no bans) affect around 8 % of the calories traded globally.[78] This protectionist impulse can exacerbate climate-induced food crises: between 2008 and 2012, 36 states restricted such exports, which led to estimated price increases of more than 30 % for wheat and rice.[79] This dynamic threatens the stability of import-dependent countries.

2.2 Scarcity of resources can aggravate existing conflicts

The effects of climate change pose particular challenges for countries which a lack good governance and where a high level of state fragility, weak state legitimacy and limited financial scope are mutually exacerbating factors. The interactions between climate and conflict are complex, the causal connections not straightforward. On the one hand, climate change compounds an existing scarcity of resources (Fig. 5). It can thus aggravate conflicts (over distribution) and increase fragility. Conversely, the repercussions of conflict can increase climate risks, because the conflict gnaws away at resilience and adaptation potential and the impact of climate change is then felt by society. In the event of a vicious cycle, there is a danger of failing states, civil war or international conflicts.[80]

In fragile developing countries, it is frequently the case that more than half of the population depends directly on agricultural production. In some states in Africa, the figure is as high as 80 %. This direct dependence on climate-sensitive natural resources heightens the socioeconomic and political risks in the context of climate-related damage. Often this leads to conflicts over distribution along political-ideological, ethnic, religious or other social fault lines, for instance between herders and farmers.[81] Environmental change leads herders to move to other areas or to move on at different times. This leads to conflicts, especially when harvests are hit.[82] As a result of increasing confrontation in which state authorities frequently take the side of the farmers, herders, often marginalised in society, become easier targets for recruitment by rebel groups.[83]

If there are no economic prospects or sound public service structures to counter such conflicts, the influence of militant groups that offer alternative sources of income and further weaken state legitimacy grows.[84] In this way, climate change exacerbates the factors that indirectly feed terrorism.[85] Islamist actors use these developments as starting-points for Islamist paradigms, and in some cases are already using climate change to propagate extremist narratives.[86]

The conflict-escalating impact of climate change can also be seen in the context of water as a resource. In many countries, water resources have been overexploited as a result of population growth and agriculture and are poorly managed owing to the lack of structures.[87] Higher temperatures and longer vegetation periods go hand in hand with increased evaporation; groundwater levels in many places are dropping. Regular precipitation is becoming more unpredictable, and the proportion that takes the form of extreme weather events (which is harder to utilise) is increasing. If demand increases as is currently forecast until 2040, the potential for conflict both within states and between neighbouring states is at risk of becoming greater, too.

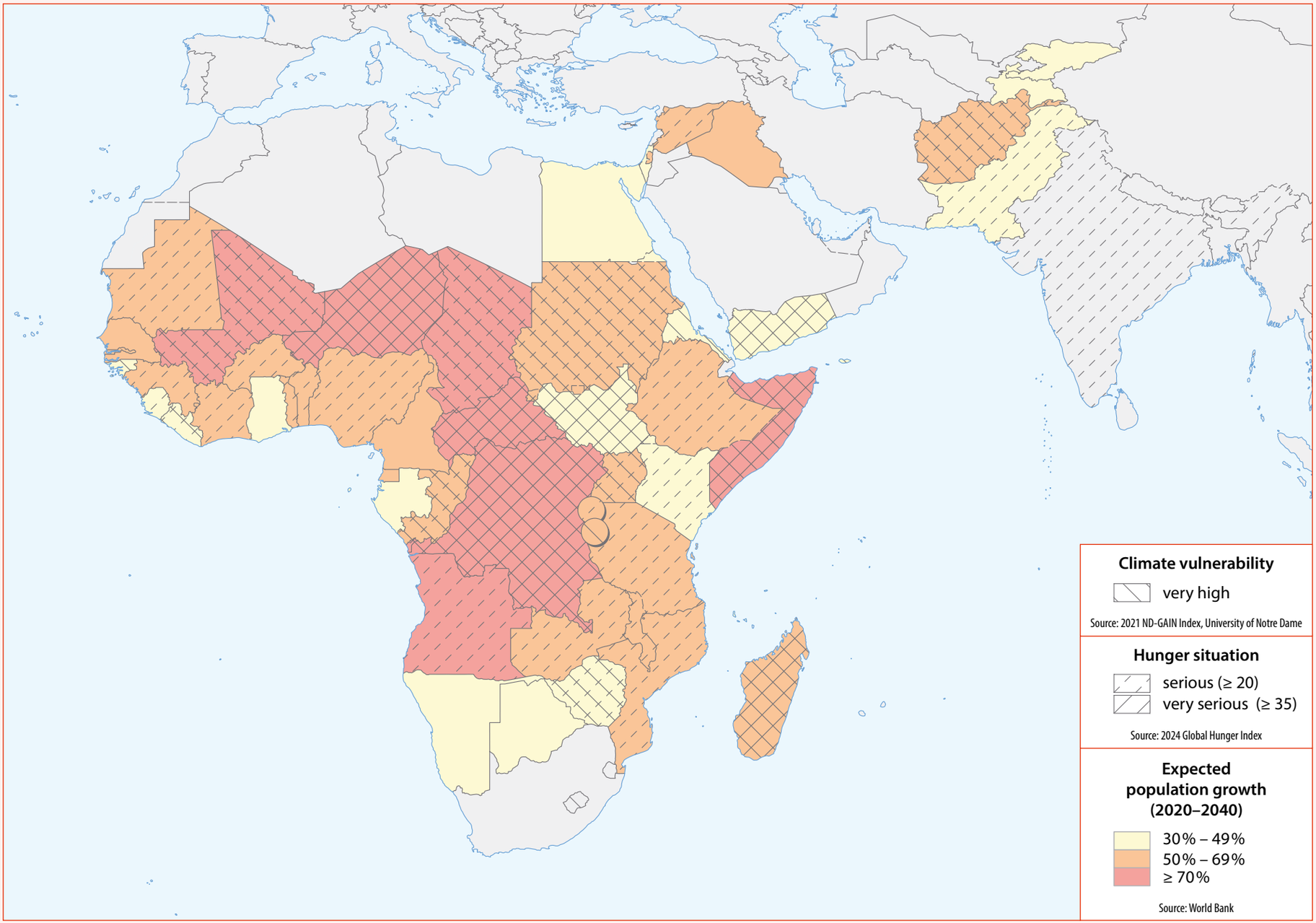


Fig. 5

Worsening food insecurity is a danger first and foremost for states where supplies are already inadequate and population growth is high

"Climate change-related events are already having an impact on displacement and migration flows, as extreme weather events and creeping environmental change are destroying natural resources and livelihoods."

