Ready for take-off?

Military responses to climate change

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Executive summary

The military is only just becoming aware of the scale of the social and environmental impacts that climate change will have in the coming decades. Increasing droughts, floods and severe weather events threaten large numbers of the world population. They lead to mass migration flows, cause resource scarcity and disrupt societies. Climate change is a risk multiplier of an existential nature, affecting every society around the world, generating new conflicts and potentially affecting our global security. This makes climate change an issue for national and international security – and thus the military.

This report illustrates the fact that oftentimes climate change not only acts as a threat multiplier in theatres of military operations, but also has direct implications for military capabilities, as it leads to calls for assistance to civil society in home territories. In some cases, it can even directly affect military capabilities and strength, as extreme weather events place a substantial additional burden on military forces' overall capacity to act and dilute the value of military assets, as exemplified by the regular flooding of the Norfolk navy bases and the recent wildfires in south-east Australia.

The extent to which the military capabilities of countries are affected by climate change is related to whether, and how, countries respond to and integrate climate change impacts into their defence strategies and policies, and more specifically into risk assessment, early warning, surveillance and operational preparations. It is also related to countries' general efforts in climate adaptation, disaster preparedness and risk reduction, even though some impacts might be difficult or impossible to prepare for entirely.

The military moreover contributes to climate change with its own emissions and although some countries have greenhouse gas (GHG) emission reduction targets for the defence sector, others do not. It seems that countries not yet undertaking adjustments in relation to climate change, or which are reluctant to do so, do not sufficiently realise its undermining impact on their military capabilities.

In the Netherlands, the general level of preparedness in relation to risks presents a mixed picture. On the one hand, in its own territory in Europe, dyke protection and (extreme) weather predictions are such that short-term risks to military installations are limited, despite a large part of the country lying below sea level. The Dutch armed forces are well prepared to provide assistance to natural disasters in the country, such as caused by the flooding of rivers.

On the other hand, the Caribbean islands seem to be less prepared for sea-level rise, with considerable implications not only for economic and human security but also for military infrastructure, such as the naval base at Aruba. With regard to operations outside national territory, the Netherlands is accustomed to operating under very different circumstances, from extremely cold (Arctic) to tropical (Caribbean) and very hot and arid regions (Middle East and North Africa – MENA). However, practice has shown that equipment and personnel are not always properly adjusted to such environments, in particular for operating in very hot weather. The contribution of the Dutch armed forces to decarbonisation is subject to specific reduction targets, but as yet has only minimally been translated into specific actions.

With regard to the approaches and experiences of other countries, the proactive role of France stands out. It is most advanced in its thinking and action to prepare for and address the first- and second-order drivers of climate security. New Zealand could be referred to as an early mover also, with climate change featuring most prominently in its recent defence implementation plan on climate change. The UK, Finland and Canada are relatively ahead of the curve as well. The US carried out a significant amount of work to address climate change under the Obama administration, but under the Trump administration has lost speed and reduced climate change-related activity after the government's decision to withdraw from the Paris Climate Agreement. Jordan is very experienced when it comes to the ability to operate in hot and water-scarce regions. Its army has realised the potential contribution of nature conservation to peacebuilding efforts.

Sweden, Norway and Germany are a little behind, but their defence ministries seem open to step up with regard to addressing the climate-security dimension, in line with their diplomatic efforts in this field. On the contrary, both Australia and the US seem most severely affected by first and second-order drivers of climate security, but their governments are reluctant to take action because of their political stance on climate change.

It would be very interesting to see how climate change affects the military strength of other military powers, notably Brazil, China, India, Pakistan, Russia and South Africa, and whether they are taking any action in this regard. The study has also found instances where more multinational cooperation is required, such as with regard to humanitarian assistance and disaster relief (HADR). Furthermore, multinational cooperation could be stepped up in activities to integrate climate change into early warning and risk assessment. The EU is already working on this, but interviews produced little evidence of its analysis being used by the military in national capitals.

In general appetite among military organisations to address climate change seems to be growing. They seem ready for take-off to make their contribution to one of the greatest challenges of our time.

1 Introduction

In September 2017, the Kingdom of the Netherlands was startled when hurricane Irma hit the Caribbean. The Dutch-French island of Sint Maarten in particular was very badly affected: over 50% of the buildings collapsed or were heavily damaged, nearly all critical infrastructures, such as water and electricity plants and the airport, were damaged or not functioning.[1] Due to the chaotic situation, with law and order no longer secure, Dutch military assistance was needed not only to provide humanitarian assistance, but to secure stability as well. Since the number and intensity of hurricanes hitting the Caribbean has increased due to climate change, this event could be considered a prime example of how climate change can affect the security situation, even for a relatively well-off country such as the Netherlands.

The security dimension of climate change has long been recognised by the United Nations (UN),[2] the European Union (EU)[3] and the North Atlantic Treaty Organization (NATO).[4] Climate change acts as a threat multiplier and as such is particularly dangerous in situations where security is already at risk. Climate change brings significant changes in the meteorological variables of weather, such as temperature, rainfall or wind occurring over a period of decades or longer.[5] It leads, for example, to accelerated melting of ice and glaciers and thereby to increased flood risks in many regions. Although climate has changed significantly many times throughout the earth's history, the current scale, scope and pace of climate change is unprecedented.[6] As climate science points to the change being caused by manmade GHG emissions, it is moreover considered to be a self-inflicted wound that needs to be remedied.

1 Instituut Fysieke Veiligheid (2018) 'Orkaan Irma treft Sint Maarten en Caribisch Nederland Een evaluatie van het door het ministerie van IenW geleverde crisismanagement', April 2018.

2 Resolution 63/281 adopted by the General Assembly on climate change and its possible security implications, June 2009.

3 Council conclusions 6153/19 on Climate Diplomacy, February 2019.

4 NATO's Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization, November 2010.

5 Environmental Protection Agency 'What is Climate Change?', 2019.

6 The Intergovernmental Panel on Climate Change (IPCC) reflects on the scientific consensus on the relationship between climate change and greenhouse gas emissions. See, for example, IPCC, *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*, August 2019.

The impacts of climate change, such as extreme weather events, have increasingly affected human security during the last decade. However, many impacts of climate change are evolving slowly and the security dimension is not always straightforward. Therefore, the urgency for action is not immediately self-evident from a hard security angle. The perception of climate change as a non-traditional risk might account for the slowness in forward thinking on the part of many countries and their ministries of defence.[7] But now a shift is occurring, with armed forces in several countries contemplating if, to what extent and how to address and respond to climate-related risks and challenges. As in the Netherlands, they are witnessing the consequences of climate change on their own territory or areas of strategic interest to them. They have started to consider what climate change means for them and how it affects their military capabilities. Armed forces are also increasingly being called upon by society to consider their own contribution to GHG emissions, as they are in many countries relatively large GHG emitters and owners of land and buildings.

The key question posed in this report is how the military could act on climate change, with regard to both adaptation and mitigation (i.e. reducing greenhouse gas, such as carbon dioxide). The research objective is to produce a better insight into the (possible) security risks associated with the consequences of climate change and the impact that these changes may have on the way the armed forces anticipate, prepare, operate and contribute to climate change. Subsequently, the authors assess what the Netherlands Ministry of Defence could do to step up its level of anticipation, (operational) preparedness and other contributions to climate change impacts and policies. This is related to a longer-standing recognition of climate change as one of the emerging threats to which the Dutch military must respond. It is also related to a more generic shift in the Netherlands and the EU to step up its level of ambition in emission reductions.[8]

This report illustrates the choices available by reviewing the efforts of ministries of defence of 11 countries and by assessing the existing capacities and expertise within the Netherlands Ministry of Defence. The selected countries are: Australia, Canada, Finland, France, Germany, Jordan, New Zealand, Norway, Sweden, the United Kingdom and the United States. Information was collected through desk research and interviews with experts in the Netherlands and in the case-study countries. We realise that these 11 countries are not a representative sample, but chose them because we some indication that they had begun considering the implications of climate change for their armed forces. This was based on written sources and their representation

7 Causevic, A. (2016) 'Facing an unpredictable threat: Is NATO ideally placed to manage climate change as a non-traditional threat multiplier?', *Connections*, Vol. 16, No. 2 (Spring 2017), pp. 59-80.

