



Metis

Study

Scenarios:

**Effects of climate change on
Bundeswehr missions**

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Summary

This study discusses the security implications and effects of climate change on future Bundeswehr operations. To this end, the study draws on and combines scenarios published by the Intergovernmental Panel on Climate Change (IPCC) on emission-induced climate change as well as the associated processes of socio-economic transformation to

create three reference scenarios that describe different climate-related operational scenarios. On the basis of the different development pathways of these scenarios, future challenges resulting from climate-induced operations are outlined and recommendations for action for the Bundeswehr are derived.

Effects of climate change

Climate change has far-reaching consequences for fundamental physical processes on this planet. The effects of global warming range from rising sea levels to glacial melt and coastal erosion. There is also a trend toward more frequent, severe and longer-lasting extreme weather events such as floods, forest fires, droughts and heat waves, storms and heavy rainfall. Whether it will be possible to limit global warming to 2°C by the end of the century remains to be seen. The regions and countries that already suffer most from these climatic changes are the ones that are also the most economically disadvantaged in the world. The availability of and access to clean drinking water has also deteriorated as a result of climate change.¹ Lack of clean water also has a strong impact on all aspects of food security. Rising temperatures lead to an increase in the spread of pathogens and climatic conditions that threaten food production. Countries of the Global South already affected by food shortages are thus faced with additional political and economic instability as well as transnational distribution conflicts and famine.² The idea of wars being fought over water has

attracted much media attention in recent years. However, research on cross-border water management has shown that states are not yet fighting over water sources with military means. It remains to be seen whether this will continue to be the case.

Security implications of climate change

Any strategically oriented policy for climate adaptation, security or the economy for the period until the mid-21st century must consider that even if global warming is limited to 1.5–2°C, the conditions and resources necessary to sustain life will deteriorate in particularly vulnerable regions. Climate change thus creates risks to human security and to political and economic stability. There are complex interdependencies and feedback loops between these dimensions, which make it difficult to isolate the effects of climate change on a single security area. Environmental changes and climatic influences in fact reinforce existing security challenges that stem from a complex web of social, political and economic factors. Climate change particularly affects those regions of the world that have long been suffering from state fragility, overpopulation, the threat of food insecurity, water scarcity and desertification. It reinforces existing negative trends and further jeopardises regional stability and global security. Climate change thus has implications for security policy which affect possible operational scenarios for armed forces.

¹ See "Food and water scarcity — A key factor in future conflicts?", Metis Study No. 6 (June 2018).

² See "Africa — a continent on the rise?", Metis Study No. 10 (February 2019).



— *Climate-induced violent conflicts*

Climate change is increasingly seen as a trigger or threat multiplier that drives existing trends, tensions and instability. So far, there is no direct causal chain between extreme weather events, climate change and violent conflicts. Most research has found no statistical evidence that climate change has directly triggered forms of violent conflicts such as civil wars or armed conflicts at state or national level. It is rightly pointed out, however, that climate change reinforces existing conflict lines both at the international level and the domestic (between ethnic and religious groups or between economic interest groups) and that it creates new causes of conflict. Studies also show that low-intensity distributional conflicts due to climate change are growing in intensity and number. This is particularly true where state measures or humanitarian aid after a disaster are perceived to unfairly favour the needs of elites to the detriment of other parts of society. If, for example, economic growth per capita deteriorates as a result of climate change, this may indirectly lead to local conflicts. These include national and bilateral border conflicts over control of fertile regions, water and food sources but also national distribution conflicts in countries with already weakened state structures. For example, interstate territorial conflicts as well as substate conflicts manifested as Lake Chad shrank. A militarised interstate dispute between Chad and Nigeria over the status of some islands that had emerged as a result of the lake's recession caused 84 fatalities. The conflict ended only after a settlement between the two countries was reached. Persisting legal ambiguity has continued to spark interstate competition over natural resources in the region, however, while insurgent groups such as Boko Haram exploit the power vacuum that results from the legal grey area surrounding the islands. In this way, transnational terrorist groups on Lake Chad exploit bilateral conflicts to establish their bases of operations in hospitable regions — and climate change laid the groundwork. Nigeria's example also illustrates how climate change induces substate conflicts. Deteriorating environmental conditions, water scarcity, desertification and soil degradation have prompted the herders of northern Nigeria to change their seasonal migration routes. Access to the pastures and watering places of central Nigeria became essential for northern herders. These changes in seasonal pastoralism, or transhumance, brings the herders into direct confrontation with local farmers in central Nigeria — confrontation that has caused more than 20,000 deaths and forced hundreds of thousands of people from their homes since 1999. In addition, a decline in habitable zones leads to increased migration, which may result in transnational conflicts or global humanitarian crises.