Intergovernmental agreements on water management are in place for only just under half of all international river basins. Even where such agreements do exist, they are generally not (adequately) designed for increasing changes in respect of the availability, quality and seasonality of the water resources. New dams generate renewable energy, make it possible to adapt water storage to less predictable rainfall and help to contain seasonal high water levels and flooding. However, they often have cross-border implications for upstream and downstream states, for example on the Nile and Brahmaputra, the Mekong and Euphrates / Tigris. Both the direct consequences of climate change for the water cycle and the indirect consequences relating to infrastructure increase the risk of conflicts. [88]

2.3 Climate-induced migration is on the rise and might contribute to conflicts

Climate change-related events are already having an impact on displacement and migration flows, as extreme weather events and creeping environmental change are destroying natural resources and livelihoods. [89] In the next few decades, more people will leave their traditional homelands because of the increasing effects of climate change. On the basis of current climate policy and an expected rise in global temperature of 2.7 °C, it must be assumed that, by the end of the century, between 22 and 39 % of the world's population will no longer live in the "climate niche" that sustains human life. [90] There can scarcely be any doubt that this will lead to increasing migration, also on a supraregional level.

The part played by climate change in migration and displacement is, however, usually indirect, and centred on scarcity of resources. The causes are difficult to delineate. Projections suggest that the bulk of mobility in the context of climate change will in future continue to take place at particular times and on a national or regional scale. [91] However, climate change is also driving cross-border migration and displacement. [92] A definitive departure from one's home is more likely to be the result of gradual climate change and not of sudden events like floods. [93] Model scenarios from the World Bank for the period up to 2050 assume that there will be 44 million internal migrants in the best case and 216 million in the worst, i.e. continuing, unchecked climate change. [94]

The nexus between climate change, conflict and migration is also complex and difficult to quantify. That there is an interaction between them is undisputed. [95] Here, too, there is an indirect connection: first and foremost, it is climate change-related scarcity of resources that leads to localised, short-term national violence and conflicts – and these can in some cases lead to migration and displacement, and vice versa. [96] Particularly where climate change impacts on regions already plagued by drought, there is the potential for simultaneous armed conflicts and disruption of existing patterns of migration. [97] It is also clear that this nexus can in turn have an influence on asylum applications. [98]

2.4 Extreme climate conditions pose new challenges for armed forces

New challenges are emerging for the whole spectrum of military tasks as a result of climate change – both in terms of foreseeably increasing uncertainties in the geopolitical environment and in terms of organisation. [99]

"Climate resilience will be one determining factor for the future operational capability and endurance of the armed forces."

Personnel, infrastructure and equipment will be exposed to more extreme climate conditions in the future. Sensor functions can be impaired by extreme heat or extreme wet weather, as can military mobility and logistics in the land, sea and air dimensions, to name but a few examples.[100] The ever more challenging circumstances affect national and Alliance defence as well as international crisis management and subsidiary tasks.[101] The demand for international crisis management and inter-agency assistance will rise.

All this must be borne in mind for planning and procurement cycles. Ships, aircraft and combat vehicles that are planned and built today will be operating in the climate conditions of 2040. Climate resilience will therefore be one determining factor for the future operational capability and endurance of the armed forces.[102]

Further, the need to cut greenhouse gas emissions is increasingly moving the German armed forces to investigate efficiency measures, avoidance strategies and alternative technologies.[103]

"The energy transition is changing international trade; thus it has a geopolitical dimension and affects international order."

Chapter 3

Energy transition involves opportunities, but also risks

In the face of climate change, the global energy transition will continue to progress until 2040 (and beyond), bringing with it geopolitical, economic and security opportunities and risks.

3.1 Geopolitics of the energy transition

The energy transition is changing international trade; thus it has a geopolitical dimension and affects international order.[104] The energy transition will probably lead to the regionalisation of trade in energy carriers, because, in comparison with oil and gas, the increasingly used electrical energy will more likely be traded regionally. Similarly, the emerging trade in green or low-carbon hydrogen will be conducted over relatively shorter distances.[105] Only hydrogen derivatives will probably also be transported over longer distances.

On the one hand, this development will incur risks, particularly for oil and gas exporters whose national budget is heavily dependent on oil and gas exports revenues (so-called petrostates),[106] because the global oil and gas demand could plateau by the end of this decade.[107] The most vulnerable petrostates face a danger of economic crises and a lack of prospects which might lead to state crises and transnational domino effects that destabilise entire regions. As is the case with regard to the vulnerability to climate impacts, states most vulnerable to the energy transition are predominantly on the African continent (Fig. 6).[108]

On the other hand, the growing trade ensuing from the energy transition provides opportunities, especially for those countries that, firstly, have a share of the clean energy technology markets, secondly, have reserves of certain mineral raw materials, or, thirdly, can produce renewable electricity cheaply.[109] Global trade in clean energy technologies, their intermediate products and certain minerals needed for their production will continue to increase strongly in the period up to 2040, while international trade in hydrogen and its derivatives will emerge.

For Germany, whose energy demands up until 2040 will shift away from oil and gas to electricity and hydrogen, there will be both opportunities and risks when it comes to shaping the country's future trade relations, including in the emerging international trade in hydrogen, for which Germany and the EU will be a major centre of demand.[110] Risks for Germany lie in particular in inadequate diversification in terms of sources across the whole range of renewable energies. Opportunities for Germany lie above all in exploiting its potential in the development and export of clean energy technologies, for instance hydrogen technologies or smart grid technologies.

3.2 Increasing competition for clean energy technologies and mineral raw materials

There is increasing competition for market shares in the growing markets for clean energy technologies and for access to mineral raw materials. Compared to other countries, Germany started investing in the energy transition early, and with the EU is among the pioneers in the development of many green technologies.[111] However, in many instances the EU has lost its initial market lead to China – for example in solar PV, but also in (onshore) wind turbines and (alkaline) electrolysers.[112] China operates a comprehensive system of technology and know-how transfer to realise its ambitious industrial policy, acquire expertise from the German research community or gain access to technologies, know-how and intellectual property – from targeted company acquisitions to research collaboration to espionage.[113]

Today, China dominates many of the complex supply chains for clean energy technologies and is itself both the biggest market and the biggest exporter; green technologies are the largest driver of China's GDP growth.[114] The (over-) production capacities in China and the resulting lower prices have squeezed out competitors, but also helped to massively reduce the costs of technologies for the global energy transition. There is a resurgence of industrial policy in various countries – particularly in China but also temporarily in the United States with the Inflation Reduction Act – to promote the national production of technologies such as lithium-ion batteries for use in electric vehicles or mineral raw materials.