8 For an overview of recent developments on Dutch climate policy, see P. Hofhuis, *Are the Dutch really going green?*, Clingendael Policy Brief, 2020.

at international events on the issue, notably in the context of the newly established International Military Council on Climate and Security (IMCCS).

The countries selected often operate in the context of the EU, NATO or the UN. For this study, we were unable to analyse in detail the efforts of those organisations to integrate climate change into their activities although other research points to them being active in that regard.[9] We include recommendations that the Netherlands could propose as a member of these organisations. In this regard, the EU currently seems most susceptible to considering how to integrate climate change into its Common Security and Defence Policy, with climate change being placed explicitly on the agenda of EU Ministers of Defence.

The report is divided into five parts: in Chapter 2 the drivers of climate change will be identified; Chapter 3 addresses climate change acting as a threat multiplier in specific geographical areas; in Chapter 4 the consequences of climate change for the Dutch military will be discussed, including the niche subjects which are of interest in specific geographic areas; Chapter 5 provides an in-depth analysis of how armed forces in the 11 countries have included climate change in their policies and activities; and, finally, Chapter 6 states conclusions and provides a list of ten recommendations for the Netherlands – in particular for the Ministry of Defence on how to mitigate, address and adapt to climate-related security risks.

9 For example, L. van Schaik, S. Sarris, T. van Lossow and A. Ursu, *Climate-related security risks in Iraq and Mali: what the EU can do*, Planetary Security Initiative, June 2018. See also S. Fetzek and L. van Schaik, *Europe's responsibility to prepare: managing climate security risks in a changing world*, The Center for Climate and Security, June 2018, and D. Smith, M. Mobjörk, F. Krampe and Karolina Eklöw, *Climate Security – Making it #Doable*, SIPRI, February 2019.

2 Drivers of climate security

This chapter discusses the drivers of climate security with regard to the impacts of climate change. We distinguish between first-order impacts that hit directly and second-order impacts that aggravate other fragility risks. In both cases, the drivers become security risks if governments and states cannot appropriately address them and the two categories cannot always be separated. We will also discuss risks related to policies implemented to fight climate change, notably the risks related to energy transition and geoengineering.

2.1 Important drivers of the first order

The most prominent drivers of first order are: rising temperatures; sea-level rise; and extreme weather events.[10]

The rise in temperatures accelerates the melting of shell ice in the Arctic and Antarctic, thus contributing to additional rises in sea levels. It further accelerates the melting of glaciers and amplifies the permanent thawing of permafrost soil, most prominently in Russia. Moreover, climate change alters the pace, timing and amount of snowfall and snowmelt in higher altitudes.

Higher temperatures also result in faster evaporation rates and accelerated desertification and land degradation; they also bring about more frequent and prolonged droughts and heatwaves, as for example in the Middle East in the late 2000s. As a consequence, water availability and agricultural production decrease globally, such as in the Middle East, southern Europe or Asia.[11] In several arid areas, including Afghanistan, Iraq and Mali, stresses over natural resources have already been used by militant groups to win support or recruit new fighters.[12] Drought and high temperatures could also undermine the operation ability of military missions (see Box 1).

10 For example, J. T. Mathews, 'Redefining security', *Foreign Affairs* 68: 2, 1989, pp. 162–77; B. Rodal, 'The environment and changing concepts of security', *Canadian Security Intelligence Service Commentary* 47, 1994; M. A. Levy, 'Is the environment a national security issue?', *International Security* 20, 1995, pp. 35–62.

11 See for more details IPCC, *Climate Change and Land, an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, 2019.*

12 On Afghanistan see: O. Brown, *Climate-Fragility Risk Brief: Afghanistan*, The Climate Security Expert Network hosted by Adelphi, 2019. On Iraq see: T. von Lossow, *More than Infrastructures: Water Challenges in Iraq*, Clingendael Policy Brief, 2018. On Mali see: T. Middendorp and R. Bergema, *The Warning Signs are Flashing Red*, Planetary Security Initiative and ICCT, 2019.

Box 1 Soldiers and ammunition in high temperature environments

Global warming poses a threat to military personnel, both at home and abroad. The rising heat exacerbates challenges the military is facing in the most destabilised regions and endangers the health of soldiers. To illustrate, by 2018 the US military faced 2,792 cases of heat stroke or heat exhaustion diagnosed among its active-duty service members. Furthermore, high temperature environments may affect the storage of ammunition. While most munitions are designed to withstand severe heat, when exposed to extreme temperatures for a longer period of time, the munition can become unstable and strip itself apart. In particular, extreme summer heat could lead to unplanned explosions at munitions sites. For example, in July 2011 huge explosions rocked the Greek-Cypriot naval base in Mari, reportedly from seized munitions, leading to several dead and injured.

In a direct way, high temperatures may render larger parts of the earth uninhabitable. This is the case when temperatures reach more than 50° Celsius, particularly in northern India, Bangladesh and southern Pakistan – a region with a total population of 1.5 billion people.[13] In cities, temperatures often exceed the average for the region, creating a lid – a so-called *urban dome* – around the city. This traps air pollution in the city and the heat can have adverse effects on human health, labour productivity, energy consumption, critical infrastructure, and water quality in cities.[14] High temperatures also pose considerable challenges to the military (see Box 2).

Box 2 Climate change impacts on personnel and equipment: which aspects of the armed forces will be affected by rising and extremely high temperatures? (based on findings of Chapter 5)

1. Military infrastructure and installations
2. Mental and physical health
3. Equipment
4. Air conditioning for personnel, computers and technology
5. Fighter jet engine performance
6. Clothing

13 *Parts of Asia may be too hot for people by 2100*, National Geographic, 2017, https://www.nationalgeographic.com/news/2017/08/south-asia-heat-waves-temperature-rise-global-warming-climate-change/ (accessed November 2019).

14 Amsterdam Institute for Metropolitan Solutions and the Wageningen University & Research (2019) 'Weather balloon research: Amsterdam's urban dome 120 meters high during last heat wave', October, 2019.

Temperature rise and drought also lead to an increase in wildfires. This is of direct relevance for several European countries, including those in Scandinavia and Germany and has proven to affect Australia, Canada and Russia. At the time of writing this report, Australia experienced extreme wildfires causing great harm (often fatal) to people and animals and extensive damage to property.[15] There have also been wildfires in Scandinavia and Russia and are considered a risk in Germany.[16] In February 2019 Canada was hit by ice storms, which resulted in power blackouts followed by floods caused by melting ice. The military was called to restore electricity supply in remote areas, thereby saving people from dangerously cold temperatures in their homes.

Rising sea levels threaten the very existence of low-lying small island states as well as military bases, for example in the Pacific or Indian Ocean.[17] Rising sea levels exacerbate coastal erosion and threaten low-lying areas behind dykes. Countries with areas just a few metres above or even below sea level today, such as the Netherlands, must step up dyke building and management to protect land and key infrastructures from flooding.

In addition, sea-level rise increases saltwater intrusion, rendering land unsuitable for agriculture and groundwater brackish – several of the world's most important aquifers lie in coastal zones. In Gaza, for instance, the water of the coastal aquifer has become almost unsuitable for drinking, as the water table fell below sea level (mostly due to overexploitation in this case). In the Shatt al-Arab in southern Iraq, saltwater has travelled as far as 65km upstream and affected large swathes of land.[18] Moreover, rivers might be unable to flow into higher seas, which increases the risk of flooding.

