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Stefan Bayer and Simon Struck

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GIDS
German Institute for Defence and Strategic Studies
Führungsakademie der Bundeswehr
Manteuffelstraße 20 · 22587 Hamburg
Tel.: +49 (0)40 8667 6801
buero@gids-hamburg.de · www.gids-hamburg.de

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Prof. Dr. Stefan Bayer and Simon Struck | Führungsakademie der Bundeswehr
(Bundeswehr Command and Staff College)

The Strategic Orientation of Armed Forces in Times of Climate Change

1 Introduction

In the decades to come, climate change will be one of the key challenges for society. Although the majority of researchers agree that changing climate conditions will have negative implications for humans, animals and plants (IPCC 2014; WBGU 2007), the international efforts to combat climate change that have been introduced since the 1992 United Nations Framework Convention on Climate Change (UNFCCC) have by all accounts been more or less unsuccessful. In 2018, for example, the International Energy Agency recorded global energy-related CO_2 emissions of 33.1 Gt, which is an increase of about 60 % (International Energy Agency 2019: 7, 10) compared with 1992 levels. This development calls the effectiveness of the current global climate protection regime and the related idea of globally coordinated climate change prevention or mitigation strategies into question. This is also evident in the following quote from a statement by President Putin at the International Arctic Forum in 2017:

> In other words, global warming started back in the 1930s, but at that time, we didn't have the same manmade factors, the same emissions as we have today, yet global warning had already started. So, it's not about preventing it, I agree with those who believe it's not about prevention, I think prevention is impossible. It's related to some global cycles on earth, or even interplanetary processes. The question is how to adapt to it (Kreml 30 March 2017).

In this paper, we would like to place the emphasis on the central dualism of the global climate debate and policy: It refers to the two pure strategies of preventing climate change or adapting to it. These two strategies act like communicating vessels: The more measures are taken to prevent climate change, the less effort countries will have to make to adapt to it and vice versa. This dualism has serious implications for the strategic orientation of armed forces in all countries: On the one hand, armed forces as emitters contribute their share to climate change prevention, and on the other hand, they are simultaneously involved as actors in dealing with climate impact (Brzoska 2015: 176, 179–181). The United States Department of Defense also differentiates between "adaptation efforts, those aimed at anticipating expected changes, and mitigation efforts, that is, those aimed at reducing greenhouse gas emissions" (Spanish Institute for Strategic Studies 2018: 27).

Moreover, strategic force planning on a global scale that disregards the issue of climate change is simply inconceivable. The nexus between climate

and security has been included in the concept of the U.S. forces since 1997 (Brzoska 2012: 45). In Germany, that connection has been illustrated by the German Advisory Council on Global Change (WBGU) in its 2007 report entitled "Sicherheitsrisiko Klimawandel?" (Climate Change as a Security Risk?) (WBGU 2007). A continuous debate on climate change has been going on in many other countries as well; a debate that has gathered momentum particularly in the last two years when several nations published position and strategy papers in which they developed concrete strategic recommendations for action for armed forces (Ministère des Armées 2018; Gemenne et al. 2019; New Zealand Ministry of Defence 2018; Spanish Institute for Strategic Studies 2018; Holloway et al. 2015: 494 f.).

The link between climate change and security has been addressed and thoroughly analysed in many papers mainly with a view to human security; however, most studies fail to go beyond the level of a more general security policy (Dröge 2018; WBGU 2007). What has been missing so far is a more advanced, comprehensive and systematic analysis at the military level. Brzoska (Brzoska 2015: 175) has been the only one to present a systematic analysis of the role of armed forces in times of climate change. However, his approach, which is based on discourse analysis, is limited to categorising future focus areas and tasks of military actors in times of climate change. The resulting structural and planning measures for armed forces are not analysed in greater detail, and no differentiation is made between the individual armed forces of the different countries (Brzoska 2015). Although Holloway et al. have developed partial concepts for the Australian military (Holloway et al. 2015), such research work has not been carried out for other major armed forces at a comparable scale. Brzoska has performed a case analysis for the United States of America, China, Russia and the United Kingdom, but his assessment remains at a political level and he has failed to thoroughly systematise specific concepts or adaptation and prevention strategies of individual armed forces (Brzoska 2012).

Right from the start, we would, however, also like to warn against the risk of *securitisation* in current debates (Brzoska 2015: 175) – a phenomenon to which we do not intended to contribute: Climate change might be deliberately constructed into an existential threat to human security in order to give armed forces a higher political priority in strategic terms. Instead, our paper focuses on how armed forces and security institutions are preparing or already have prepared for climate change. Basically, there are two ways to do so: either by successfully preventing global climate change or by adapting to it. The question as to which of these two options is more realistic is the subject of a mainly economic analysis in Chapter 2. Subsequently, we take an in-depth look into several aspects of prevention and adaptation measures carried out by different armed forces. At this point, it should be emphasised that this paper cannot provide an all-embracing overview of international efforts of armed forces concerning climate policy. Instead, we intend to describe major developments in this area by giving several examples. Eventually, we will compare those developments with current Bundeswehr plans.

2 Between prevention and adaptation: difficulties in implementing climate policy within existing economic and political structures

The two basic climate policy options available are rather straightforward: You either try to prevent climate change or else you have to live with the consequences (adaptation). The two approaches are interrelated: The more adverse effects of climate change are prevented, the less adaptation measures must be taken and vice versa.

Since the adoption of the UN Framework Convention on Climate Change (UNFCCC) in 1992, the international community has been trying to develop and, more importantly, implement political solutions. Relevant examples include the UNFCCC, the 1997 Kyoto Protocol and, more recently, the 2015 Paris Agreement. The focus has always been on preventing the most adverse effects of climate change (United Nations 1992: Article 2). So far, however, such efforts have achieved only limited success: Since 1992, we have seen an almost unrestrained rise in global CO_2 emissions (International Energy Agency 2019: 7, 10). Forecasts for the future do not indicate a trend reversal either. What might be the reason for the obvious discrepancy between political declarations of intent (we intend to prevent) and the actual status of prevention (we have prevented)?

In the early 1990s, the international community was intrigued by the idea that prevention was generally the better of the two strategies and that the ultimate objective should be "to achieve [...] stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (United Nations 1992: Article 2). However, this wording also leaves room for the political strategy of adapting to climate change unless there are dangerous anthropogenic interferences with the climate system. In any case, the following rules apply: The longer the international community fails to make use of preventive options, the more drastic the adaptation measures will have to be. However, the actual development of greenhouse gas emissions over the last 30 years during which efforts have been made to pursue a more or less active climate policy strongly suggests that prevention on a global scale is not taking place (International Energy Agency 2017: 55). This implies that in the future, we will have to pay much more attention to adapting to a changing climate or to already changed conditions. Back when global climate policy was still in its infancy, a fundamental 'error of construction' was made at the 1992 Framework Convention on Climate Change in Rio de Janeiro: Developing countries were granted a status that released them from any prevention responsibility (keyword: *common but differentiated responsibilities*).