— *The fight for raw materials and new sea routes*

International distribution and resource conflicts are already increasing as a result of climate change.³ Fossil economies have incurred enormous sunk costs in the area of fossil energies and industries and therefore depend on exploiting their investments. In order to politically slow down the decarbonisation of international economic policy, large fossil powers are blocking access to raw materials, which could lead to the formation of political and economic blocs between “green” major powers and fossil-based ones. Green technologies also depend on special minerals and rare earths.⁴ Most of these are found in the most fragile states of Africa, Latin America and Asia. About 73% of the world's deposits of graphite, 76% of selenium, 70% of cobalt, 67% of tellurium and 70% of molybdenum are found in highly fragile or disintegrating states. In combination with the effects of climate change, these fragile states will likely fall into established conflict patterns surrounding raw material extraction. War-economic developments are also likely to result from a green transition and the associated global run on rare minerals in Africa and Asia. Climate change also opens up new sea routes and raw material sources in the Arctic and the Arctic Circle. Here, too, bilateral conflicts over maritime borders and restrictions on the freedom of sea routes are foreseeable.

— *Climate migration*

Reduced economic opportunities in regions affected by climate change fuel migration flows. Migration takes a variety of different forms: international or national, permanent, circular or temporary, voluntary or forced. Gradually developing disasters, such as the rise of sea levels, which render habitats unlivable are a reason for permanent migration, while short-term extreme weather events lead to temporary movements. Locally recurring extreme weather events, such as droughts or monsoons, further intensify ongoing migration flows. Various triggers of migration such as social, economic or environmental aspects are amplified by climate change. Deteriorating environmental or climatic conditions alone are currently not a compelling reason to leave one's home. It also remains uncertain how well the developing countries will respond to the challenges of climate change in the future. A straightforward correlation between climate change and migration cannot currently be established because of the wide range of possible motivations and different types of migration. Nevertheless, we can expect climatic changes

³ See “Increasing competition for resources — What are the implications for security?”, Metis Study No. 9 (November 2018).

⁴ See “Armed forces and the European Green Deal”, Metis Study No. 23 (February 2021).



to become a much stronger and thus absolute reason for migration in the future. In certain scenarios, coastal areas and islands will become uninhabitable due to rising sea levels and areas close to the equator will become unlivable due to heat and water shortages. In both cases, people will be forced to migrate.

Basic scenarios for emission-induced climate change

In 2014 and again in 2022, the Intergovernmental Panel on Climate Change (IPCC) published Assessment Reports that outlined several scenarios for the possible development of emissions-induced climate change. These scenarios were presented as Representative Concentration Pathways (RCPs) and describe four different paths for the development of the global average temperature in the 21st century. The RCPs represent plausible scenarios (see Figure 1) for the effects of both emissions and emission reduction and are based on a broad spectrum of scientific literature.

- RCP 2.6 assumes that global annual greenhouse gas emissions will peak sometime between 2020 and 2040 and then decline.
- RCP 4.5 assumes that emissions will peak around 2050 and then stagnate.
- RCP 6 assumes emissions will peak around 2100 before stagnating.
- RCP 8.5 assumes that emissions will continue to increase unchecked.

For the IPCC's Assessment Report 6, Shared Socio-economic Pathways (SSPs) were developed to complement the RCP scenarios. The SSPs outline five scenarios:

- SSP1–1.9 describes a green sustainability scenario in which the global commons are preserved, economic growth is coupled with environmental protection, and global consumption is less resource- and energy-intensive.
- SSP1–2.6 steers a middle course of continuing the current development. International cooperation continues to develop but has limited effects overall. Population growth remains moderate and stagnates around 2050 while environmental systems experience a certain level of degradation.
- SSP2–4.5 assumes that competitiveness and regional conflicts will overshadow global issues. Investment in technological developments declines while social inequalities increase. On a global scale, issues of environmental protection fade into the background.
- SSP3–7.0 assumes great global inequality. Cooperation between developed societies and less developed states decreases. Environmental policy is increasingly dictated by economic necessities and focuses on issues that benefit the elites.
- SSP5–8.5 continues the current fossil development. Economic growth continues to be based on fossil fuels and is characterised by high energy intensity. The global economy continues to grow, while environmental impacts are managed locally. There is a general belief that social and economic systems can be effectively managed, if necessary by geoengineering.