3.3 Risks for German energy security are changing

The energy transition is leading to the electrification, decentralisation and digitalisation of our energy systems. In the period under consideration, up to 2040, supplies of both fossil fuels and – a new factor – hydrogen will play a role for German and European energy security. At the same time, the risk of cyber attacks against the increasingly smart infrastructure will grow.[115] As the share of renewable energy sources in the energy mix increases, so does the importance of technologies like solar PV, wind turbines and electrolysers for energy security. Germany's electricity supply will increasingly be embedded into the European electricity supply through the expansion of cross-border electricity transmission links via interconnectors. All in all, the energy transition is likely to reduce the energy supply risks in Germany.[116]

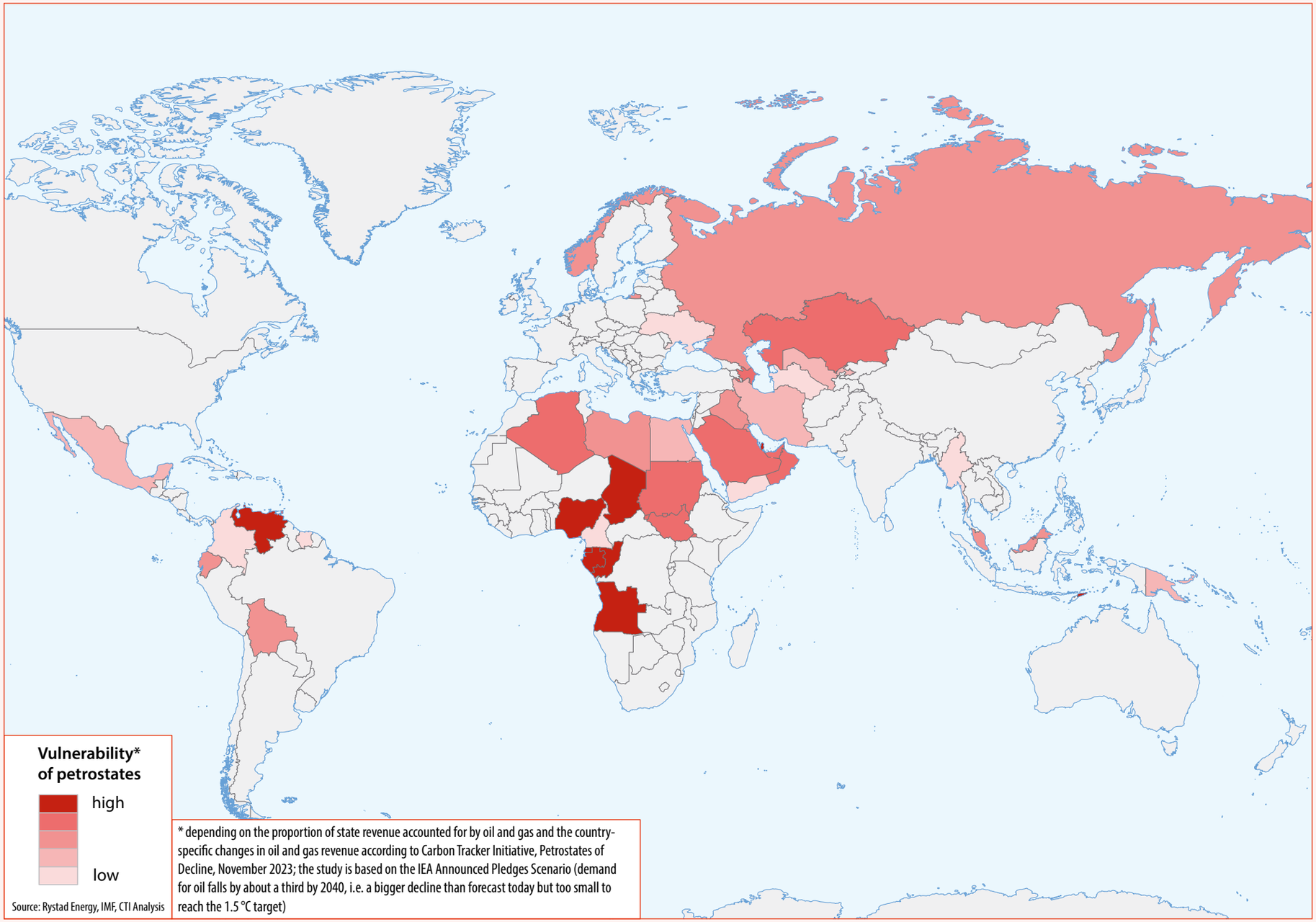
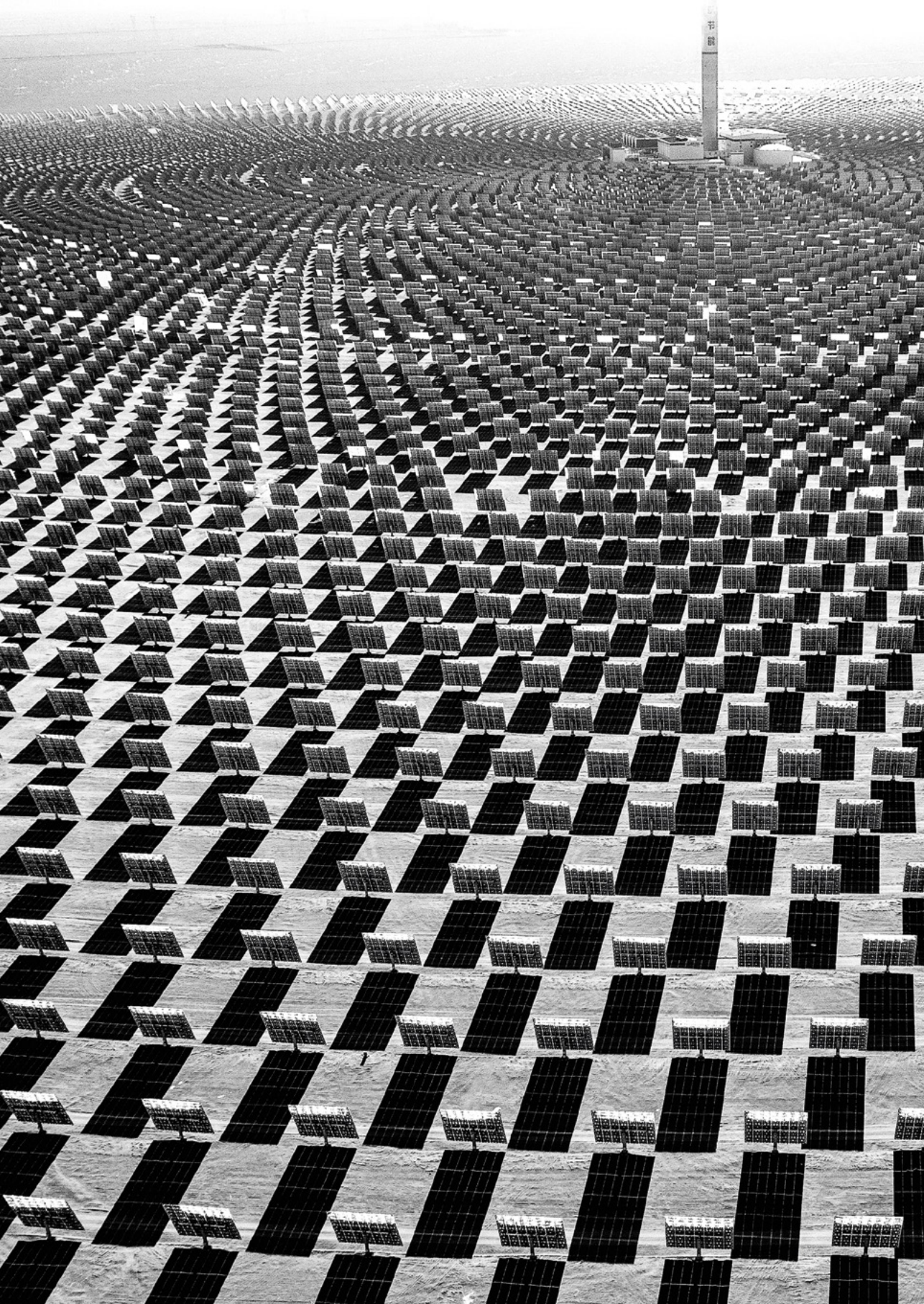