In any case, rivers flood more often due to heavy precipitation and to glaciers melting at faster pace. Increasing numbers of floods have already affected several European countries: in January 2018, the Seine peaked at about four metres above its normal water level, which led to the flooding of Paris.[19] Most recently, Venice, sitting only about one to two metres above sea level, was hit by three exceptional tides in one week.[20]

15 *'Australia fires: Sydney blanketed by smoke from NSW bushfires'*, BBC, 2019, https://www.bbc.com/news/world-australia-50468450 (accessed 20 November 2019).

16 For a comprehensive global overview of climate risks, see the *World Climate & Security Report 2020* published by the International Military Council on Climate and Security.

17 L. van Schaik, S. Sarris and T. van Lossow, *Fighting an existential threat: Policy Brief small island states bringing climate change to the UN Security Council*, Planetary Security Initiative, March 2018.

18 T. von Lossow, *More than Infrastructures: Water Challenges in Iraq*, Clingendael Policy Brief, 2018.

19 '*French floods: Seine river reaches peak in flood-hit Paris*', BBC, 2018, https://www.bbc.com/news/world-europe-42856634 (accessed 20 November 2019).

20 'How Venice's plan to protect itself from flooding became a disaster in itself', *Washington Post*, Washington DC, 2019, https://www.washingtonpost.com/world/europe/how-venices-plan-to-protect-itself-from-flooding-became-a-disaster-in-itself/2019/11/19/7e1fe494-09a8-11ea-8054-289aef6e38a3_story.html (accessed November 2019).

Extreme weather events – such as torrential rain and floods, droughts and heatwaves as well as cyclones and hurricanes – occur more frequently, are prolonged or intensified. In many cases, humanitarian catastrophes are the result of immense economic damage, dramatic numbers of fatalities and calls for military assistance. Prominent examples are Hurricanes Katrina (2005), Joaquin (2015) or Irma (2017); the floods in Pakistan (2010) and Kerala (2018); or droughts in the Middle East in the late 2000s or in East Africa (2011-2012).

In many areas, multiple drivers of the first order hit at the same time, reinforcing each other and intensifying the impact. For example, melting glaciers, faster snowmelt and more frequent heavy rainfall all contribute to more flooding, as glacial lakes and river systems cannot drain such massive amounts of water. Further examples are rising temperatures and sea levels, prolonged droughts and heat waves with record temperatures at around 50˚C, more frequent dust storms and desertification. These phenomena reinforce each other and exponentially aggravate water scarcity and water stress. The number of wildfires, which damage soil and render it repellent to water, are expected to rise, as the world becomes hotter and drier.[21] Water stress is already fuelling various conflicts, for instance, playing a role in violent clashes over ever-more scarce fertile land between mostly sedentary farmers and nomadic pastoralists in Kenya and Mali.[22]

Climate change effects of the first order related to heat increasingly also affect the European mainland. Southern and central Europe are seeing more frequent heat waves, forest fires and droughts; the Mediterranean area is becoming drier, making it more vulnerable to drought and wildfires. Northern Europe is becoming significantly wetter; winter floods could become more common and urban areas are exposed to heatwaves, floods or rising sea levels.[23]

2.2 Important drivers of the second order

Most drivers of climate change have direct and indirect effects on ecological, social, economic and political systems. For drivers of the second order, climate change acts as a threat multiplier by amplifying critical situations within these systems, such as migration, and thus negatively affects stability and security. Most prominently, it is the degradation

21 'California fires are raging: Get the facts on wildfires', *National Geographic*, Washington DC, 2019, https://www.nationalgeographic.com/environment/natural-disasters/wildfires/ (accessed November 2019).

22 S. Mitra, *Mali's Fertile Grounds for Conflict: Climate Change and Resource Stress*, Policy Brief, Planetary Security Initiative, 2017.

23 European Commission, *Climate Change Consequences*, n.d. https://ec.europa.eu/clima/change/consequences_en.

of natural resources such as land and water which increases competition, and triggers and prolongs conflicts. The United Nations Environment Programme (UNEP) has specifically referred to the conflict in Darfur in this context.[24] The situation in the Sahel has similar characteristics (see Box 3).

Box 3 Resource conflicts in Mali

The centre of Mali is inhabited by several ethnic groups, including Fulani herdsmen, Dogon and Bambara farmers and Bozo fishermen, all of whom face a daily struggle to survive. This fertile area of Mali has been the backdrop of many historical conflicts largely revolving around administration of the land, the use of watercourses, the sharing of resources and the seasonal migration of livestock during the dry season. Population growth and climate change have been major contributing factors in creating fertile grounds for conflict in Mali: the population will rise to approximately 45 million by 2050 and more frequent and intense droughts and floods inflict a huge cost on crops and livestock.

Both the EU and the UN have acknowledged climate change as one of the root causes of conflict across the Sahel region, and in Mali specifically. In June 2018, the Council of the EU formally recognised the crucial need to address climate security in Mali. The UN Security Council has acknowledged climate as a risk factor for West Africa and has included it as such in the MINUSMA mission mandate since July 2018. It is currently waiting for another extension of this mandate.

Sources[25]

Drivers of the second order are linked and reciprocally reinforcing, with cascading effects on security. The MENA region is a leading example where climate change exacerbates tensions between ethnic groups, in addition to existing grievances about oppression and human rights violations. The Arab Spring of the late 2000s has been linked in part to higher prices of staple food in the aftermath of droughts hitting grain production in Russia and Ukraine, which traditionally export to Egypt, Libya and Tunisia.

24 *Sudan: Post-Conflict Environmental Assessment*, United Nations Environment Programme, Nairobi, 2007, https://postconflict.unep.ch/publications/UNEP_Sudan.pdf (accessed November 2019).

25 M.D. Diop, *The urgency of climate change in Mali: an aggravating factor for the security of the people living in the centre?*, Planetary Security Initiative, April 2019; R. Magowan, L. van Schaik, T. von Lossow and L. Donkor, *Resource-focussed solutions to escalating violence in Mali*, Planetary Security Initiative, April 2019.

Mortality rates rise due to an increasing prevalence of diarrhoeal diseases caused by poor water quality, the spread of vector-borne diseases helped by a warmer climate, and heat-related or flood-related fatalities. As a consequence, productivity of the labour force decreases and economic growth slows down. Families are economically worse off, which potentially prevents their children going to school but instead requires them to contribute to the family income. Lastly, the lack of prospects for young people has the potential to threaten the social fabric and a country's stability, providing a fertile ground for radicalisation.[26]

Climate change accelerates pressures on socio-economic conditions that are stressed by population growth, migration and urbanisation. More people need more water and food, but climate change reduces availability. In Jordan, for example, the population has more than doubled over the last 20 years,[27] drastically increasing water consumption – forcing the Kingdom to import water from neighbouring Israel. In southern Iraq the drastic deterioration of basic water supply and electricity services during the heatwave in summer 2018 played a central role in triggering anti-government protests and uprisings.

Climate change can act as a push factor for out-migration if peoples' livelihoods are deteriorating and certain areas become uninhabitable. It is debated among scholars whether climate change, drought and the large out-migration of farmers from northern Syria in the late 2000s might have been the direct trigger for the uprisings and the following civil war in Syria. However, it is beyond contestation that climatic factors did play a role when the farmers decided to leave the north.

The war in Syria has resulted in waves of migrants seeking safety in Europe. Although it is difficult to attribute to climate change an expected increase in numbers of migrants coming to Europe, there are indications that climate change is a contributing factor in a mix of motivations playing a role in people's decision to migrate.[28] For the military, this may mean an increased need for assistance with border protection.

26 T. Middendorp and R. Bergema, *The Warning Signs are Flashing Red*, Planetary Security Initiative and ICCT, 2019.

27 *Estimated population of 2018 and some selected data*, Department of Statistics, Amman, 2018, http://dosweb.dos.gov.jo/DataBank/Population_Estimares/PopulationEstimates.pdf (accessed November 2019).