From an economic point of view, the slow implementation or lack of global prevention measures can be explained quite easily. On the one hand, the future effects of climate change are non-internalised external effects: Given today's combustion of fossil fuels, the costs of climate change are not fully

charged to the emitter. Economically, this means departing from the full-cost principle (Bayer 2015). In the presence of external costs, the emitter of greenhouse gas emissions may charge third parties with the costs of the related climate changes – this is the case both geographically (for example, emissions from German traffic reinforce climate change in Southeast Asia) and temporally (today's emissions from air travel will result in a sea level rise in 30 years from now). The dimensions of space and time may, of course, blend into one another, which makes the problem difficult to manage for today's actors. Migration resulting from climate change would be some kind of internalisation of the external costs mentioned above; however, this internalisation is only to be expected in the future. Due to incomplete cost accounting, external costs today lead to a situation where excessive production quantities are produced too cheaply. Introducing a CO_2 price, which is currently the subject of a controversial international debate, would adjust the inefficient and unfair exculpation of the consequences of one's own actions to an optimum level – in the field of economics, the Pigouvian tax has been referred to as a standard textbook example of such a measure since the beginning of the 20th century (Cansier/Bayer 2003: 147). Specifically, the intended effect of a Pigouvian tax is that people living today should bear the costs caused by themselves instead of charging them – as is still common practice – to future generations or people living far away and thereby forcing these people to increase their efforts to adapt to climate change.

But often this internalisation of negative externalities has inevitably adverse effects on a country's competitiveness: As a result of political intervention, domestic production becomes more expensive compared with the existing (biased) status quo. This leads to a conflict constellation which has great explanatory power especially in a game theory setting: The non-internalisation of external costs by climate protection measures and the related and anticipated positive effects on the competitiveness of large-scale greenhouse gas emitters may be described as a Nash-equilibrated dominant strategy for all actors, although all countries involved in the "climate protection game" want to prevent a continuation let alone acceleration of climate change. Such behaviour must be overcome. The resulting prisoners' dilemma prevents joint climate protection measures on an international scale. In this context, political scientists and sociologists refer to a *tragedy of the commons* because

> no party can be excluded from these benefits regardless of its own actions. Public goods are typically underprovided in the absence of a governing authority because each actor has an incentive to freeride— to gain a beneficial climate while failing to pay its share (Keohane/Victor 2016: 570).

Moreover, it is very difficult to influence the world's climate system in political and economic terms because it is a classical long-term and cumulative phenomenon. Climate change takes place over long time scales. Besides, we must consider the inertia of such a system and the amount of time needed for changes to take place: Climate change would continue for quite a while even if emissions were stopped immediately. For example, the maximum warm-

ing effect of greenhouse gases manifests itself as late as ten years after their emission, and even then those emissions remain in the atmosphere for several years or decades (Ricke/Caldeira 2014: 6 f.). Moreover, there may be so-called tipping points that will irreversibly transform today's world climate into a completely different one. Such tipping points may relatively soon lead to permanent, massive changes, including the release of additional greenhouse gases from melting permafrost (IPCC 2016: 130; Sachs et al. 2012: 24).

From an economic perspective, it is important to carry out a cost-benefit analysis illustrating in what way climate protection incurs costs today and later on will induce benefits in that future generations will have to live with less damage to the environment and climate. In cost-benefit calculations, future benefits (i. e. climate change prevented) must be made comparable with today's costs – to this end, they must be discounted and "scaled down". Structurally, this economically correct approach bears the risk that, depending on politically determined discount rates, future benefits may be compared only to a limited extent with today's costs and that the cost-benefit calculation may thus prove the inefficiency of climate protection measures. The level of the chosen discount rate is thus most relevant for decision-making (Bayer 2011) – politically, the risks inherent in the unreflective or even strategically deliberate use of an excessive rate cannot be denied.

Alternatively, a cost-benefit analysis might also be used politically to look into the question whether it might be efficient not to carry out a certain climate protection measure. Economically, at least two alternatives are generally available: Resources available for alternative options (e. g. railway infrastructure improvement, digital training programmes at schools, etc.) that were previously earmarked for climate protection measures can be accounted for as benefits. The costs associated with this measure will take the form of future climate change – and they may be discounted and, where applicable, scaled down based on the above arguments. Again, an economic cost benefit calculation tends to identify climate protection as an inefficient measure, and this conclusion is reached all the more easily the higher the discount rate.

Even if this discounting issue were resolved, there would still be considerable uncertainty regarding measures to prevent climate change because of their preventive nature: It is impossible to exactly quantify the amount and term of investment in measures that is required for a certain climatic effect not to be induced or only to a certain extent. In this context, we may speak of a curse of prevention: Successful prevention prevents the worst case – and since the worst case has not occurred, measures designed to prevent it might be reduced in the future. If the circumstance to be prevented remains absent, further precautionary measures may be suspended, etc. The curse of prevention means that reducing precautions results in a situation where the probability of maximum damage steadily increases with an (allegedly) growing prevention success.

Finally, we would like to return to the principle of *common but differentiated responsibilities* (United Nations 1992: Article 3) predominant in international climate protection: Ultimately, the UNFCCC defined responsibilities in

accordance with the specific development status of individual countries and their contribution to the climate change observed at that time. This division of the world into committed (developed countries) and uncommitted (developing countries) states is permanent and protected by international law. Developing countries – a designation that includes countries like China, India, South Africa and Brazil to some of which the status no longer applies – have been granted the permanent right to a catch-up development that is not restricted by greenhouse gas emissions. Thus, developing countries insist on maintaining a right granted to them a long time ago; politically, it is almost impossible to overcome this dominant game theory strategy. The Paris Agreement contains a more nuanced differentiation of this principle, but the overall problem of the lack of binding global targets remains unresolved (Rajamani 2016). In particular, China and India as increasingly relevant greenhouse gas emitters have been defending their status as developing countries (Sethi 2018). Furthermore, the efforts of Paris to create a more effective international climate regime are still limited to target definition, given that the two-degree Celsius threshold has been politically agreed on as a global objective, but specific implementation measures still remain at the level of individual nation states (UNFCCC 2015: Article 3). A successful implementation of the Paris Agreement calls for nation states to take active measures, the qualities of which vary and the impact of which may be small because individual countries like the U.S. will not even join the agreement.

For the above-mentioned reasons, we think it is highly improbable – despite the positive, almost euphoric perception of the Paris Agreement – that significant progress in climate change prevention will be made on a global scale and effective climate protection achieved in the near future. Several countries have simply withdrawn from the Paris Agreement, while for others compliance with self-imposed prevention measures is highly uncertain (as was already the case with the Kyoto Protocol). Therefore, international climate policy will, in future, mainly take the form of adapting to changing climate – and in this regime, armed forces will, of course, play a multifaceted and important role.

3 Prevention rationale in the military context

Before we take a closer look at the part played by armed forces to support adaptation policies, we will first look into the alternative prevention strategy adopted by the military. This can be described in terms of two dimensions. First, armed forces as emitters may be integrated into an overall environmental strategy in order to promote CO_2 reduction. Second, armed forces or military infrastructure facilities may be used to protect existing ecosystems to maintain their respective functions.