Fig. 6

African petrostates in particular are vulnerable in the context of the global energy transition



Chapter 4

Climate policy interacts with fields of conflict in international policy

Even though the energy transition is moving forward in Germany, the EU and worldwide, the goal of the Paris Agreement – to limit global warming to well below 2 °C and if possible to 1.5 °C – is not going to be met as things stand. The Federal Government's Council of Experts on Climate Change currently assumes that Germany will not achieve its ambitious climate targets with existing climate policy.[117] The EU, too, will fail to reach its climate goals unless it further refines its climate policy.[118] In global terms, the expectation at present is that the average surface temperature will increase by approx. 2.7 °C compared to pre-industrial levels by the end of this century.[119] If the international community as a whole does not succeed in stepping up its climate policy, not only would more severe climate impacts and climate risks become inevitable, but the erosion of the international order would be accelerated. Should the effects of climate change assume dramatic dimensions and tipping-points be reached, the risk that individual states will implement geoengineering measures unilaterally and without regulation, despite the associated dangers, will increase.

4.1 Hesitant climate policies contribute to the erosion of the international order

Almost every country in the world (195 out of 198 Parties) has committed to the Paris Agreement with universal application and obligations under international law. The Paris Agreement emphasises the principle of joint but differentiated responsibilities. In practice, however, there is substantial resistance to ambitious policies at the climate negotiations. Both petrostates and sub-state actors with interests in the oil and gas sectors continue to push back against the shift away from oil and gas. The path dependence in the economic systems and the reluctance to embrace change are considerable.

"The Federal Government's Council of Experts on Climate Change currently assumes that Germany will not achieve its ambitious climate targets with existing climate policy."

Those who profit from the fossil era – not only international or national oil and gas corporations, but also industrial companies dependent in a broader sense on fossil energy – are trying to counteract the transformation by influencing public opinion and policy.[120] Virtually all the major oil, gas and coal producing countries – including industrial countries with ambitious decarbonisation goals – are planning to expand production even though this runs counter to their net zero targets.[121]

However, the slower the progress on decarbonisation and the provision of support for the hardest-hit is, particularly on the part of the industrial countries and despite available solutions and resources, the less countries might eventually feel themselves bound by the Agreement. Confidence in the feasibility of the transition to a climate-neutral global economy would be lost, and the legitimacy and effectiveness of the rules-based international order based on binding treaties and agreements would be cast further into doubt. In the end there would be not only a potentially more unstable world, but also one in which Europe could exert less influence on global events. Such a development would, by contrast, be of benefit to actors who even now are already undermining the United Nations system and the entire rules-based international order. International cooperation – and thus also globally effective climate policy – would be made even more difficult.

4.2 Pressure grows on great powers, too

Major powers such as the United States and China are also vulnerable, for example owing to their dependence on food imports or their coastal economic centres' increasing susceptibility to floods and storms.[122] China, the United States and India are particularly exposed to the risk of damage caused by more frequent extreme weather events.[123]