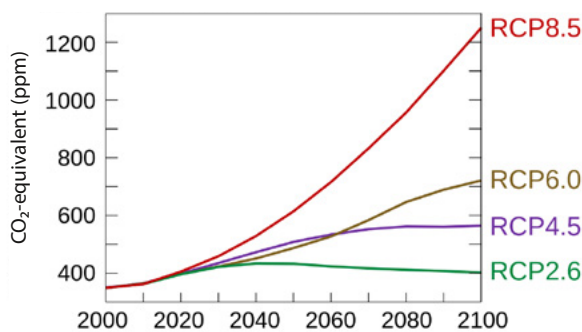


Fig. 1 Scenarios for all forcing agents' atmospheric CO₂-equivalent concentrations | Source: Wikipedia (simplified illustration), based on IPCC AR5 2014

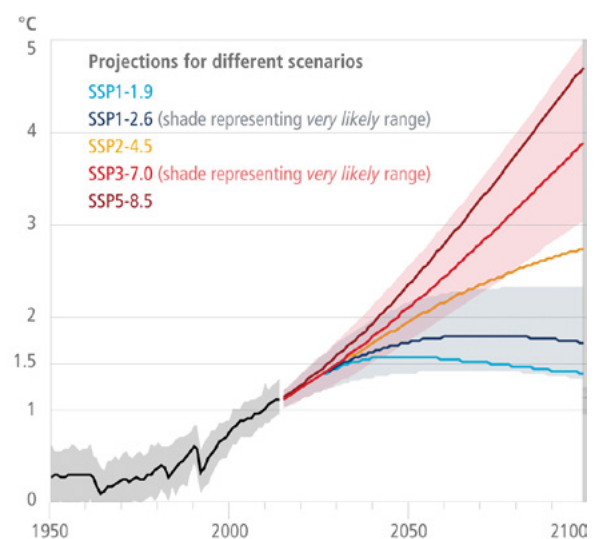


Fig. 2 Socio-economic scenarios for global surface temperature changes relative to 1850–1900 | Source: IPCC AR6 2022



Possible operational scenarios and climate change

Based on the security implications of climate change described above and a combination of the emissions-based and socio-economic development pathways, the following section outlines three different operational scenarios for the period until 2050.

— Scenario 1: African World War (RCP4.5 + SSP1–2.6)

The African World War scenario assumes that the CO₂ content in the air will exceed 500 ppm by 2050 and that the global average temperature will have increased by 2.1 °C. Under these conditions, large parts of the African continent will be affected by desertification and water scarcity. Migration movements from the Sahel to the still habitable coastal zones will increase and cause living conditions there to deteriorate as a result of overpopulation and lack of resources. This will fuel domestic and transnational violent conflicts over control of clean water sources, pastures and fertile agricultural land. Ethnic and religious conflicts, famine as well as economic distribution conflicts (such as over land for crop farming or for rearing livestock) coupled with overpopulation will combine to increase state fragility. The need for food production will lead to overfarming of habitable areas, which will be further damaged by the overexploitation of natural resources and contaminated through excessive use of fertiliser and pesticides. Off the coast of Africa, hypoxic dead zones will develop and kill off fish populations through lack of oxygen. Volatile food prices will have a serious impact on import-dependent developing countries. High and fluctuating food prices will lead to an increased risk of domestic conflicts, which will be further aggravated by factors such as poverty, urbanisation and ineffective government structures. Given these conditions, a large number of parallel, highly complex and interconnected international, transnational, national and intercommunal conflicts can be expected in Africa, which will occur simultaneously and together will form a continental world war. Many African countries will become failed states dominated by local warlords. Radical and terrorist groups will exploit the erosion of the state monopoly on legitimate force to establish areas of operations and retreat. China, Russia, the US and Europe will fight each other for access to raw materials by choosing sides in conflicts that they will thus become secondary parties to. External state and non-state actors seeking to take advantage of the weakness of African governments will use proxies to initiate regime changes, establish satellite regimes and thus gain unrestricted access to resources such as rare earths. They will also use frozen conflicts to destabilise regions less affected by climate change in order to expand their spheres of influence.

For the Bundeswehr, this scenario will translate mainly to humanitarian missions and stabilisation operations in the context of collective security organisations.