An immediate possibility to protect various ecosystems is seen by the armed forces in their own premises; the respective literature mainly refers to

training areas where unique ecosystems[1] of particular vulnerability are preserved. The strain on such ecosystems caused by immissions of various combat agents is also under discussion (Australian Government – Department of Defence 2016: 102; Infrastructure and Environment Assistant Deputy Minister 2017:16 f.; Spanish Institute for Strategic Studies 2018: 31 f., 220). However, climate protection from the perspective of military planners is actually more far-reaching and involves more than just military infrastructure. Naval forces, for instance, will play a central role in the protection of marine environmental systems due to their enormous surveillance capabilities. France, for example, refers to its particular responsibility as the country with the second-largest exclusive economic zone stating that it "dedicates a significant military effort to protect marine ecosystems" (Ministère des Armées 2018: 7). In South America, such thoughts have already been put into concrete terms. Chile, for example, is currently working to put 40 % of its exclusive economic zone under ecological protection. The establishment of this protection status is pursued using an integrative approach that includes management plans, satellite monitoring and control technology contributed by the Navy (Gemenne et al. 2019: 54). Armed forces may also play an important part in protecting the environment on the mainland as well. The Brazilian White Paper of 2012, for example, refers to the strategic significance of its Amazon region:

> The modernization of Brazil's defense structure is vital for protecting this enormous asset. The preservation of the environment in general, and the conservation of tropical rainforests and other biomes are responsibilities shared by government agencies in the municipal, state and federal levels. The Ministry of Defense is aware of its responsibility to contribute to the preservation, control and maintenance of the country's forest areas (Ministério da Defesa 2012: 51).

The particular significance of such climate protection tasks becomes evident when they reveal a need for further adjustments in existing military structures. Brazilian armed forces play an essential role in monitoring and enforcing environmental legislation in this region. In 2011, the Operations and Management Center of the Amazonian Protection System (CENSIPAM) was assigned to the Defence Ministry. This means that the Ministerio da Defesa plays a central role in the field of reconnaissance and information collection concerning interventions in and changes to the Amazon ecosystem and thus helps to maintain biodiversity and curb illegal overexploitation (Ministerio da Defesa 2012: 51, 64 f.; Anatol 2006: 18 f.).

Ultimately, CENSIPAM illustrates the wider contribution that military actors can make to preserve ecosystems as military capabilities or infrastructure are used for the purpose of exploring ecosystems and climate change. Conceptually, armed forces focus not only on civil-military cooperation but

1 Measures to protect such unique ecosystems are in place, for example, in military training areas in Brazil. Worth mentioning here is the high level of biodiversity in the Formosa Military Training Area (Arimoro et al. 2017).

also on international collaboration in this field (Gemenne et al. 2019: 57). In this context, armed forces may serve as platforms to exchange knowledge and to form a network focusing on the nexus between climate change and security as illustrated by the initiative envisaged by the Ministère des Armées in France (Ministère des Armées 2018: 11).

The Spanish armed forces are working to establish a concrete link between the two dimensions concerned. Not only is the deliberate preservation of forests on military premises understood as a contribution to maintain biodiversity, but the role of forests as carbon sinks is also included in the calculation to partially offset greenhouse gas emissions resulting from the activities of the armed forces. Such measures are part of an attempt to transform the military into a *zero carbon* force (Spanish Institute for Strategic Studies 2018: 31 f., 220, 223).

Although *zero carbon* may ultimately be defined as the final stage of a process of creating *greener* armed forces, it should be noted that energy efficiency and sustainable development are already part of military planning and strategy development. Here, individual armed forces only differ in their specific objectives. The central task of sustainable development in the military is to first implement monitoring and assessment mechanisms that create a data base from which to derive (more) sustainable measures. An example of such a development is the "Strategic Sustainability Performance Plan" of the US Department of Defense, which has been submitted annually since 2010 (US DoD 2010). The British forces have a similar mechanism in place (United Kingdom Ministry of Defence 2018). It also involves specific objectives with the United Kingdom Ministry of Defence seeking to achieve a CO_2 reduction of 80 % compared to 1990 by 2050 (Brzoska 2015: 179).

Related sustainability strategies can be observed in several areas. Examples include investments in more energy efficient construction, the use of renewable energy sources, sustainable resource and acquisition management (United Kingdom Ministry of Defence 2018: 25–30, 32–36; US DoD 2018) and the implementation of a culture of sustainability among staff members (US DoD 2016: 9–14).

Water and fuel resource management, in particular, is a major concern of armed forces because water and fuels are both essential resources at the operational level (Canadian Department of National Defence 2013: 47; US DoD 2016: 1 f). In connection with resource management, *Green Procurement* (Infrastructure and Environment Assistant Deputy Minister 2017: 20) plays a special role in the strategic orientation of armed forces in order to develop fuel and emission-saving solutions. The Canadian forces, for example, refer to the *life-cycle* approach as a central assessment principle that covers the overall service life of equipment (Infrastructure and Environment Assistant Deputy Minister 2017: 20 f.). This sustainable approach of the Canadian armed forces deserves special mention.

In the future, energy and resource security will obviously help to substantially promote environmentally friendly technologies. In a changing climate,

oil and water scarcities will always generate not only a prevention component, but also an adaptation effect:

> Energy is critical to the delivery of military capability, to aid this the MOD is working to improve the efficiency of use and in the longer term reduce reliance on fossil fuels (United Kingdom Ministry of Defence 2018: 25).

Even when taking a closer look at possibilities of *greening* the military, it becomes obvious that the above-mentioned measures alone will hardly suffice to generate comprehensive let alone global climate protection. Crawford found in his study that, in 2017, US DOD energy-related greenhouse gas emissions amounted to 59 million metric tons of CO_2. The emissions of US forces thus slightly exceed the overall emissions output of Sweden (Crawford 2019: 13, 31 f.). Compared with global energy-related CO_2 emissions of 32.5 Gt in 2017 (International Energy Agency 2019: 3), the percentage of emissions caused by U.S. Forces is about 0.18 %.

> Although this case analysis does not yet permit conclusions as to the statistical population[2], it seems natural to assume that emissions caused by other armed forces are lower than or similar to those generated by the armed forces with the highest military expenditure.

It can therefore be concluded that armed forces may well be employed in the sense of the prevention rationale. The military may assume an important role in preventing negative interventions in ecosystems as surveillance capacities in particular allow for the enforcement of existing environmental legislation. Furthermore, the *Green Military* process may set an example for the implementation of sustainable development in society (Holloway et al. 2015: 505). On a global scale, however, armed forces cannot make a significant contribution to greenhouse gas reduction due to the fact that their activities causing greenhouse gas emissions are far below-average. Therefore, the role of armed forces in preventing climate change is a factor that is usable and playable only to a limited extent. The economic explanation provided in Chapter 2 in combination with the assessment of the global effectiveness of prevention measures taken by armed forces to protect the climate leads to the interim conclusion that there are clearly more effective levers for political prevention measures in various countries. In the following, we will therefore mainly address potential courses of action for armed forces seeking to adapt to ongoing climate change.