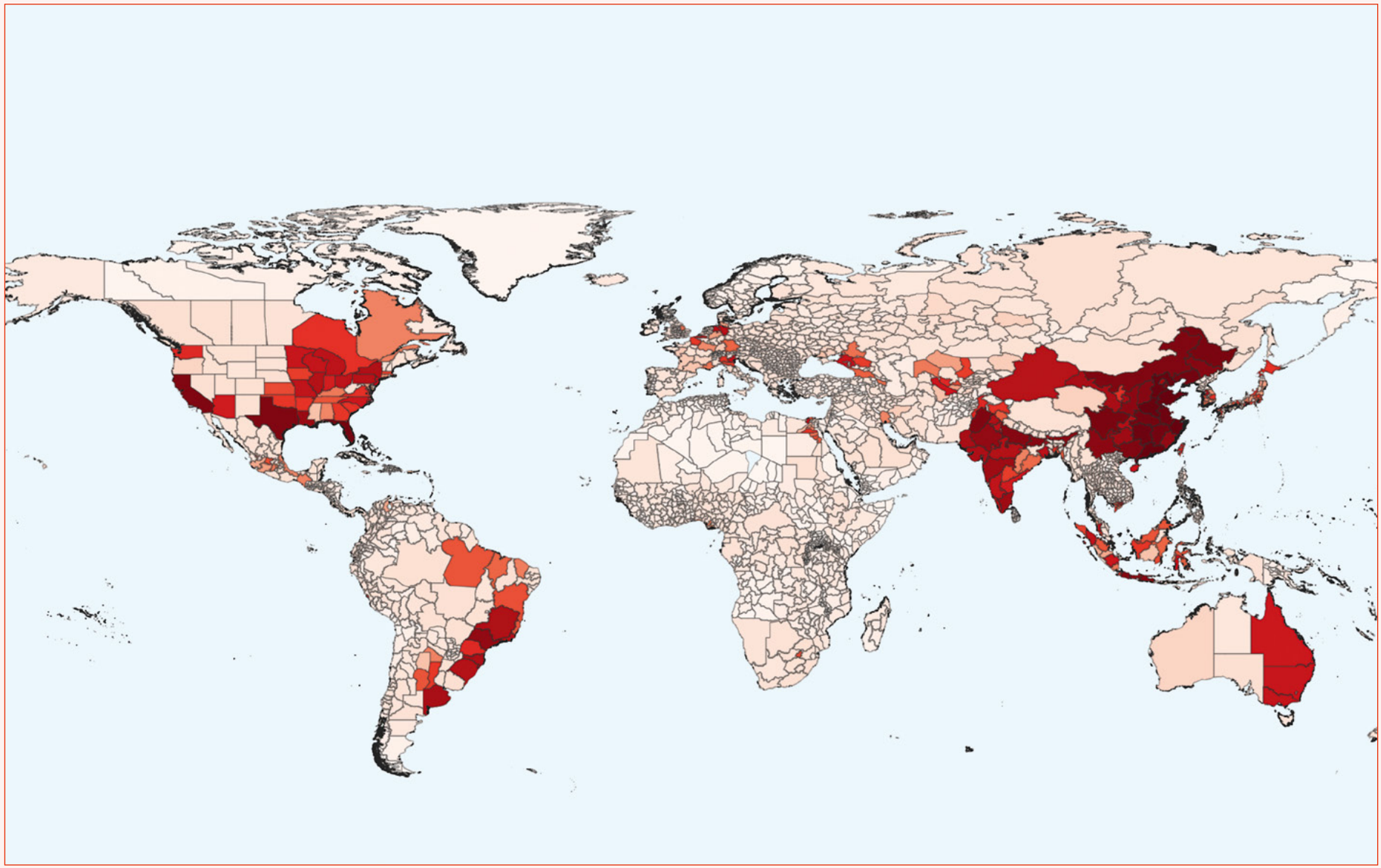


Fig. 7

Sharp regional increase in climate change-related damage risks by 2050 due to more frequent and more severe extreme weather events
The ranking of provinces and states is based on an index of damage risks to existing assets (**darker red = higher risk**). Regions with extensive residential, industrial, or commercial areas near rivers and coasts face a particular threat of material losses. Lower Saxony is the federal state with the highest index in Europe. | Source: XDI Gross Domestic Climate Risk Report 2024

As the promise of prosperity is a substantial factor underpinning the political legitimacy of major powers, too, even they can be affected by a weakening of state authority. Drastic climate impacts on major powers will indirectly be felt worldwide, because the major powers help shape the stability of the international system via global power projection and the provision of public goods.

In addition, major powers are in competition for raw materials and new spaces. One such space of relevance from Germany's and Europe's perspective is the increasingly ice-free Arctic, as a shipping route and potential resources exploitation area.[124] All in all, the military, political and economic significance of the Arctic will further increase in the foreseeable future. For Russia, a northern flank that is no longer protected by the ice is a danger in this context, as opposing armed forces could then act from the sea domain on opening sea routes and could restrict Russia's economic exploitation of the Arctic. This is why Russia has for some years now been expanding its military presence and activities in the Arctic. At the same time, Russia's ability to impair the northern shipping route in the Northwest Passage – and as it is in the Northeast Passage – poses a growing strategic challenge for Germany and its allies.[125]

4.3 Geoengineering as a new area of conflict: Aerosol injection as an example

In the light of the worsening climate crisis, one scenario that has potentially serious security implications is the use of certain geoengineering technologies. A lack of confidence in the global implementation of the climate goals, the approach of irreversible tipping-points (e.g. the AMOC collapse referred to in the section on the natural science background), or other political and economic interests are factors leading to the consideration of methods such as solar radiation modification. However, there are great uncertainties about the climate physical effects and the socio-economic implications of these technologies,[126] meaning it would be undesirable to implement them without prior global agreement.[127]

The growing discussion focuses on stratospheric aerosol injection (SAI), whereby a fleet of aircraft yet to be developed would introduce particles (aerosols) into the stratosphere at a height of over 10 km. Roughly comparable to a large-scale volcanic eruption, the aerosols would reflect a proportion of solar radiation back into space and thus have a cooling effect on the climate system. The development of SAI would bring enormous risks for the climate system and for geopolitics.[128] Because, unlike the energy transition, this approach would not combat the actual cause of climate change (the concentration of greenhouse gases in the atmosphere), but would merely tackle one symptom (the increase in global mean surface temperature). The climate with SAI would not be the same as that in a world without further climate change. Studies indicate that precipitation patterns would shift and, as a result, further affect crop yields, for example.[129] Thus the deployment of SAI, not least depending on how it is deployed, would mean that some countries would be relative losers and others relative winners. Given that international consensus appears unlikely, geoengineering initiatives by individual actors could, if the burdens are not shared, exacerbate inter-state conflicts.[130]

"Without social balancing mechanisms and targeted social support for particularly hard-hit and / or vulnerable groups, the necessary step of raising the cost of environmentally damaging behaviour will heighten the risk of social inequality."

Chapter 5

Climate policy involves domestic policy risks for Germany and the EU

In most states, even those pursuing an ambitious climate policy, the course and speed of decarbonisation is the subject of tough political contestation. If climate policy is not economically viable and socially responsible, there is a danger that domestic political conflicts will heighten, that society will become jaded with the transformation [131] and that sections of the population will be radicalised, which external actors will in turn use for disinformation campaigns. Within the EU, too, unfair burden-sharing is becoming a challenge. [132]

5.1 Climate policy and the dilemma between time pressure and the support of society

Within Germany – as in other EU states – the burdens of the climate crisis are unevenly shared. This weakens social cohesion. [133] A purely market-based climate policy with no corresponding social balancing mechanisms is in danger of exacerbating inequality, because price increases resulting from carbon pricing reduce the purchasing power of poorer sections of the population, and these groups have to bear a disproportionately large share of the adaptation burden. [134] Without social balancing mechanisms ("climate allowance/*Klimageld*") and targeted social support for particularly hard-hit and/or vulnerable groups, the necessary step of raising the cost of environmentally damaging behaviour will heighten the risk of social inequality and further the divisive narrative that climate action is policy for the elite far removed from reality. This creates the potential for tensions within society which is not conducive to the timely implementation of climate policy. This leads to social conflicts and offers an open flank for disinformation campaigns by external actors via hybrid attacks that undermine democracy. [135]

The governments of Germany and other EU Member States as well as the European Commission will find themselves confronted with ever more difficult dilemmas combined with increasing time pressure:

on the one hand, they need to drive forward on climate policy, without damaging their own competitiveness and losing their own prosperity – and thereby losing the support of their populations and upsetting social peace. On the other hand, they have to rapidly demonstrate progress on climate action and economic success so as not to lose their international credibility and thus their leverage in climate negotiations with other states. If Germany and the EU were to slacken in their efforts, it would not only endanger work to avert the catastrophic effects of climate change at global level, it would also hand over the lead in the green transformation entirely to China – which is already the biggest supplier of green technologies anyway. If climate policy is not implemented in good time in Germany and the EU, the scope for shaping long-term prevention measures will also shrink, because acute natural disasters will absorb more and more political capital and financial resources.