Direct confrontations with Russian and Chinese contingents will also be a possibility. Such operations will be carried out under climatic conditions that are extremely hard on both personnel and material. The armed forces will have to not only work within the scope of their mandate and in cooperation with allies to support the government, regain the monopoly on violence and enforce cease-fires but also provide humanitarian support and protect international and local civilian forces and NGOs active in the area of operations.⁵ In addition to fighting proxies and other hybrid actors such as insurgent groups who exploit climate-induced state fragility, operations to protect supply chains and sources of raw materials will also be a possibility.

— Scenario 2: Mass migration to Europe (RCP6.0 + SSPP3–7.0)

The migration scenario assumes that the concentration of CO₂ in the air will exceed 550 ppm by 2050 and the global average temperature will have increased by 2.25 degrees. Entire regions in Africa and Asia will be rendered unlivable as a result. Migration movements, which previously were caused primarily by conflict and socio-economic issues, will increasingly become a direct consequence of climate change. Millions of climate refugees will migrate toward Europe, initially becoming stranded in North Africa, Turkey, Central Asia and on the eastern borders of the EU. A multi-billion-dollar hidden economy and an informal labour market will emerge as a result of this mass migration. Organised crime will capitalise on human trafficking and exploitation while the drug trade flourishes as customs and border police become overwhelmed. Countries that border the EU will try to avert a humanitarian crisis first through national efforts, then with the financial assistance of the EU and the United Nations. Human rights violations along national borders will increase as border police attempt to prevent migrants both from entering receiving countries and from leaving them for the EU. Fragile cooperation and coordination agreements with EU neighbours to protect borders and manage the refugee and migration crisis will collapse under the weight of an ever-increasing number of new arrivals. In order to protect their own state stability, to exert political pressure on the EU and to appease their own citizens, these neighbours will then allow or force hundreds of thousands of migrants at a time to cross the border. Subversive and radical elements of terrorist groups will try to enter the EU by blending in with climate refugees and migrants.

⁵ See “New challenges for UN peacekeeping”, Metis Study No. 27 (May 2022).



For the Bundeswehr, this scenario will predominantly entail humanitarian operations. Operations to counter hybrid threats as a result of forced migration and to fight transnational organised crime at the external borders of the EU and NATO will also be a distinct possibility. Disinformation campaigns that negatively portray the armed forces and spread fake reports of human rights violations in order to influence public opinion will highlight the need for appropriate strategic communication systems. Bilateral partnerships and cooperation with EU and NATO partners will characterise the operational framework. In such scenarios, the Bundeswehr will therefore have to cooperate more closely than ever with state and international partners and improve its cooperation with civil society actors and NGOs active in the area.

— Scenario 3: Fight for Arctic resources (RCP8.5 + SSP5-8.5)

The Arctic scenario assumes that the concentration of CO₂ in the air will exceed 600 ppm by 2050 and the global average temperature will have increased by 2.5 degrees. The resulting decline in Arctic sea ice area will have opened up new sea routes that are ice-free throughout the year: the Northeast Passage between the North Atlantic and the North Pacific Ocean, along the Arctic coast of Russia, as well as the Northwest Passage, which connects the North Atlantic to the North Pacific via the Canadian Arctic Archipelago. Compared to the route via the Suez Canal and the Indian Ocean, these new sea routes will shorten the shipping route between Europe and Asia by 8,000–10,000 km. Compared to the route through the Panama Canal, the sea route will be shorter by about 4,000 km. Since shipping near the equator is exposed to more storms and higher temperatures, more and more ship owners will use these routes, although the necessary investments in ports along the routes will mean that the Arctic will only handle 20% of global maritime trade by 2050. Resources that were previously almost impossible to exploit will become accessible to mining in the Arctic. Since the Arctic contains 13% of the world's oil reserves and about 30% of its natural gas reserves, a race for control over extraction rights between local and external stakeholders will be likely. Climate change will thus increase the geopolitical significance of the Arctic. Territorial conflicts and economic zone disputes between states that neighbour the Arctic will gain in importance, while the commodification of the Arctic will facilitate the advance of foreign powers. China will try to get a foothold in the Arctic and pursue its plans for a Polar Silk Road via Russia. Against this backdrop of the increased importance of the Arctic, China and Russia will use the freedom of sea routes as leverage to assert their political interests there. By 2050, the effects of climate change will have amplified the system conflict in the Arctic to the same level of intensity as in Europe, Asia or the Pacific.

For the Bundeswehr, this scenario will translate to operations that make a conventional confrontation in the Arctic

between NATO on the one side and Russia and/or China on the other more likely in the future. These operations will take place mainly in the context of antagonism around access to resources and freedom of sea routes as well as bilateral conflicts over the 12-mile zone of territorial sea and the 200-mile exclusive economic zone. Likely scenarios will also include attacks on critical infrastructure, such as ports or drilling platforms, as well as operations to liberate oil platforms or ships.