4 Adaptation strategies to climate change within armed forces

A failure of the global climate protection policy is a failure of international coordination efforts: The international community is unable to come up with

2 An in-depth comparative survey on the emissions output of armed forces is not yet available due to the lack of data (Brzoska 2015: 176).

a coordinated solution to the international control problem. In a rationale of adapting to climate change, only isolated activities of individual countries and ad-hoc coalitions for specific purposes remain promising; in effect, there is a clear tendency towards renationalisation of climate protection in the adaptation regime.

The focus placed on climate change adaptation measures of armed forces indicates that security implications calling for an intervention of military actors are likely to arise. As mentioned before, this is reflected in the connection between climate change and aspects of human security established by the WBGU in 2007 (WBGU 2007). The security implications identified by the WBGU will be addressed in our study in order to link related security threat situations with potential strategic orientations of individual armed forces.

4.1 Security implications of climate change

The impact of climate change on people's safety mainly consists of changing living conditions: Regional production and supply structures will deteriorate so that, apart from economic decline (or reduced economic growth), an aggravation of resource and supply shortages must be expected. In the future, farmers, in particular, must expect an increase in droughts and water shortages. Moreover, there will be shifts in climate and weather zones that will reinforce the process. People living in coastal regions, in particular, will be directly at risk due to the increase in extreme weather conditions and rising sea levels; the same applies to transport, supply and production infrastructures (Dröge 2018: 3f.; WBGU 2007: 3, 6). This is particularly significant if we consider the fact that even back in 2000, 10–11 per cent of the world's population lived in coastal regions[3] that account for only about 2 percent of the global land area (McGranahan et al. 2007: 22; Neumann et al. 2015: 10 f.).

Another major threat identified by the WBGU is the increasing number of weak and fragile states: With progressing climate change they are increasingly unable to fulfil their core functions such as to enforce the state's monopoly on the use of force. The main reason for such a development could be weak institutional structures that have insufficient capacities to deal with the described challenges arising from a changing climate. In particular, cascade effects have been identified that have the potential to destabilise entire regions (WBGU 2007: 5). In this context, particular emphasis should be placed on the issue of migration that results not only from the increasingly fragile political situation, but also, and especially, from changing ecological and economic conditions. The WBGU expects climate change to exacerbate existing migration hot spots and give rise to new ones. The resulting regional conflict potential involved in such refugee crises is obvious (WBGU 2007: 5 f.).

The WBGU has drawn the following conclusion for security institutions:

3 Coastal regions are defined here as low elevation coastal zones that are less than 10 metres above sea level (McGranahan et al. 2007: 17).

> The future impact of unrestrained climate change will probably lead less to classic interstate wars and instead to increasing disintegration and destabilisation processes with diffuse conflict structures and security threats in countries and societies that are under excessive political and economic strain. The nature of conflict constellations, disaster management failures after extreme weather events as well as increasing environmental migration will hardly be manageable without police and military support and thus pose a challenge to traditional security policy (WBGU 2007: 6).

Moreover, the structures of traditional security policy and the actors involved will ultimately be unable to cope with the new environmental conditions and an overstretch of those actors may result (WBGU 2007: 6).

Military planning adapted to climate change clearly reflects the fact that armed forces, too, need to adapt. First, climate change and extreme weather events are viewed from the perspective of specifically military and therefore critical infrastructures. It turns out that the military is a key actor that is, and will continue to be, affected by changing climatic conditions (Dröge 2018: 5; Brzoska 2015: 179).

It should, however, be noted that strategic planning for the described threats to armed forces has more than a purely intra-military dimension. This becomes obvious especially in the changing deployment and mission profile. When developing central capacities and adaptation requirements, the issue of disaster management failures due to extreme weather is addressed in particular with a view to armed forces deployed within individual states (Holloway et al. 2015: 506 f.; Brzoska 2015: 179 f.).

Looking beyond national borders, the increasing destabilisation and disintegration processes of states caused by new climate-related conflict constellations (for example, conflicts over access to water, resources and the sea, conflicts over remaining agricultural areas) as well as natural disasters are at the centre of attention when the role of the military and the related capabilities concerning humanitarian interventions and humanitarian aid are described (Dröge 2018: 4; Brzoska 2015: 180; Holloway et al. 2015: 507).

Environmental migration resulting from such threat situations has also been identified as a special problem in the South Pacific, but not as a direct security threat. It is mismanagement that has raised some security concerns at the local level (Gemenne et al. 2019:16; Ministère des Armées 2017: 29).

Although armed forces refer to major threat situations that have also been identified by the WBGU, scenarios beyond such phenomena are conceivable, for example within new intrastate conflict constellations. Interstate conflict potential arises from distribution conflicts over resources that will be aggravated by a changing climate (Brzoska 2015: 181). In particular, the Arctic coastal states and nations in the South Pacific have emphasised the special importance of the poles for any future security policy (Closson 2019; Canadian Department of National Defence 2017: 50 f.; Holloway et al. 2015: 507; Office of the Under Secretary of Defense for Policy 2019).

It seems obvious that such shifts at the mission and deployment level will ultimately also require adaptations in the procurement system in order to

build specific capacities that meet the new conditions (New Zealand Ministry of Defence 2019: 17).

The categorisation described above must be understood as an idealised framework: In practice, it is not always possible to arrive at a clear-cut distinction. Nevertheless, the systematisation approach taken by Brzoska is practical and useful, and we will therefore use it in our further analysis with only two additions: First, we aim to investigate the role of the procurement system in times of climate change. Second, the climate-induced risk of economic decline as predicted by the WBGU will be viewed from the perspective of armed forces.

4.2 The effects of climate change on military infrastructure and personnel

The fact that the nexus between climate change and security in the armed forces context as presented in our deliberations is primarily restricted to the forces' own infrastructure is shown very clearly in Kelly's paper, which emphasises the implications of rising sea levels on the infrastructure of the Navy (Kelly 1990). With Kelly's study, however, the US Navy also touches on the efforts of the Department of Defense to deal with climate change. In particular armed forces that have military bases in different climatic regions of the world have made considerable progress in adapting to such problem situations.

The implications of rising sea levels as addressed in the study play a very prominent role in current debates that look at the risks of flooding and storm tides in coastal areas (US DoD 2019: 5 f.; Gemenne et al. 2019: 26). A distinction can be made between the immediate effects of rising sea levels on military bases and armed forces and the indirect effects on civilian infrastructures, which restrict or even render impossible the military's operational capabilities in the *traditional* sense and as part of disaster management (Holloway et al. 2015: 505).

Increasing global temperatures as a result of the greenhouse effect are leading to droughts and even desertification in many regions of the world. Various problem situations arise for armed forces in this context. Above all the critical water infrastructure of military bases proves particularly vulnerable to climate change. Furthermore, long spells of hot weather – and the increased drought and temperature levels such heatwaves entail – have a negative effect on the test and training cycles of armed forces, which are sometimes made difficult or impossible by factors such as strain on personnel or forest and bush fire risks. What is more, changes to ground conditions have various adverse consequences for military personnel, since they often cause damage to the surfaces of buildings, roads, and most importantly runways (US DoD 2019: 6, 9).