5.2 Transformation as a point of attack for extremist actors

Even now, climate change and climate policy are leading to polarisation and, in some cases, to the radicalisation of individuals and groups. Climate change is being instrumentalised across a range of ideologies, and false information is being spread about the effects of climate policy decisions. Extremist actors are focusing particularly on young people, who are especially easy to reach, given their great affinity for social media. Hybrid operations aimed at influencing climate policy are also conceivable.

Right-wing populists and right-wing extremists – not only in Germany – are instrumentalising the fear of change and of losing individual and collective status felt by certain sections of the population and specific social milieus in connection with the green transition in order to stoke a broader voice of protest and attract these groups to their own ideas. The repercussions of this can already be seen in many countries, furthering polarisation. Sections of the right-wing extremist scene have for decades been spreading the narrative that it is not the effects of climate change that are responsible for the challenges being faced by countries of the Global South, but merely overpopulation, destruction of the environment and scarcity of resources.[136]

Within the heterogeneous spectrum of actors furthering the anti-constitutional delegitimisation of the democratic state, there are many who cast doubt on the very concept of climate change, presenting it simply as yet another conspiracy of the elites intended primarily to further cement their "rule and control" over the population. As a result, climate action measures are often woven into the overarching narrative of increasing, undemocratic state repression, and are therefore rejected.[137] The more the energy transition advances – and the stronger the population's fear of change – the more it becomes a suitable canvas for this delegitimisation narrative. This impairs and slows down the transformation, with all the greater consequences in future. In the context of this phenomenon, while some individuals may acknowledge the existence of climate change, at the same time they fundamentally reject any responsibility for it: this then includes a refusal to alter anything of their conventional CO_2-intensive lifestyles, as well as a refusal to take in refugees.[138]

The left-wing to extreme left-wing spectrum, by contrast, views the government's action to combat climate change as inadequate. Further radicalisation following a failure to take action against climate change is likely. Individuals and groups around the world are already responding with civil disobedience going as far as violent resistance with attacks, including against companies they hold responsible.

"If Germany and the EU were to slacken in their efforts, it would not only endanger work to avert the catastrophic effects of climate change at global level, it would also hand over the lead in the green transformation entirely to China."

These attacks are frequently accompanied by demands for a radical overhaul of the economic system, because the capitalist system is often viewed as the cause of climate change and the reason for inadequate measures to curb it. This argument, it might be pointed out, is also used by Islamist actors to propagate the uselessness of the existing system in comparison to the "Islamic" system.[139]

5.3 Tensions as a result of climate change impacts and climate policy in the EU

The burden of climate impacts will probably be unequally distributed within the EU and increase inequality in the EU as a whole. While programmes for joint disaster response like the EU Civil Protection Mechanism have proved their worth, the burden-sharing mechanisms within the EU are still too limited to offset the huge effects of the climate crisis in a spirit of solidarity.

Spain, Italy and France are currently the worst affected by drought in absolute figures.[140] The EU Mediterranean states in particular are at risk of increasing economic losses in future as a result of the effects of climate change on the one hand and political instability in their geographical vicinity on the other.[141] Lower profits in agriculture and tourism will go hand in hand with job losses and a lack of prospects in rural areas in southern Europe and, if there is no investment in alternatives, will result in increased migration to the north. This will increase tensions in the countries themselves and create potential for conflict within the EU, diminishing the potential for joint action.

“The climate crisis amplifies a trend that has been observable for at least 10 years, namely that the level of conflict in the international system is increasing overall.”

Conclusion

We are already living in the climate crisis. This brings substantial security risks at global and national levels. Owing to the inertia of the climate system, climate impacts and climate risks will unfold up until 2040 and far beyond, even if we are able to reduce greenhouse gas emissions globally at a much faster rate than currently predicted.

There is a complex interplay between climate change and other global trends and context factors. Climate change exacerbates existing negative trends and also acts as a multiplier or generator of risk. The National Interdisciplinary Climate Risk Assessment focuses on selected risks that are being caused or heightened (in part) by the impacts of climate change and that are relevant to Germany's security. While seeking to overcome the climate crisis through emissions reduction, adaptation and resilience-building, it is imperative that we do not lose sight of other context factors. For example, the increasing global need for resources – in the wake of population and economic growth – is resulting in environmental degradation, reducing the availability of these goods, especially water and fertile ground. The competition for natural resources is taking place in a context of inequality in and between countries, where, particularly in fragile states and regions of the world, there is a lack of legitimate institutions to balance interests and regulate conflicts. The climate crisis interacts with these factors as well as with the increasing geopolitical competition and the erosion of the rules-based international order. This creates the generally more uncertain geopolitical environment of the 21st century that brings about many different security risks, including for Germany (Fig. 8).

The climate crisis amplifies a trend that has been observable for at least 10 years, namely that the level of conflict in the international system is increasing overall. According to the United Nations, the number of violent conflicts was already higher in January 2023 than at any time since the end of the Second World War. Furthermore, the probability that wars that are stopped will break out again within a year is increasing. In 2022, there were 55 active conflicts around the world, that had lasted an average of between eight and eleven years – a clear rise over the 33 active conflicts a decade before that lasted an average of only seven years. [142]