28 L. van Schaik and T. Bakker, *Climate-Migration-Security: A contested relationship*, Clingendael Institute for International Relations, November 2017; G.J. Abel, M. Brottrager, J. Crespo Cuaresma and R. Muttarak, 'Climate, conflict and forced migration', *Global Environmental Change*, vol. 54 (January 2019), pp. 239-249; C. Kohler, C. Denner Dos Santos and M. Bursztyn, *Understanding environmental terrorism in times of climate change: implications for asylum seekers in Germany*, Planetary Security Initiative, November 2019.

In summary, climate change, in combination with broader socio-economic trends, such as a growing world population, is likely to lead to more conflict and migration.[29] The often already strained and less resilient ecological, social, economic and political systems are not able to absorb related challenges. Therefore, armed forces should not only prepare for increased demands for humanitarian assistance and disaster response, but also for migration movements caused by increased resource competition or interstate conflict over resource management in cross-border issues. Effective early warning systems and planning capabilities will be part of this preparation and will demand larger budget allocations.

2.3 The security dimension of policies to address climate change: maladaptation, energy transition risks and geoengineering

It is increasingly realised that it is not only climate impacts that are threat multipliers, but also some policies to address those impacts. The security implications of energy transition or adaptation policies that are not conflict sensitive can pose security risks as well, even though very little research is available on these issues to date. Even less strategic analysis has been undertaken on another potential security risk related to climate change, which is that of geoengineering, if used as a solution to halt climate change.

Climate adaptation policies may benefit one community or social group over another – resulting in increased tensions. Consider, for instance, a land restoration or water project that benefits Sahel farmers, but not herders. In this case, adaptation policies are not conflict sensitive and are thus labelled 'maladaptation'.[30] Military bases can also place an additional strain on scarce water and food resources, which needs to be taken into account when military forces are operating in climate-vulnerable regions.

The transition away from fossil energy sources to renewables is the explicit objective of many climate change policies, even though it is also motivated by costs, competitiveness and energy security considerations. Fossil fuel is a cost driver for military forces, as they are relatively big consumers of oil and diesel and use it both for buildings and military equipment. Moreover, in battlefield areas, supply lines of oil and diesel are known to be vulnerable and hence expensive and dangerous to maintain. Green energy in combat

29 Ibid.

30 L. van Schaik, C. Born, E. Sellwood and S. de Bruin, *Making peace with climate adaptation*, Clingendael Institute for International Relations, August 2019.

zones also saves lives beyond reducing the carbon footprint: mobile solar-power units are almost silent and can cross enemy territory without being noticed.[31]

Policies to reduce greenhouse gas emissions (mitigation) can also lead to tensions, as losses can be expected with regard to the (economic) activity that caused the emissions. A relatively new field of research points to energy transition also having geopolitical and security implications.[32] Discussions have started about so-called stranded assets: investments into fossil that will no longer generate revenue when renewables become cheaper, and therefore are 'stranded'. It has been pointed out that large coal, oil and gas companies might collapse if they do not shift their business model to renewables in the very near future, and some argue it will no longer be possible for them to generate equally large profits, as the business model of renewable energy production and consumption is fundamentally different and margins are lower.[33] Consequently, the question is: what happens to regions and countries like Russia and the OPEC countries that are highly dependent for their wealth and stability on revenues from coal and oil. Similar problems may emerge in other sectors significantly affected by energy transition, such as car manufacturing or steel production.

At the same time, the transition might reduce crime and corruption related to fossil fuel production, whereas an uncontrolled collapse of oil and gas markets could cause unrest. A relatively high number of petrostates are politically unstable or entrenched in domestic or international conflict.[34] Oil and gas companies, as well as pipelines, are often connected to oligarchs and networks of corruption, in both production and transit states. Reduced demand for oil and gas in the main export markets, in petrostates that have not (yet) having diversified their economies, could lead to more instability and economic uncertainty. In the long run, energy transition could reduce corruption and spark economic diversification.

Geoengineering poses another security risk. It concerns the deliberate and large-scale intervention in the earth's atmosphere and stratosphere with the aim of mitigating the adverse effects of climate change. Measures could focus on either GHG removal or solar

31 'U.S. military marches forward on green energy, despite Trump', *Reuters*, 1 March 2017, https://www.reuters.com/article/us-usa-military-green-energy-insight/u-s-military-marches-forward-on-green-energy-despite-trump-idUSKBN1683BL (accessed November 2019).

32 P. Stevens, *The Geopolitical Implications of Future Oil Demand*, Chatham House the Royal Institute of International Affairs, August 2019.

33 *Oil and gas companies risking $2.2trn in stranded assets during low-carbon transition, report warns*, Euractiv, September 2019, https://www.euractiv.com/section/energy/news/oil-and-gas-companies-risking-2-2trn-in-stranded-assets-during-low-carbon-transition-report-warns/ (accessed November 2019).

34 P. Stevens, *The Geopolitical Implications of Future Oil Demand*, Chatham House the Royal Institute of International Affairs, August 2019.

radiation management. The problem with geoengineering is the current lack of insight into potentially dangerous longer-term effects.

Deeper analysis and examination of the risks of climate-manipulating technology was proposed by Switzerland and 12 other countries as a first step towards stronger oversight of potentially world-altering experiments that would have implications for food supply, biodiversity, global inequality and security, for example.[35] Calls are being made to discuss rules of geoengineering at multilateral level to avoid countries going it alone with impacts going widely beyond their own territory.[36] Therefore, several initiatives have been established, for example the Carnegie Climate Governance Initiative, which aims to catalyse the creation of effective and inclusive governance for emerging climate technologies.[37]

The security risks of both energy transition and geoengineering are relatively uncharted territory and we have not found any evidence of armed forces considering these risks extensively. Nevertheless, where possible, we will take them into consideration in our analysis of areas of strategic impact and the efforts of armed forces to address climate change security risks.

35 'US and Saudi Arabia blocking regulation of geoengineering', *The Guardian*, 18 March 2019, https://www.theguardian.com/environment/2019/mar/18/us-and-saudi-arabia-blocking-regulation-of-geoengineering-sources-say (accessed 19 November 2019).

36 'What if geoengineering goes rogue?', *The Economist*, 6 July 2019, https://www.economist.com/the-world-if/2019/07/06/what-if-geoengineering-goes-rogue (accessed 19 November 2019).

37 For more information see: https://www.c2g2.net/.

3 Climate-security drivers affecting areas of strategic interest to the Netherlands

The impacts of climate change differ from region to region, state to state, and even internally, for example from mountain areas and coastal areas. In this chapter we discuss impacts for regions of direct strategic interest to the Netherlands:

1. The Netherlands itself, as this is the primary focus of the Netherlands Ministry of Defence.
2. The Caribbean region of the Netherlands, which consists of: the other three constituent countries in the Kingdom of the Netherlands – Aruba, Curaçao and Sint Maarten; and the special municipalities of the Netherlands – Bonaire, Saba and Sint Eustatius. The constituent countries participate on a basis of equality as partners in the Kingdom but are dependent on the Netherlands for foreign policy and defence.
3. The Arctic region, which is heating up twice as fast as the rest of the world – making new sea lanes and resources accessible. Yet geopolitical tensions between great powers are on the rise and it is not clear who owns the Arctic, with territorial disputes among NATO allies and between NATO allies and Russia.
4. The Middle East and North Africa (MENA) region is an area of priority for the Netherlands and the EU, and is among the areas hit hardest by climate change.

3.1 The Netherlands

According to the Royal Netherlands Meteorological Institute (KNMI) the most severe effects of climate change related to the Netherlands are the rising average temperature, the increased occurrence of extreme weather events, and the rising sea level.[38]
The report also concludes that changes in wind speed are negligible and the number of days with fog are declining.

While the global average temperature has risen by 0.8°C in the last 120 years, this average temperature rose twice as fast in the Netherlands. Specifically, the number of 'summer days', days with a temperature of 25°C or higher, has increased by 20 days

38 *KNMI'14-klimaatscenario's samengevat (trans.: Royal Netherlands Meteorological Institute '14-climate scenarios summarised)*, Royal Netherlands Meteorological Institute (KNMI), De Bilt, 2014, http://www.klimaatscenarios.nl/scenarios_samengevat/index.html (accessed November 2019).

a year, while the days of frost have decreased by the same number. A threat to public health deriving from rising temperatures is the risk of increased number of infectious diseases and disease-spreading mosquitoes, such as dengue and the zika virus.[39] Heatwaves make it more difficult to carry out military exercises.