Increasing desertification induces similar effects, reducing the quantity and quality of vegetation and thus encouraging more and more surface runoff due to increasing rainfall. Above all, this has negative effects on flood control, accompanied by the risk of water reservoirs silting up (US DoD 2019: 6 f.).

Increased average temperatures are also having a significant effect on ground conditions in the northernmost and southernmost latitudes, causing the permafrost there to steadily thaw. This phenomenon affects Russian, American and Canadian bases in particular. The thawing plays a significant part in making the basic structure of buildings in all areas of the infrastructure unstable (US DoD 2019: 7; Brzoska 2012: 49; Infrastructure and Environment Assistant Deputy Minister 2017: 26).

At the same time, the consequences described here are also having an impact on the traditional areas of conventional security policy, making permanent military operations in various regions more expensive or more difficult (Foresight 2011: 46–48; Brzoska 2015: 179). Ultimately, climate change is thus having a negative influence on power projection capabilities,[4] making it more difficult or even impossible to keep certain bases going in strategically relevant regions.

Such far-reaching consequences of a changing environment on military infrastructure thus play an increasingly prominent role in armed forces planning. Considerations in this respect focus on the development and use of monitoring and assessment mechanisms with a view to deriving efficient measures to increase resilience. An interesting approach can be found in the British context. The Ministry of Defence has developed the Climate Impacts Risk Assessment Methodology (CIRAM) in order to systematically include climate change in its existing infrastructure planning and resource management (United Kingdom Ministry of Defence 2018). The US Department of Defense also has similar methods (US DoD 2019: 2 f.) but is drawing criticism due to lack of coherence and management. For the most part, the approach is limited to individual initiatives within military bases (United States Government Accountability Office 2019: 32 f.). This can be illustrated particularly clearly by looking at the American JBLE-Langley Air Force Base, which

> is using a flood visualization tool to understand flooding impacts across the base. By modeling different storm flooding elevations, they were able to determine where to install door dams, which require less time and less labor than sandbags. The base reduced the number of required sandbags by 70 percent (US DoD 2019: 11).

Despite all the far-reaching and sometimes serious consequences, the military does not seem – from a worldwide perspective – to have become sufficiently aware of such a development. After all, other than in Great Britain and the United States only few such approaches are to be found. This is particularly astounding in the Russian context, since melting permafrost is having a very serious impact on the armed forces there (Brzoska 2012: 49). There does, however, already seem to be an initiative underway to implement a systematic approach:

4 France, for example, clearly refers to the role of overseas territories as an instrument of power projection in the world (Ministère des Armées 2018: 75).

> Russian authorities have begun work on a national climate change adaptation strategy. [...] Due in part to an escalation in severe weather events, melting ice could swallow parts of islands that Russia uses for military purposes, including bases, but also radar stations and rocket sites (Closson 2019: 374).

It is already evident from existing initiatives, however, that the military does have a role to play in climate policy. The data and experience gathered and the mechanisms that have been developed can be put to good use not only in the military context but also in the civilian context in situations where civilian infrastructures face similar challenges[5] (United States Department of Homeland Security 2013: 12; Closson 2019: 372). Both standardisation and the sharing of best practices in the field of critical infrastructure are of great importance if adaptation to climate change is to be successful (Gemenne et al. 2019: 58–60).

4.3 A changing military mission and deployment profile

Apart from the immediate impact climate change is having on armed forces, the new climate conditions also call for an adjustment to their fundamental mission and deployment profile. In addition to the increased use of traditional military capabilities in humanitarian interventions and new areas of conflict, the expansion of disaster management and humanitarian aid means that these fields will come to play an increasingly prominent role in future armed forces deployments.

4.3.1 Disaster management of the future: Military involvement in disaster control and humanitarian aid in the context of climate change

Throughout the world, an increase in extreme weather events and natural disasters is leading to a growing number of armed forces deployments at home and abroad to combat and/or mitigate the consequences of such phenomena (Australian Government - Department of Defence 2016: 56; Gemenne et al. 2019: 31). However, the fact that comprehensive disaster management does not usually form part of the military's core responsibilities gives rise to a two-way problem. Climate change is increasingly involving military capacities in deployments related to disaster management, which means that those capacities cannot be employed in traditional security policy missions. In the event of traditional threats to national security, on the other hand, there are fewer capacities available to deal with natural disasters and extreme weather events. From an economic perspective, conventional opportunity costs come into the picture. In addition, the already existing boundaries of both military and civilian capacities in the event of a disaster mar the success of any expected and intended effects (Brzoska 2015: 180; Gemenne et al. 2019: 31).

5 The US Navy is making efforts to initiate such civilian-military cooperation in coastal regions in particular. In the Hampton Roads region, for example, which has been severely affected by floods, information is being provided about the dangers and about preventive measures, and an exchange of ideas between military and civilian institutions has been initiated (US DoD 2019: 12).

In essence, a distinction can be made between two concepts that could constitute the role of the military in this field. The traditional concept that makes the involvement of the armed forces in handling environmental disasters possible is their cost effectiveness. Although permanently available military capacities and capabilities are geared to traditional areas of security policy, they can also be resorted to for disaster control measures (Brzoska 2015: 180). In many countries, armed forces are only given a subsidiary role to play in disaster management, since this area is predominantly taken care of by civilian workforces (Brzoska 2015: 179 f.; US DoD 2019: 9; Gemenne et al. 2019: 30; United Kingdom Ministry of Defence 2018: 17).

By way of example, the US Department of Defense provides a clear illustration of such a support concept. The running and coordination as well as the leading role of civilian institutions are primarily the responsibility of the Federal Emergency Management Agency (FEMA) (US DoD 2019: 9). Much the same applies to missions outside the United States: "DoD does not develop its force structure for foreign disaster relief missions, but supports USAID with available unique military capabilities and assets" (US DoD 2019: 9). In addition to providing these capabilities and assets, the US military places special emphasis on enabling other nations to establish their own effective disaster management system and resilient infrastructures (US DoD 2019: 9).

Contrary to the above-mentioned custom of resorting to general military resources, another development can be observed where specific capacities and capabilities are established or deployed so that they are available in the event of a disaster. Such units, however, still remain part of a civilian disaster management process.

With the establishment of the Unidad Militar de Emergencias (UME) in 2006, for example, Spain has created resources of this kind in the fields of disaster management and humanitarian aid within its armed forces. These Spanish military units are also understood as an element that can be used to deal with climate-related disasters. The UME is comprised of approx. 4,000 soldiers who can be employed both at home and abroad (Spanish Institute for Strategic Studies 2018: p. 30, 219; Fernandez Romero 2015: 13). However, this Military Emergencies Unit also remains part of a civilian-military cooperation as it operates under the *civil protection system* (Fernandez Romero 2015: 9).