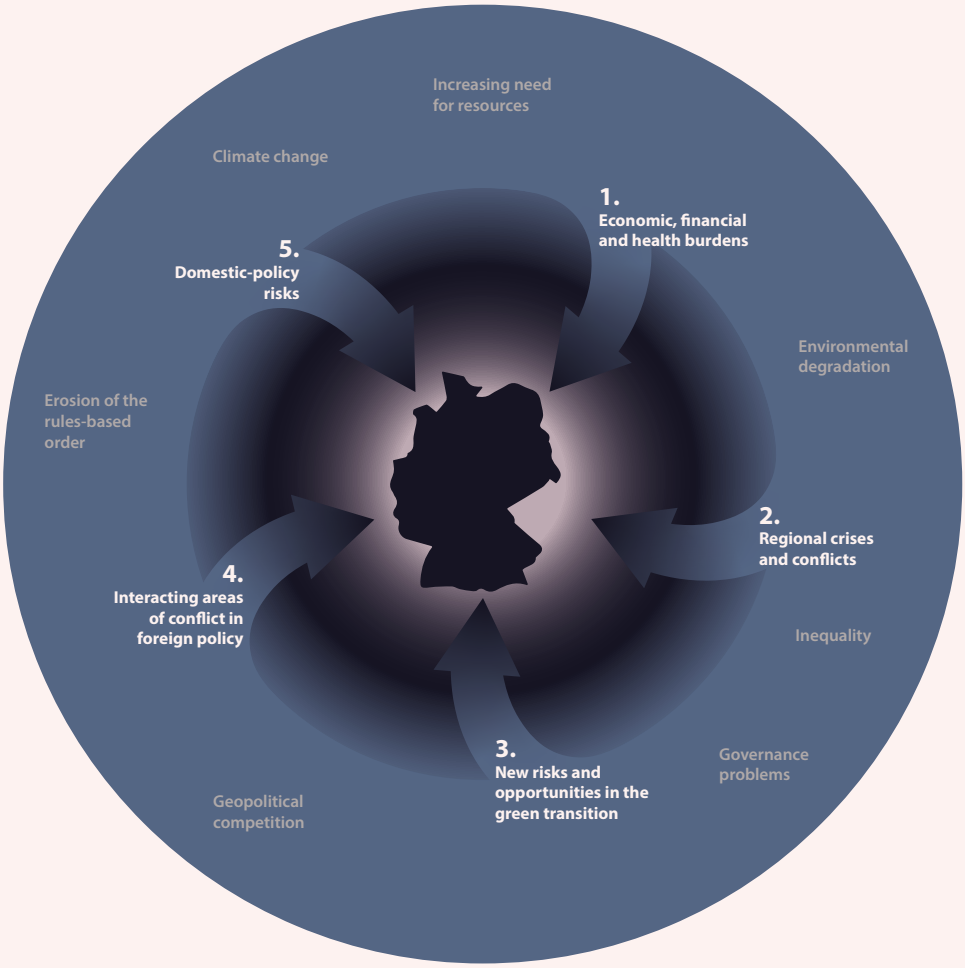


Fig. 8

The climate crisis in the context of the polycrisis: effects of climate change exacerbate other problems – and vice versa

"The example we set is also important to show that rapid decarbonisation is not only possible, but can also be of economic benefit."

The concept of the *Zeitenwende*, or "watershed moment",[143] that became manifest in politics in response to Russia's invasion of Ukraine, here broadly understood as the end of certainties regarding the conditions for peace and prosperity and as a phase of fundamental change to which Germany must adapt, is also an appropriate expression in connection with the climate crisis.

The National Security Strategy responds to this with the triad "robustness, resilience and sustainability". Robustness includes strengthening the Bundeswehr and adapting our armed forces to altered climate conditions at home and abroad. Resilience includes civil-military cooperation and subsidiary support for civil defence and civil protection, because extreme weather events and natural disasters endanger the people's security and property, threaten Germany's economic prosperity and lead to disruption in critical infrastructure and in public life. Finally, sustainability includes tackling the crises facing the global climate, biodiversity and ecosystems in order to ward off risks such as endangered livelihoods and pandemics, which in turn impact on the global, regional and national security environment.

As stated in the Introduction, the task of the Federal Government is to "arrive at informed choices of action" on the basis of the National Interdisciplinary Climate Risk Assessment. It is not the task of the authors of this assessment to provide an equally systematic list of opportunities or to come up with concrete recommendations for action. However, the consortium comprising research institutions and the Bundesnachrichtendienst does feel that four areas of action can be highlighted in the context of dealing with risks. These involve combining emissions reduction and adaptation on the one hand and domestic and foreign policy approaches on the other:

1. **Implementing decarbonisation at national and European levels quickly and in a socially responsible manner:** This is necessary first to ensure that our national security is not further endangered by our own actions in the form of an additional increase in greenhouse gases. Above all, however, it is necessary in order to enhance our own international credibility and thus to be able to influence other actors to undertake greater efforts to minimise the shared risk. The example we set is also important to show that rapid decarbonisation is not only possible, but can also be of economic benefit.

2. **Driving forward an ambitious climate policy at international level:** The majority of security risks associated with the climate crisis are, in the end, a function of global emissions, of which German and European emissions account for only a small proportion. This does not mean that they are insignificant; it does mean, however, that an ambitious climate policy from other (bigger) states is an absolute prerequisite for managing the risks. If we are to conduct effective climate diplomacy, we need to lead by example by decarbonising our own economy, as stated in 1 above. Economic competition for new technologies and the danger of otherwise being left behind in economic terms can be motivation for international decarbonisation. Moreover, offers of ambitious international cooperation in the transition can help tempt major and growing emitters to shift to an ambitious course of transformation as quickly as possible, a move which they have hitherto rejected owing to (perceived) economic risks and the injustice of historical responsibility for greenhouse gas emissions.

The first two areas of action refer to efforts to avoid the expansion of the problem in the form of greenhouse gases further accumulating in the atmosphere, in other words to avoid perpetuating the climate crisis depicted in Fig. 1 as an infinite loop. The related goal is to lessen the existing and currently rapidly growing climate risks and to stop their increase in the medium term (post-2040). National and international emissions reductions are a necessary precondition, but not an adequate prerequisite, for national security. The existing and foreseeable risks demand huge adaptation efforts so that they cause as little damage as possible to Germany's security. This, moreover, conditions the other two fields of action:

3. **Adapting to the effects of climate change in Germany in all social spheres in order to enhance socioeconomic resilience and thus lessen the impact of climate change:** This applies to the physical infrastructure, the "hardware", but also to the "software", of our society. If sections of the population (e.g. in agriculture or in coastal regions) are particularly affected by climate change or by climate action policy, there need to be mechanisms to ensure a fair balance and to reduce the potential for conflict. Resilience also implies the availability of adequate expertise and means to provide appropriate assistance in case of need. Enhanced cooperation on disaster prevention and relief at EU level would produce synergies.

4. **Supporting international stability and resilience:** It is also in Germany's interests to mitigate the impact of climate change beyond its borders. If adaptation outside Germany does not progress fast enough, Germany too will be affected due to global interdependencies – be it through disrupted supply chains or through destabilisation and conflicts on Europe's periphery. Germany must prepare itself for these costs and risks or – and this would be even better – help reduce them through prevention measures. Alongside adaptation of the infrastructure, this support comprises governance mechanisms – for instance, with an eye to the issue of how food security can be further strengthened globally. Another benefit of this type of engagement: demonstrations of international solidarity can also have geopolitical (or, within the EU, European) advantages, because as well as reducing indirect risks they might also go some way to balancing out historical injustices or the relationship between emitters and those affected. With support for adaptation abroad, too, Germany can dispel one key political argument that poorer countries use to justify a less developed sense of ambition in climate policy.