Sea levels will continue to rise and may rise faster if ice is melting in the Arctic and Antarctica.[40] The Netherlands needs to prepare for this, as it is particularly vulnerable to flooding: most of the country lies below sea level. Dutch dyke management is exceptionally well developed and is not questioned, despite its high costs.[41] However, dyke management is not an effective measure against rising groundwater or salinization. The higher the sea rises, the saltier the groundwater in coastal provinces becomes, thereby threatening agriculture — one of the Netherlands' key export sectors.[42] Second, rising sea levels mean that saltwater flows into rivers with lower water levels, instead of fresh river water draining into the sea; this causes problems inland with fresh water supplies and agriculture.[43] In the worst situations, rivers cannot drain into the sea, causing estuaries to shift inland as well as more severe flooding in low-lying riverbanks.

According to some experts, rising sea levels may necessitate moving low-lying air strips to higher ground, and could might also affect naval bases.[44] Much will depend on the measures taken by political authorities to deal with these risks relating to water management. However, the closer military infrastructure is located to the big rivers, the higher the risk of potential effects of climate change. Sea-level rise is a longer-term danger, but in the worst-case scenario (up to +70cm this century) naval infrastructure may be affected.[45]

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39 *Ziektenverspreidende Muggen Rukken door Klimaatverandering ook op naar Nederland (trans.: Disease-Spreading Mosquitoes Are Also Advancing to the Netherlands Due to Climate Change)*, De Volkskrant, 2019, https://www.volkskrant.nl/wetenschap/ziektenverspreidende-muggen-rukken-door-klimaatverandering-ook-op-naar-nederland~b1e02102/ (accessed November 2019).

40 *Deltaprogramma 2019, Bijlage B: Rapport Deltares*, Government of the Netherlands, The Hague, 19 September 2018, https://www.deltacommissaris.nl/documenten/publicaties/2018/09/18/dp2019-b-rapport-deltares (accessed November 2019).

41 *Dutch Vision on Global Climate Action*, Government of the Netherlands, The Hague, n.d., https://www.government.nl/topics/climate-change/dutch-vision-on-global-climate-action (accessed November 2019).

42 *Impact Analysis of Drought and Salinity on Grassland Production in the Netherlands Using Historical and Future Climate Data*, Wageningen University & Research, Wageningen, 2011, https://www.wur.nl/nl/Publicatie-details.htm?publicationId=publication-way-343134313335 (accessed November 2019).

43 *Deltaprogramma 2020: Doorwerken aan de delta: Nuchter, Alert en Voorbereid*, Government of the Netherlands, The Hague, 17 September, 2019, https://deltaprogramma2020.deltacommissaris.nl/ (accessed November 2019).

44 Van Reedt Dortland M., et al. 2019, *Climate Change and Degradation of Natural Resources: Implications for the Military*, Planetary Security Initiative.

45 RTLZ, IJsmassa Groenland smelt veel sneller dan gedacht, RTLZ, 10 December 2019. https://www.rtlz.nl/algemeen/artikel/4951071/ijsmassa-groenland-smelten-ipcc-klimaatverandering-opwarming-nature.

On top of this, extreme weather may further contribute to the difficult drainage of water, as drainage systems and rivers have to deal with sudden large volumes of water. The intensity and frequency of rainfall will change, just as periods of extreme heat and drought change. Observations show that with the most extreme rainfall, the amount of precipitation per hour increases on average by around 12% per degree of warming.[46] Related to drought, the prices of onions, beetroot and potatoes have been rising in the last few years due to poor harvests.[47] At other times farmers have been very badly affected by heavy hail storms that ruined crops and greenhouses. Two years ago, damage to the agricultural sector exceeded 100 million Euros.[48]

The KNMI also points to an increased risk of other extreme weather events, with intense storms and extreme meteorological phenomena such as tornadoes and whirlwinds hitting the Netherlands more frequently.[49] These events could more often lead to loss of life, property and livelihoods, thereby threatening national security and increasing the need for the army to safeguard the security of communities, as well as law and order.

Extreme weather can also refer to extreme droughts or extended periods of drought. In the last few years the KNMI has published several reports stating that water scarcity in the Netherlands will likely be caused by extended periods of drought in Europe. The water drainage of the Maas – a drinking water source for almost four million Dutch citizens – will decrease from 45% to 65%.[50] Companies that extract drinking water from the Maas will be more susceptible to incidents related to pollution and industrial discharges.[51]

46 *Waarnemingen Klimaatverandering (trans.: Observations of Changes in the Climate)*, Royal Netherlands Meteorological Institute (KNMI), De Bilt, n.d., https://www.knmi.nl/kennis-en-datacentrum/achtergrond/waarnemingen-klimaatveranderingen (accessed November 2019).

47 *Fruittelers plukken vruchten van droogte: tot wel 21.000 euro meer inkomen (trans.: Fruit growers are reaping the benefits of drought: up to 21,000 euros more in income)*, RTLZ, 2018, https://www.rtlz.nl/algemeen/binnenland/artikel/4386071/fruittelers-plukken-vruchten-van-droogte-tot-wel-21000-euro (accessed November 2019).

48 *Meer dan 100 miljoen euro schade in Zuidoost-Brabant door noodweer: boeren luiden noodklok (trans.: More than 100 million euros of damage in Southeast Brabant due to heavy weather: farmers sound the alarm)*, Omroep Brabant, 2016, https://www.omroepbrabant.nl/nieuws/215047/Meer-dan-100-miljoen-euro-schade-in-Zuidoost-Brabant-door-noodweer-boeren-luiden-noodklok (accessed November 2019).

49 *KNMI'14-klimaatscenario's samengevat (trans.: Royal Netherlands Meteorological Institute '14-climate scenarios summarised)*, Royal Netherlands Meteorological Institute (KNMI), De Bilt, 2014, http://www.klimaatscenarios.nl/scenarios_samengevat/index.html (accessed November 2019).

50 *Jaarrapport 2018: de Maas (trans.: Annual Report 2018: the Maas River)*, Vereniging van Rivierwaterbedrijven (RIWA), 2019, https://www.riwa-maas.org/publicatie/de-kwaliteit-van-het-maaswater-in-2018/ (accessed November 2019).

51 Ibid.

Migration from other parts of the world could increase pressures in Dutch society, leading to demands for stricter border controls. Rising sea levels may also mean that migration from low-lying areas within the Netherlands may need to be considered. Related loss of assets and properties may lead to financial losses and feelings of insecurity, and drops in price may emerge well before actual migration takes place, with potentially serious implications for economic security.

3.2 Caribbean region of the Kingdom of the Netherlands

The economies of the Caribbean islands primarily depend on tourism and agriculture – the two sectors most susceptible to the negative effects of climate change.[52] In the south of the Caribbean, climate change will most likely result in less rainfall, which could threaten water supplies on the islands.[53] Moreover, high temperatures in combination with humidity create an environment in which disease-carrying mosquitoes can flourish — a significant public health risk. Hurricanes pose a direct threat to lives and damage critical infrastructure and livelihoods.

While rising tides are a threat to all coastal areas, the Caribbean Basin is unusually vulnerable, due to the flat low-lying topography, porous limestone bedrock and tropical cyclones common to the area.[54] Integrated sea-level rise projections and flood risk analysis indicate that floods reaching at least 0.5m above high tideline at shore will become common events throughout most of the Caribbean within half a century, and more likely sooner. In the case of an extreme weather event, in combination with a higher sea level, sea water will reach much further inland. At this moment, the larger islands of Aruba and Curaçao lack coastal protection as exists in the Netherlands.