A similar development can be observed in the Chinese People's Liberation Army. Due to the country's poorly established civilian disaster management, the army by tradition plays an important role in this area. The link between climate change and the role of the military has become particularly obvious since climate change was identified as a non-traditional threat for the People's Republic (Chen 2016, p. 82, 88f). With the *national military operations other than war (MOOTW) capacity-building plan*, the Chinese armed forces are setting up several Emergency Response Teams with a total strength of about 50,000. Their main task is disaster management but they can also be deployed for other operations as part of the MOOTW concept (Chen 2016: 86). Effectively, this means that there are capacities available for handling disasters that will assume an increasingly important role in the wake of climate change.

The Canadian military follows a middle course, pursuing a *multipurpose* approach for its own armed forces in the procurement and equipment sectors:

> Making targeted and strategic investments will enable the Canadian Armed Forces to function as a multi-purpose military that can deliver on all operations – from domestic humanitarian assistance and disaster response, to counter-terrorism and peace support operations, to high intensity combat operations (Canadian Department of National Defence 2018a: 21).

In the course of this study, we will be coming back to the effects of climate change on the military procurement and equipment sectors (cf. Chapter 4.4 below). Within the Canadian armed forces as well, however, some special capacities are kept available for humanitarian aid, e.g. the Disaster Assistance Response Team (DART) (Canadian Department of National Defence 2017: 86 f.). With a strength of only about 200, however, this team can be described as relatively small (Arizman 2015: 15 f.).

The frequency with which a disaster calls for the use of both civilian and military capacities in the wake of climate change is highly relevant for smaller countries and regions that are affected particularly badly by extreme weather events. Ultimately, there are limits to the extent to which armed forces can adapt to climate change – increased disaster management means that French troops in the South Pacific, for example, are being deployed to full capacity:

> the French troops deployed in the Pacific have already been experiencing the limits of their capacities in regard to the requirements of their missions: CASA planes and PUMA helicopters, for instance, are not fitted for massive population evacuations (Gemenne et al. 2019: 35).

In this respect, the method used in the French Pacific region with its small island states can be regarded as an example of a forward-looking approach to dealing with climate change: Most notably, the approach used here strengthens cooperation mechanisms that exist between military and civilian players. This takes place on both a national and a regional level. In particular French, Australian and New Zealand armed forces are assuming a significant role in the fields of disaster management and humanitarian aid in the entire region. The institutionalisation of such a regional civil-military cooperation system in the FRANZ Arrangement can be interpreted as an effective international institution (Gemenne et al. 2019: 30 f., 34; Gero et al. 2013: 60 f.). Such cooperation can also be observed in other parts of the world. NATO, for example, has created a similar cooperation mechanism with its Euro-Atlantic Disaster Response Coordination Centre (EADRCC) (Bezerita 2013: 300).

In a nutshell, three main developments can be observed: Firstly, the increase in military deployments in the field of disaster management and humanitarian aid is indisputable and is recognised by many armed forces. Some countries still differ considerably in terms of their armed forces concepts, however. A comparison could help to identify and produce efficiency potentials. And thirdly, regions already badly affected by extreme weather conditions and natural disasters do not – even on a military level – have enough

capacities, making it difficult or even impossible to deal successfully with further effects of climate change. Increasing cooperation can be regarded as a way of remedying this situation and will come to play an even greater role in the wake of climate change.

4.3.2 Increasing destabilisation and disintegration processes – expansion of humanitarian intervention by armed forces

The growing number of failing states forecast by the WBGU as a result of climate change is mainly due to the fact that such weak countries are unable to provide the capacities to adapt to climate change, which results in the people being constantly exposed to its consequences. This entails the risk of such nations ultimately becoming fully overwhelmed in the wake of climate change (Foresight 2011: 40; WBGU 2007: 5): In this respect, climate change often affects already existing conflict constellations indirectly, like a catalyst. Armed forces therefore identify climate change as a threat multiplier (US DoD 2014; Gemenne et al. 2019: 43; Spanish Institute for Strategic Studies 2018: 194). The way climatic conditions affect conflicts and, in turn, the way both aspects affect weak or weakened states, can vary greatly. In addition to the immediate threat to human security posed by extreme weather events and natural disasters, other threats are anticipated, in particular the aggravation of already existing conflicts in the field of resource distribution, migration mismanagement, health crises, extremism, land distribution, and food and water security (Australian Government - Department of Defence 2009: 39; Australian Government - Department of Defence 2013: 18 f.; Bundesministerium der Verteidigung 2016: 42; CNA Military Advisory Board 2007: 44 f.; Gemenne et al. 2019: 13–18, 29).

Against this background, a study of the most important South Pacific states clarifies the role of the armed forces:

> All these stressors will lead to increased demand upon regional militaries and other security focused institutions to conduct stability operations or provide other types of assistance (Gemenne et al. 2019: 30).

Such a causal link between a change in environmental conditions and the need for humanitarian interventions has already begun to emerge. Rising sea levels, for example, are making it difficult or almost impossible to live in certain parts of coastal regions and islands. This quickly leads to migration movements and resettlement measures that break up various societies and then force people to be integrated into other social and cultural settings. Some currently local conflicts in the South Pacific can already be attributed to climate change. In addition to cultural and ethnic conflicts, some of the clashes are due to land distribution problems in new settlement areas (Gemenne et al. 2019: 16, 29 f.; New Zealand Ministry of Defence 2018: 7).

On a conceptual level, the U.S. Africa Command (US-AFRICOM) is already emphasising the destabilising effect of increasing drought on the continent's

conflicts: "At US-AFRICOM, climate impacts and drivers of instability and factional conflict are fully integrated into planning efforts" (US DoD 2019: 15).

However, it is important to emphasise at this point that only few states have armed forces that can prepare successfully for such a task and also have the necessary capability profiles. Even in countries that would at present be in a position to do so, additional deployments would make it necessary to expand such capacities and capabilities (WBGU 2007: 6; Brzoska 2015: 180 f.).

4.3.3 New interstate conflict structures in the wake of a changing climate – the Arctic

The causal link described above is not only limited to weak states and to guaranteeing human security but can also decisively encourage conflict potential between states. In particular conflicts relating to the distribution of resources and territories are relevant not only on a local but also on a transnational level (Brzoska 2015: 181). The poles above all are identified as the most important connecting point between security and climate change within major military powers. Most notably the countries that border the Arctic are developing comprehensive strategy concepts that take into account the implications of climate change.

Russia's Arctic strategy in particular clearly shows the completely ambivalent position of bordering states, with reactions to climate change on the one hand and the link between climate change and regional interests in the Arctic on the other. While numerous players in Russia draw attention to the dangers of climate change, there are others who represent positions of partial or even outright skepticism towards man-made climate change or wish to use it to their own advantage (Closson 2019: 369, 374). And this is one of the key reasons for the ambivalent nature of Russia's perception: Especially in Russia, Arctic warming is seen as an opportunity when territorial claims are made and access to resources becomes possible due to the melting of the polar ice cap. Russia sees the Arctic as a *strategic resources basis*. What is more, the ice-free trade routes between the United States, Europe and Asia provide a central source for future economic growth (Closson 2019: 378; Sergunin/Konyshev 2017: 173 f.).