All in all, dealing with climate risks via the four areas of action brings more advantages than costs. A successful transition affords tremendous opportunities for increased growth and prosperity. Thus ambitious climate policy not only cuts the climate security risks resulting from it: a study published in 2025 on the macroeconomic consequences of climate change concludes that investments in emissions mitigation generate benefits from avoided damages amounting to at least five times the initial investment.[144]

The latest IPCC report estimates that the benefits of lower air pollution alone resulting from emissions reductions will reach a similar economic magnitude as the related costs (and might possibly exceed them).[145] The EU would benefit hugely: in 2021, more than 250,000 people here died prematurely as a result of air pollution.[146] This number proves the massive cost of the status quo and at the same time – as soon as one compares it with the over 390,000 premature deaths attributable to air pollution recorded in 2011 – underlines the potential of ambitious environmental policy.[147]

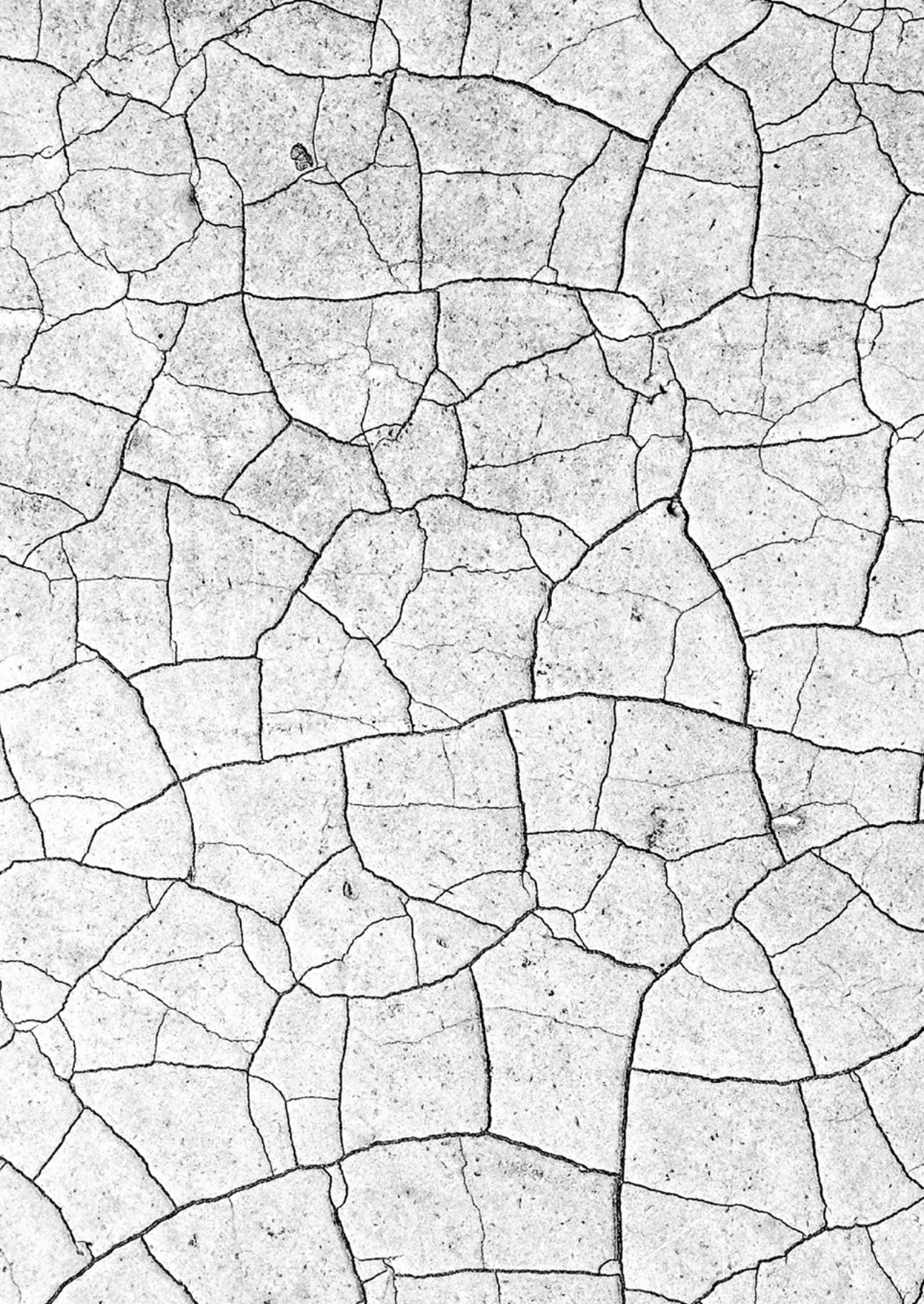
The areas of action sketched out above should not, therefore, be considered only in terms of the associated challenges and costs. Rather, they represent investments leading to welfare gains. What is not "saved" now through successful mitigation and adaptation will cause exponentially higher costs in the years and decades ahead. This is true both of decarbonisation and the energy transition and of the development of national and international resilience.

At the same time, ambitious climate policy, and the technological advancements it brings, can help Germany and Europe to gain an advantageous position in major global markets of the future. Moreover, declining dependence on oil and gas would not only strengthen Germany's security through fewer weaponisable interdependencies, but also cut off income sources for state actors with revisionist and aggressive goals who derive their power from fossil fuel exports.

Naturally, this is not a comprehensive picture of all the opportunities inherent in the transformation. What is crucial is that there is no conflict of goals. The

"It is also in Germany's interests to mitigate the impact of climate change beyond its borders."

possibilities for seizing the opportunities must be sought in the same place as those for reducing the risks imposed by climate change, risks that at present are still increasing. The longer the resolute pursuit of this course is put off, the smaller will be the room for manoeuvre, because the climate crisis will intensify and soak up more and more political capital and resources. In short, taking into account the expected economic, environmental and security policy consequences, there is no reasonable alternative to prevention. **Anyone thinking about security needs to think about climate as well.**



Endnotes

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Publishers

Consortium National Interdisciplinary Climate Risk Assessment, consisting of:

Metis Institute
for Strategy and Foresight
(Consortium leadership)

adelphi research gGmbh

Bundesnachrichtendienst
(Federal Intelligence Service, BND)

Potsdam Institute
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Editorial deadline

November 2024 | Updated: February 2026

Supported by

Auswärtiges Amt

Bundesministerium der Verteidigung

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Zum Staunen*
SciComm Creative Studio

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“Anyone thinking about security needs to think about climate as well.”