On the Caribbean islands, a large majority of the population lives in coastal areas, which are likely to be affected by floods caused by sea-level rise in combination with hurricanes or storms. Small, densely built-up areas will become less habitable in the

52 *Klimaatverandering op de Caribische Eilanden (trans.: Climate change on the Caribbean Islands)*, Royal Netherlands Meteorological Institute (KNMI), De Bilt, 2017, https://www.knmi.nl/over-het-knmi/nieuws/klimaatverandering-op-de-caribische-eilanden (accessed November 2019).

53 *Grootschalige afsterving koraalriffen door opwarmende oceanen (trans.: Large-scale coral reefs dying due to warming oceans)*, Royal Netherlands Meteorological Institute (KNMI), De Bilt, 2017, https://www.knmi.nl/over-het-knmi/nieuws/grootschalige-afsterving-koraalriffen-door-opwarmende-oceanen (accessed November 2019).

54 B. Strauss and S. Kulp, *Sea-Level Rise Threats in the Caribbean: Data, tools, and analysis for a more resilient future*, Inter-American Development Bank, February 2018.

future.[55] Moreover, drinking water supplies will become brackish, soil will become salinized and beaches (essential for the tourist sector) will disappear when seawater reaches further inland.[56] The effects of sea-level rise will be most visible at Bonaire, as the island is built on coral reefs (like the Bahamas). Saba and Sint Eustatius are built on volcanic ground, which locates them a little bit more above sea level and therefore less prone to the effects of rising sea levels.

Extreme weather events will occur more often, most notably hurricanes, which have grown in number and strength. Extreme weather is also leading to floods caused by tropical storms. In Sint Maarten the devastating impact of Hurricane Irma necessitated a military operation from the Netherlands to provide assistance and maintain law and order. One and half years later, the island is still struggling with recovery, and unrest has returned to the French part of the island, caused by grievances about the slow pace of recovery.

The Caribbean region is extremely vulnerable to environmental changes caused by climate change. The coral reefs attract tourists from all over the world, but over 70% of the reefs have disappeared since 1973.[57] If this trend continues, the amount of coral remaining will drop below 1% by 2030.[58] This will be a huge blow for the tourist industry, but coral also functions as natural coastal protection, which will be even more important as sea levels rise. Furthermore, the islands are heavily affected by ocean acidification caused by discharges of polluted water, excessive algae growth, and coastal erosion.[59]

The fishery sector is facing severe problems due to over-exploitation and irregular fish migration caused by rising sea temperatures; the agricultural industry is having similar problems because of overgrazing. Overgrazing causes widespread erosion and

55 *Cariben nu een tropisch paradijs, straks een onbewoonbaar moeras?'* NOS, 2017, https://nos.nl/artikel/2194865-cariben-nu-een-tropisch-paradijs-straks-een-onbewoonbaar-moeras.html (accessed 20 November 2019).

56 *'De onontkoombare verwoesting door de stijgende zeespiegel in beeld' (trans.: 'The unavoidable disasters caused by a rising sea level in pictures'*, Trouw, 2019, https://www.trouw.nl/duurzaamheid-natuur/de-onontkoombare-verwoesting-door-de-stijgende-zeespiegel-in-beeld-gebracht~b4ad180f/ (accessed 20 November 2019).

57 A.O. Debrot, R.J.H.G. Henkens, P.J.F.M. Verweij, Staat van de natuur van Caribisch Nederland 2017: een eerste beoordeling van de staat (van instandhouding), bedreigingen en managementimplicaties van habitats en soorten in Caribisch Nederland, Wageningen Marine Research rapport C086/17, 2017.

58 *Minister Schouten: kom in actie want de koraalriffen in Caribisch Nederland sterven! (trans.: Minister Schouten: take action, because the coral reefs in The Caribbean Netherlands are dying!)*, World Wildlife Fund, 2019, https://www.wwf.nl/wat-we-doen/actueel/nieuws/minister-schouten-kom-in-actie-want-de-koraalriffen-in-caribisch-nederland-sterven (accessed November 2019).

59 *De kwetsbare kant van de Caraïben (trans.: The Vulnerable side of the Caribbean)*, TNO, 2016, https://www.tno.nl/nl/tno-insights/artikelen/de-kwetsbare-kant-van-de-caraiben/ (accessed November 2019).

eradication of rare vegetation, preventing nutrients entering the sea which, in turn, leads to reduction of fish stocks.[60] Hence, climate change-related problems and tourism are strongly linked in the Caribbean islands.

The geographic position of the islands means they receive increasing numbers of migrants from countries in (political) crisis, such as Venezuela, or countries with a considerably lower level of economic development, such as Haiti. They are also vulnerable to organised crime, money laundering, drug trafficking, and even human smuggling; all recognised as security issues in the Caribbean. And they import most of their food from the region. The islands are struggling to deal with rising numbers of migrants and with criminal activities originating outside their own territory. Food prices have already risen considerably. These challenges already pose a threat to the Caribbean and may be aggravated by climate change.

3.3 Arctic region

Ice melting in the Arctic and the accompanying sea-level rise have many global repercussions, including above all have an impact on the security situation in the Arctic region. New sea lanes are opening up in an area of contested borders, and it is expected that economic activities such as shipping, oil and gas exploitation, fishing and tourism will increase in the coming years. This will cause a shift in geopolitical dynamics and put stress on relations between the Arctic countries – the United States, Canada, Denmark, Finland, Iceland, Russia, Norway and Sweden – and the indigenous people of the region.[61] In addition to this, China also shows serious interest in the Arctic region, calling itself a 'near Arctic state' with the intention of opening a 'Northern Silk Road', thereby hoping to make the Arctic region the Suez Canal of the 21st century.[62]

Russia, the US and China all see the Arctic area as a top priority – not only economically, but also militarily.[63] Naval vessels and submarines are being designed to move through

60 *Natuur in Caribisch Nederland zwaar onder druk (trans.: Nature in Caribbean Netherlands under significant pressure)*, Wageningen University & Research, Wageningen, 2019, https://www.wur.nl/nl/nieuws/Natuur-in-Caribisch-Nederland-zwaar-onder-druk.htm (accessed November 2019).

61 T. Dams and L. van Schaik, *The Arctic Elephant: Why Europe must address the geopolitics of the high north*, Clingendael Netherlands Institute for International Relations, November 2019.

62 *China breidt Zijderoute via Groenland uit naar Noordpool, VS vrezen 'agressief gedrag' (trans.: China expands Silk-route via Greenland to the North Pole, US fears 'aggressive behaviour')*, De Volkskrant, 2019, https://www.volkskrant.nl/nieuws-achtergrond/china-breidt-zijderoute-via-groenland-uit-naar-noordpool-vs-vrezen-agressief-gedrag~b96fe690/ (accessed November 2019).

63 L. van Schaik and T. Dams, *The Arctic Elephant: Europe & Geopolitics of the High North*, Clingendael Institute for International Relations, November 2019.

ice, and cold-weather experts are being gathered to study the first line of defence.[64] Russia and Canada have indicated that they consider the Northern Route and North-West Passage to be their national waters and can charge revenues for ships passing through, something which is not acceptable to the US or other countries. With regard to the Northern Route located on Russian shores, new harbours are being developed with Chinese investments. A general increase in military exercises and build-up is being seen, and for NATO addressing the region is a sensitive matter, as disputes exist between NATO allies, as well as between NATO and Russia. The great powers also show a significant interest in Greenland, due to its geostrategic position and because melting ice is making rare metals and uranium available for mining.