The distribution conflicts and geostrategic changes that derive from this are the two central crystallization points of military strategy concepts in the region. Against this background, Russia perceives NATO as a significant threat in the North Pole and reacts by modernising and expanding its Arctic-specific capacities and capabilities (Closson 2019: 370–372; Sergunin/ Konyshev 2017: 181-185). The fact that the focus in this region ultimately lies on the security policy implications is demonstrated by the fact that the Arctic Commission set up by the Kremlin in 2015 is under the direction of Dmitry Rogozin, who, in addition to this function, is also responsible for tasks in the fields of defence and space travel (Closson 2019: 374).

In this respect, the threat situation described above constitutes an interdependent conflict situation – in its respective strategy developments, the

United States is concerned about Russia's activities in the Arctic (Office of the Under Secretary of Defense for Policy 2019: 3 f.). The US armed forces assume three strategic positions with regard to the Arctic: Firstly, the *homeland* is defined as the central category, also in terms of its military intention. This also encompasses the growing economic exploitability and the increasing traffic in the region. These developments call for increasing support from the armed forces in disaster management, for example because of accidents at sea or oil catastrophes. What is more, rising sea levels as a result of the melting of the Arctic pose an additional challenge to coastal defence. Secondly, the region is understood as a collectively used area that is running the risk of becoming a restricted-access zone due to a shift in regional power relationships. In particular, the increase in passable shipping routes, for example, will influence the relocation of troops across the globe – either directly or indirectly. And thirdly, a geostrategic dimension is being addressed that is having a mutual effect on existing conflicts in other regions and the Arctic (Office of the Under Secretary of Defense for Policy 2019: 6). This is where the Department of Defense ultimately derives its conceptual orientation in the region:

> A stable and conflict-free Arctic benefits the United States by providing favorable conditions for resource development and economic activity, as well as by contributing to upholding the international order and regional cooperation on challenges that affect all Arctic nations. DoD will seek to shape military activity in the Arctic region to avoid conflict, while ensuring that the Joint Force is postured and prepared to deter strategic competitors from threatening our interests (Office of the Under Secretary of Defense for Policy 2019: 7).

The fact that the climate-related change in the region can be interpreted as an economic opportunity for the United States only becomes marginally clear in this quotation. Nevertheless, these considerations are clearly reflected in the armed forces as well (United States Coast Guard 2019: 12–14).

On the strategic-military level, the credible deterrent shown here is mainly achieved by expanding capabilities and capacities and adapting them to the prevailing environmental conditions. In addition, the Arctic strategy of the Department of Defense makes cooperation with its allies and the *Coast Guard* the focus of its own orientation (Office of the Under Secretary of Defense for Policy 2019: 7 f.).

The Canadian forces in particular are to be understood as a cooperation partner. In their own strategic concept, they also refer to the expansion of their capabilities, which is hoped will be achieved by means of a US-Canadian cooperation. Canada's armed forces also see Russia's regional activities as a specific threat to the security of the NATO Alliance (Canadian Department of National Defence 2017: 79 f.). The main aim is thus to preserve the international status the region has enjoyed thus far and to achieve the cooperation mechanisms anchored in it (Canadian Department of National Defence 2017: 50).

Nonetheless, the Canadian Ministry of National Defence still places particular emphasis on the need to expand deployments and to change the operational profile in the region:

> Climate change, combined with advancements in technology, is leading to an increasingly accessible Arctic [...] Today, state and commercial actors from around the world seek to share in the longer term benefits of an accessible Arctic. Over time, this interest is expected to generate a corresponding rise in commercial interest, research and tourism in and around Canada's northern territory. This rise in activity will also bring increased safety and security demands related to search and rescue and natural or man-made disasters to which Canada must be ready to respond (Canadian Department of National Defence 2017: 51).

Ultimately, this cursory depiction of the conflict in the Arctic clearly shows that the nexus between climate change and security goes beyond domestic or human security and that it is also becoming relevant on an intergovernmental level. The security policy constellation is changing significantly for Canada, for example. We must note in this context that climate change can be understood not only as a threat but also as an economic opportunity if new resources and trade routes are opened up. Armed forces are aware of the distribution conflicts arising from this, and the Arctic is seen as a new conflict area. Despite having identified the inherent conflict potential of a changed physical environment, some nations have thus far considered it rather unlikely for conflict to escalate in the current context because of the institutionalised nature of transnational cooperation (Canadian Department of National Defence 2017: 50; Sergunin/Konyshev 2017: 187; Office of the Under Secretary of Defense for Policy 2019: 3). However, as competition for trade routes and resources grows, the military will become increasingly relevant in the future as – in addition to its central role in the sense of a mutual deterrence logic – it takes on more and more tasks in the field of regional disaster management in an adaptation regime.

4.4 The effects of adaptation strategies on the procurement and equipment sectors

The emergence of new conflict areas where difficult weather conditions prevail (as in the Arctic, for example) makes it necessary to adjust the procurement system owing to changes to the requirements profile. Alongside the *Green Military* initiative, this need to adapt forms the most important connecting point between climate change and military procurement.

The increasing weather extremes that come with climate change pose a challenge not only to the infrastructure of armed forces but also to their equipment. In addition to the new demands placed on the latter (United Kingdom Ministry of Defence 2018: 31), the Department of Defense in particular emphasises the potential effects of the climate on the *supply chain*. On the one hand it addresses the issue of access to resources and the industrial production of

armed forces materiel connected with this. In particular, reference is made to the task of supplying personnel with food and water. On the other hand, the likelihood of possible interruptions to the supply and transport infrastructure is addressed, with discussions in this connection about the new demands placed on storage (US DoD 2014: 7 f.). At this point, we would like to come back to the Arctic context: "In the Arctic, the acquisition and supply chain requirements are considerably longer and are much costlier." (US DoD 2019: 9).

Specifically, various armed forces emphasise some of the new roles that the military might potentially assume in the context of climate change and demand that greater account than to date be taken of the implications for procurement: In this context, the New Zealand armed forces, for example, place particular emphasis on expanding their sea- and air-based supply logistics as well as their air surveillance activities and *maritime domain awareness* in order to adapt to the consequences of climate change and to ensure that the maritime ecosystem is preserved. Their main goal is to combine improved capabilities for dealing with natural disasters at home and abroad with the development of climate research capacities. To achieve this, additional personnel is also required (New Zealand Ministry of Defence 2019: 14, 17).

The new requirements placed on the equipment sector call for modifications in the field of procurement in the Canadian context as well: Canada pursues a *multipurpose approach*. The Department of National Defence verifies its own military capabilities and capacities in terms of their specific flexibility and their broadest possible employability in various kinds of mission contexts in order to be able to cope with the specific security threats posed by climate change (Canadian Department of National Defence 2019: 3 f.; Canadian Department of National Defence 2018b: 15).