Recommendations for action to prepare Bundeswehr operations in times of climate change

Because of the complex nature of security challenges, climate change cannot simply be addressed with existing security paradigms for risk prevention, mitigation or management. The traditional instruments for dealing with security challenges must be accompanied by a more comprehensive and climate-specific approach that expands the traditional understanding of national and regional security to include the systemic and global security aspects of climate change.

The effects of climate change on the Bundeswehr are already becoming apparent in a number of areas. Defence-critical infrastructure near the German coast will be directly affected by rising sea levels. National and collective defence as well as host nation support will continue to play a key role but will eventually be overshadowed by new priorities in the area of subsidiary and administrative assistance in disaster situations. In terms of territorial tasks, the Bundeswehr supports civilian actors when it comes to containing and managing natural disasters and large-scale emergencies and provides assistance for rebuilding efforts. In this regard, the Bundeswehr is thus already at the centre of crisis management and disaster control today, mostly as a direct consequence of climate change.

We must also assume far-reaching implications for forces on operations abroad. As described in the above scenarios, international missions will increasingly take place in regions that are more affected by the consequences of climate change. For the personnel and technology deployed on these missions, this means an increased need for training, equipment, resilience, sustainability and protection. Climatic and environmental factors must be considered when it comes to force protection, while mission accomplishment even under extreme climate conditions will play a more important role during training. The task spectrum abroad will also be substantially expanded. Disaster control, crisis management and local humanitarian assistance will also play a more important role alongside the accomplishment of mandated missions. A higher proportion of special and recovery vehicles and a growing demand for amphibious, tropical and, where appropriate, chemical, biological, radiological and nuclear (CBRN) capabilities must also be expected.



In order to be prepared for the climate-induced operational scenarios outlined above, the Bundeswehr must initiate measures to provide the capabilities needed to ensure operational and materiel readiness as well as the future task spectrum and necessary resilience.

General measures for future operations against the backdrop of climate change

- More than ever, strategic considerations must factor in climate change, for example on the basis of a relevant policy document.
- National and collective defence efforts should be expanded to include national resilience for the protection of critical infrastructure and management of natural disasters. Subsidiary assistance through administrative assistance must be a new focus at the national level.
- Besides lethality, capability and price, aspects of climatic resilience must also be considered in the procurement of equipment and materiel.
- Procurement should be based on dual-use criteria. Materiel must meet military requirements but must also be usable in the event of a disaster.
- Training and exercises must be expanded to include a climate-specific spectrum of operations so as to increase the survivability of troops on operations.
- Civil-military cooperation and coordination must be intensified at national and international levels and expanded to include aspects of agile operations and cooperation with civil society, non-state and economic actors.

Possible measures for Scenario 1 missions:

- development of multi-domain operational capabilities (military air, land, sea, space and cyber components) and their coordination with and contributions to civilian elements;
- procurement and provision of materiel and equipment that will be ready and operational even under extreme weather conditions;

- development of training components for long-term operations under extreme weather conditions;
- expansion of special operations capabilities for anti-terror operations under extreme conditions;
- creation of mission-specific coordination agencies for local actors as well as national and international NGOs to enable a holistic approach to peace operations.

Possible measures for Scenario 2 missions:

- establishment of an EU-wide response force to protect critical infrastructure;
- establishment of an EU Resilience Task Force to counter physical hybrid threats;
- improvement of maritime policing capabilities for support missions at the external borders of the EU and NATO;
- development of additional capabilities for strategic communication to counter hybrid disinformation campaigns;
- multinational cooperation to test the interaction of armed forces with EU services such as Frontex as well as local and civilian actors.

Possible measures for Scenario 3 missions:

- expansion of the deployment and supply capabilities of units in the Arctic region;
- development of military capabilities specific to the polar region for application in the context of an EU Arctic Brigade in cooperation with Denmark, Sweden and Finland – and possibly Norway – within the NATO framework;
- procurement of icebreakers and expeditionary naval capabilities for deterrence purposes or for possible operations in the Arctic;
- improvement of search and rescue as well as special operations capabilities for the protection of critical infrastructure and for hostage rescue operations in the Arctic;
- establishment of a European Arctic Command or a NATO Arctic Command.

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Cover photo: A CH-53GS transport helicopter lands in the dust as part of the Heli Dust 2018 exercise at the Upper Lusatia military training area, on 26 February 2018.
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