Hence, climate change-related security risks in the Arctic region are slightly different from global risks, but may have a considerable geopolitical impact. Russia, the US and China will not back down in their race for Arctic supremacy. The European Arctic powers (i.e. Norway, Sweden and Finland), together with the EU, are trying to de-politicise the issue and steer the focus towards climate change mitigation, scientific cooperation and environmental protection.[65]

In the meantime, there is no inclusive forum where these political/security issues can be addressed. The Arctic Council is a unique body of global governance in which all the great powers meet, but it is explicitly mandated not to discuss security and rather focuses on, for instance, environmental cooperation. Other forums exist to discuss the security situation but they are not supported by all the great powers, a prominent one being the Arctic Security Forces Roundtable (ASFR), a semi-annual gathering focused on improving communications and maritime domain awareness in the Arctic Circle. ASFR meetings are attended by Canada, Denmark, Finland, France, Germany, Iceland, the Netherlands, Norway, Sweden, the United Kingdom and the United States. Russia used to take part, but has not been invited since 2014. China is not involved either. In 2020 the EU is expected to publish a new Arctic strategy in which security might be more central. A debate has also begun on where, other than in the Arctic Council, security concerns could be discussed with all of the great powers.

It is unclear who owns the Arctic Sea and several claims have been submitted to the Commission on Arctic Shelves of the United Nations Convention on the Law of the Sea (UNCLOS). Canada, Denmark and Russia all claim that a rig (small mountain) on the bottom of the sea indicates the extension of their continental shelf and thereby

64 'Polar powers: Russia's bid for supremacy in the Arctic Ocean', *Financial Times*, 2019, https://www.ft.com/content/2fa82760-5c4a-11e9-939a-341f5ada9d40 (accessed November 2019).

65 *Legislative Train Schedule: Europe as a stronger global actor, Integrated Arctic Policy*, European Parliament, Brussels, 2019, http://www.europarl.europa.eu/legislative-train/theme-europe-as-a-stronger-global-actor/file-integrated-arctic-policy (accessed November 2019).

ownership of the Arctic Sea. Technically the legal claims are complicated and a verdict is not expected until about a decade from now, with the US not even being a member of UNCLOS. In addition, there are territorial disputes over ownership of islands, for example Hans Island. Because there are overlapping claims between NATO allies (Canada and Denmark) and between these NATO allies on the one hand and Russia on the other hand, the situation in the Arctic may have repercussions for the NATO alliance or Article 5 of the Washington Treaty.

3.4 Middle East and North Africa

The Middle East and North Africa (MENA) area is particularly vulnerable to climate change. It is one of the driest regions in the world and highly dependent on climate-sensitive agriculture.[66] Moreover, it has been a major area for exploration and exploitation of energy resources for decades, often in the midst of intense security issues. Climate change will likely exacerbate destabilisation and political turmoil in the region. Rising temperatures will put pressure on food availability and contribute to desertification. Water scarcity and the lack of sustainable water management is already having significant negative effects on both agriculture and drinking water.[67] Simultaneously, extreme weather events will have a disastrous impact on livelihoods and economic activity in flood-prone urban coastal zones. Hence, in the MENA region, climate change acts as a threat multiplier of conflict and destabilisation.

For the EU generally and in the Netherlands, developments in the MENA region are of great concern in light of the close geographical proximity, which is translated into close trade relations, migration flows and imported insecurity. Many of the (potential) Common Security and Defence policy missions of the EU, as well as NATO missions, are in this region.[68] The uninhabitable conditions in some areas could act as a push-factor for migrants towards Europe. Increasing sand and dust storms in the region, particularly in Iran and Iraq, are a public health risk.[69] Iraq may have to face 300 'dust events' per

66 *Adaptation to Climate Change in the Middle East and North Africa Region*, The World Bank, n.d., http://web.worldbank.org/archive/website01418/WEB/0__C-152.HTM (accessed November 2019).

67 *Why the MENA region needs to better prepare for climate change*, Atlantic Council, 2019, https://www.atlanticcouncil.org/blogs/menasource/why-the-mena-region-needs-to-better-prepare-for-climate-change/ (accessed November 2019).

68 Tweede Kamer der Staten-Generaal, Actuele Situatie in Noord-Afrika en het Midden-Oosten, The Hague, 6 June 2018. https://zoek.officielebekendmakingen.nl/kst-32623-220.html.

69 Abumoghli, I. and Broughton, M., 2019. 'Environmental outlook for the West Asia region,' in: *Environmental Challenges in the MENA Region: The long road from conflict to cooperation*, ed. Pouran, H. and Hakimian, H., 20-21.

year in the next decade.[70] Climate change-induced desertification is a contributor to the increasing number of sand and dust storms, further accelerating the unsustainable use of land and water. Hence, climate change as a threat multiplier in unstable areas and as the cause of uninhabitable land could put pressure on the national security of the Netherlands and the EU and lead to extended calls for tighter border control.

In the MENA region examples have been found of the use of water and other natural resources as strategic and tactical weapons in conflict. ISIS used the provision of water to win the hearts and minds of local populations and for recruitment purposes.[71] Similar examples can be found in the Sahel region.[72] Possession of dams and water infrastructure was used strategically and it was realised that military operations in the region rely not only on fuel and soldiers, but also on the availability of fresh water. Water also plays an important role in Middle-East disputes. The UN has tasked military missions in Mali (MINUSMA) and Iraq (UNAMI) with taking into account the way in which climate change aggravates resource stresses and, by extension, tensions between conflicting groups in society.

70 Ibid.

71 T. von Lossow, *More than Infrastructures: Water Challenges in Iraq*, Clingendael Policy Brief, 2018.

72 T. Middendorp and R. Bergema, *The Warning Signs are Flashing Red*, Planetary Security Initiative and ICCT, 2019.

4 Implications for the Netherlands armed forces

This chapter assesses the implications of the climate change drivers on the Netherlands armed forces and the Ministry of Defence at large. First, the consequences for security strategy and defence policies will be analysed, followed by an assessment of operations, personnel and equipment based on the climate change drivers of the first and second order as described in Chapter 2. More specific climate change consequences for the Dutch armed forces are assessed in the context of the four areas of geographical relevance described in Chapter 3: the Netherlands national territory; the Caribbean; the Arctic region; and the Middle East and North Africa. Finally, this chapter deals with the issue of greenification of the Netherlands armed forces.

4.1 Security strategy and defence policy

In the past two years, two new security strategies have been published in the Netherlands. The Integrated International Security Strategy[73] refers to climate change, but in the list of security threats to the country climate change is absent. Climate change is mentioned with regard to conflict prevention as well as with regard to the MENA region and the Arctic. The National Security Strategy[74] identifies climate change as a security challenge and refers to floods, storms, rising temperatures, long periods of drought and sea-level rise as factors affecting the security of the Netherlands. The National Security Strategy refers to policies and measures to be taken and it makes the case for stepping up civil-military cooperation in the context of an integrated approach to national security. The 2018 Defence White Paper pays scant attention to climate change as a factor influencing the security environment, with its potential consequences for the Dutch armed forces.[75]

Recently, climate change has attracted more attention at the Netherlands Ministry of Defence. Strategic foresight activities have been stepped up and are taking climate change into consideration in applicable regional cases. The new Conflict Prevention Unit

73 *Working Worldwide for the Security of the Netherlands: An Integrated International Security Strategy 2018-2022.*

74 *Nationale Veiligheid Strategie 2019.*

75 *Defensienota 2018*, The Netherlands Ministry of Defence, March 2018, https://www.defensie.nl/downloads/beleidsnota-s/2018/03/26/defensienota-2018 (accessed 20 November 2019).

of the Directorate-General on Policy and the Military Strategic Element in the Defence Staff have launched a series of joint foresight studies with regional focus across the globe. Thus far, however, the Arctic region is missing, which is remarkable considering that the Netherlands government is preparing a new Polar strategy to be published in 2020. Furthermore, there is close cooperation with other ministries and international partners such as the Ministries of Defence of France and the UK.

When it comes to defence policy and planning, the impact of climate change has not been embedded in the process in a structural manner. The consequences for personnel and equipment have been addressed primarily on an ad hoc basis and mainly relate to real-life operations such as in Afghanistan and Mali. While tailor-made solutions are the answer to problems encountered during operations, they are often expensive as equipment might have to be upgraded at short notice or procured due to urgent operational requirements. The growing impact of climate change on armed forces requires a more fundamental and structural approach, from security and defence strategies and policies to defence, personnel and equipment planning.