4.5 Armed Forces as instruments for limiting the risks posed by climate change to the development of the global economy

Climate change can also put a strain on global economic development: In extreme cases, increasing crises and conflicts act as dampening forces on growth, but even low intensities of climate change could be enough to cause illness-related incapacity to work, higher transportation costs in times of political unrest, etc. This can ultimately lead to interruptions in value-added chains and massive disruptions in our globally connected production chains. In such cases, there is a short- or medium-term risk of the development of (or rise in) unemployment or even of entire regions becoming excluded from economic growth. We do not intend to go into detail about the additional crises and conflicts such problems can lead to in these regions, but there is no doubt that unemployment induced by climate change is going to affect economies that are integrated into the global value creation process.

A classic response to such periods of underutilisation is for the state – fully in keeping with Lord Keynes' theory – to create additional demand in order to eliminate the (economic) disruption. Normally, this is achieved through expenditure programmes in building and civil engineering. However, if climate

change consequences that are relevant to security at present are going to place even greater demands on the armed forces of the future, an analogous translation of Keynes' considerations would be to apply these expenditure programmes to future armies as well. The likely political consequence would be an increase in consumption spending, for example on more personnel and investment-related programmes, in order to increase capacities in the armed forces (cf. above, Chapter 4.4. on procurement programmes).

To date, increased personnel expenditure (i.e. the recruitment of more personnel into the armed forces) and materiel allowance can only be observed in particular countries. In this respect, we believe that it is necessary in strategic papers on the further development of armed forces in times of climate change to place greater emphasis on increasing expenditure – at least temporarily – in the fields of personnel and materiel as one facet of the adaptation rationale.

5 Conclusions

At this point, the reader may rightly ask why so far hardly any reference has been made to the Bundeswehr. Official documents of the Federal Ministry of Defence indicate that a number of initiatives were started and implemented in line with the prevention rationale. These initiatives have placed emphasis on the preservation of ecosystems, especially on training areas, and also focus on making the Bundeswehr more sustainable. Individual measures are carried out particularly in the areas of building management and electrification of mobility within the civilian vehicle fleet (Bundesministerium der Verteidigung 2018: 28–45). However, little attention is paid to the role of the armed forces in adapting to climate change in the Bundeswehr's strategy development. Although a link is made between climate change and security, a detailed examination of the topic remains only on a theoretical and case-specific level (Planungsamt der Bundeswehr 2012). A discussion on a conceptual or even strategic level could not be found in the orientation of the Bundeswehr, except for a much too general note in the White Paper (Bundesministerium der Verteidigung 2016: 42; Dröge 2018: 6). There are no signs that efforts are made to develop strategies for adaptation to the anticipated climate change.

However, the integration of armed forces into a national climate policy can, at least occasionally, be observed in the context of climate protection measures. Military forces can be meaningfully involved in the protection of ecosystems. And yet, "greener" armed forces will only be able to make a small contribution to global CO_2 reduction. If this empirical finding is combined with the theoretical mechanisms presented at the beginning of this study, which make it difficult to apply a climate policy prevention rationale within existing economic-political structures, it ultimately becomes clear that the role of the military can at best be marginal when it comes to making an efficient contribution to climate policy. Special attention must therefore be paid to the role of armed forces in adapting to climate change, particularly in the context of military concept development.

The systematic overview we have presented of various measures to adapt to the anticipated global climatic changes has made it clear that climate change is already recognised by very different armed forces and is being incorporated into a strategy and planning level. While Brzoska (2012: 44, 2015: 187) has emphasised the particularly far-reaching consideration of climate change in American and British armed forces, our study shows that quite a number of nations are adopting or have already adopted adaptive concepts against climate change within their armed forces. In these concepts, adaptation to climate change is still primarily seen as protection against direct effects on military infrastructure, which are addressed through monitoring and assessment mechanisms. The insights thus gained are then translated into individual measures to make military facilities more resilient to climate change. The resulting measures and investments can also be used to protect civilian infrastructures, thereby facilitating a civil-military exchange of best practices.

In addition to these direct effects the climate has on armed forces, the shift in the mission and deployment profile also becomes evident. In particular, ministries of defence are emphasising the increasing relevance of disaster management (Brzoska 2015: 183). Despite the different understanding of the role of armed forces in primarily civilian disaster management, it finally becomes clear that an increase in the quantity and quality of deployments is expected in the wake of climate change. However, military capacities are already being stressed to their limits today. The resulting problems ultimately lead to regional and international cooperation in this field, for example in the South Pacific. Although the WBGU has highlighted the greater frequency and intensity of natural disasters, the related disaster management, and particularly disintegration processes of weak states as challenges in the context of climate change, humanitarian interventions are merely recognised as an instrument for managing such processes, whereas tangible implications for military structures and capabilities are hardly detectable. The identification and integration of such threat scenarios into military planning can only be observed within individual armed forces that anticipate an increase in humanitarian interventions. The situation is different, however, where the development of new conflict areas is concerned. Particularly in the thawing Arctic, a concrete buildup of military capabilities and capacities and the application of regional deterrence logics are clearly visible. Nevertheless, the US Department of Defense, for example, considers it unlikely that a conflict will arise in the immediate future (Office of the Under Secretary of Defense for Policy 2019: 3).

The impact that climate change will have on people's lives, on the development of conflict scenarios and on the conditions under which military operations will take place will also affect the military procurement system in the foreseeable future. This is why aspects of adaptation to these developments should be taken into account in the planning of future procurement projects. In the decades to come, procurement processes will be characterised by a greater urgency in disaster management.

Finally, it would be interesting to consider an overarching strategy – driven by the need for armed forces to adapt to climate change and, in addition, to

be able to make a (small) contribution to preventing climate change. One such example would be the idea of implementing fossil-free propulsion technologies on a large scale in armed forces; this would prevent the danger of fossil fuels being no longer available in the required quantities in future. However, such a measure requires a lead time: If we were to implement such a strategy today, we would be able to make this technological change in the future and already avoid greenhouse gas emissions during the transition phase. Since the procurement of such propulsion technologies by armed forces would certainly create demand for larger quantities, armed forces could thus assume a technology leadership position and – en passant – make such a technological change possible in society (and across social borders). In this way, such an adaptation measure would also help to avoid emissions and could curb climate change.

The systematisation presented here and the associated analysis of selected concepts in various armed forces can only provide a partial overview. Consequently, this is not a complete picture of how climate change is addressed within all armed forces. Nevertheless, it has already become clear in this paper that climate change and the conceptual orientation for its management have far-reaching consequences for the structure and strategic planning of armed forces and will continue to do so in the future. It is therefore imperative for the Bundeswehr to actively address this problem. In addition, it will also be necessary to discuss at societal level how adaptation to climate change can be functionally designed in the context of a whole-of-government approach to promoting national security: A strict separation between internal and external security could prove to be dysfunctional in the context of climate change – the Free and Hanseatic City of Hamburg still gratefully recalls Helmut Schmidt's approach to dealing with even more catastrophic effects of the storm tide of 1962.

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