4.2 Implications of drivers of the first order

Logically, countries have a national focus on the risks of and responses to natural disasters, including overseas territories. However, the global impact of climate change implies potential occurrence of natural disasters all across the world. In the case of severe natural disasters military organisations often act as a first responder for the simple reason that they are ready to move at short notice and, in applicable cases, they have the capabilities to provide immediate humanitarian assistance and disaster relief (HADR).

An increasing number of HADR operations can be expected in the future as a result of the rise in the number and intensity of natural disasters. As the Netherlands armed forces have a wide range of capabilities – air and sea transport, reconnaissance and intelligence, communications, engineering, medical, etc – they might be called upon when assistance is urgently needed. They are most likely to called to assist within Europe and its neighbourhood, plus the Caribbean, rather than the Pacific region, which lacks any national Dutch permanent military presence.

As defined in Chapter 2, the most prominent drivers of the first order are: (1) rising temperatures; (2) sea-level rise; and (3) extreme weather events. The effects of these three drivers can have the following impact on the Netherlands armed forces:

1. *Effects of rising temperatures:*
   A higher demand for: gathering and processing information; firefighting, in particular in areas which are remote or difficult to access; delivering water and food; search

and rescue; evacuation of civilians; engineering to restore infrastructure, and also to arrange temporary urgent energy supply or communications; protection of civilians; temperature-sensitive munition storage.
In terms of capabilities and equipment: intelligence and reconnaissance capabilities, in particular in the air and at sea (manned aircraft and helicopters, unmanned aerial vehicles); engineering capabilities both to enforce access as well as to repair, restore or rebuild infrastructure (bulldozers, cranes, trucks, etc); search and rescue capabilities (helicopters in particular); medical capabilities (up to field-hospital level).

2. *Effects of sea-level rise:*
   As sea-level rise is a long-term matter, it is unlikely to lead to immediate or first responder-type HADR operations – unless the rising sea is in combination with extreme weather (see next point). First of all, sea-level rise has an impact on military infrastructure in harbours and low-lying land areas, which might set different requirements for safeguarding its future use. In the longer term, infrastructure might need to be transferred to higher altitude areas. A sea-level rise of one metre may already have affected some military infrastructure, e.g. the Marines Barracks Savaneta at Aruba.

3. *Effects of extreme weather events:*
   A higher demand for: emergency access by air or boat (when entering by land is impossible); delivering water and food supplies; search and rescue; evacuation of civilians; engineering to restore infrastructure, roads and bridges; providing temporary urgent energy supply or communications.
   In terms of capabilities and equipment: transport capabilities, in particular in the air and at sea (manned aircraft and helicopters, unmanned aerial vehicles); water pumping; divers; small boats; engineering capabilities, in particular to repair, restore or rebuild infrastructure (bridging equipment, bulldozers, cranes, trucks, etc); search and rescue capabilities (helicopters in particular); medical capabilities (up to field-hospital level).

There are two other dimensions to the increase of HADR operations: civil-military interaction and multinational cooperation. Civil authorities have the lead in HADR activities. Even when the military arrives as first responders, sooner or later they will need to cooperate closely with civil authorities and/or non-governmental organisations (NGOs). As a consequence, civil-military interaction will be crucial. Optimal functioning and effectiveness will require structures, procedures and arrangements to be in place permanently and to be tested, exercised and evaluated regularly. In the national context, most countries have appropriate arrangements for civil-military cooperation, including in the Netherlands. Internationally, this is a challenge as different organisations may be involved (the United Nations, with a variety of institutions and bodies; regional organisations; and NGOs, etc). More permanent arrangements might help to smooth civil-military cooperation at international level.

Multinational military cooperation in HADR operations is essential. A country hit by a disaster will most likely ask for help from several partners; outside EU territory a multinational coalition may be required in terms of needs and capabilities. This makes HADR a matter for multinational military cooperation in terms of developing common doctrine and procedures, training and exercising, interoperability and standardisation, and integration of capabilities. Therefore, the topic deserves to be positioned more prominently on the agenda of multinational defence cooperation.

4.3 Implications of drivers of the second order

Climate change acts as a threat multiplier in areas already characterised by tensions and conflict. The fight over water distribution, reduced habitable land areas, fishing grounds and other natural resources adds new dimensions to crises, demanding new approaches from the actors involved in crisis management, including the military.

- First, the scale of the human factor in crisis management operations – i.e. the attention to be paid by the military to assist the population, also referred to as the human security dimension – will increase. Climate migration in conflict zones implies a much greater demand on the military to combine intervention and stabilisation of the security environment with immediate HADR activities, such as water and food supply on a large scale. The same requirement will apply to medical assistance. Moreover, the distinction between 'classical' crisis management (military security and prevention of renewed fighting) and HADR operations could become blurred: the military might have to carry out the two types of operations at the same time, as was the case in Afghanistan for example. This will affect operational concepts, training and exercises, force composition, and the logistics and equipment needed in military operational theatres.

- Second, as migration might increase due to climate change the importance of border protection will grow. Military assistance to border and coastguard organisations, and customs and immigration services, may be called upon more frequently and at larger scales. In emergencies, civil authorities are likely to ask for military support, in particular for reconnaissance, transport and medical assistance. One result might be a more prominent role for the military – in particular Royal Marechaussee in the Dutch case – at the Schengen area borders or on the Caribbean islands.

- Third, the geostrategic element of climate change – competition for geopolitical influence, geo-economic interests and military presence – can also have an impact on the Netherlands armed forces. For the Netherlands, the consequences are dependent on the strategies, policies and actions undertaken by multilateral organisations – in particular the EU and NATO – or by coalitions of the willing led by one or more larger partner countries. Geostrategic competition affects all

capabilities, including at the high end of the spectrum. It should be noted that issues arising from geostrategic competition will most likely be settled first and foremost by political-diplomatic means, but military involvement – for example, by being present – might also be required.

With regard to the character of the impact, drivers of the second order can be expected to set higher demands on the armed forces than drivers of the first order, for example, by the combination of crisis management and HADR operations or by the need to deploy a force package across the full spectrum for geostrategic interests. Another conclusion is related to time: regarding HADR, we can expect more short-term calls on the military due to climate change effects. Crisis management deployment, even when there is a multiplier effect stemming from climate change, will have a lead-in time that places a higher demand on early warning and crisis detection. The impact of sea-level rise as well as of geostrategic competition are longer-term phenomena, requiring far-reaching action by ministries of defence in terms of adjusting armed forces infrastructure and adaptation across the full spectrum.

Netherlands national territory

The Netherlands armed forces are mandated to support civil authorities with the preservation of the rule of law, humanitarian assistance and disaster relief.[76] Detailed arrangements are in place and are regularly evaluated, updated or adjusted.[77] On many occasions the Dutch armed forces have provided such support, for example in cases of flooding, forest or wild fires and other natural disasters. Climate change effects will potentially lead to further need for support in national emergencies, first and foremost as a result of extreme weather events such as storms and heavy rainfall. Engineering capabilities (clearing debris, fallen trees, collapsed infrastructure or providing temporary bridging, etc) and transport capabilities (helicopters in particular) might be called upon more often and at larger scales. Rising temperatures and extended periods of heatwave could primarily lead to a call for military air transport (e.g. to the Wadden Islands) and for medical assistance.

Sea-level rise raises the question of longer-term provision of existing military infrastructure, such as in the naval base Den Helder and other infrastructure further inland. Long periods of drought might also cause damage to buildings, perhaps setting additional requirements for future construction.

76 This is considered the third key task of the military. The first task is territorial defence and the second task is to strengthen the international order (e.g. by contributing to crisis management operations).

77 For a detailed overview, see: Ministerie van Defensie, *Catalogus Nationale Operaties*, Uitgave 2018/1: juli 2018.

Caribbean

Hurricanes pose the primary threat to the Caribbean, in particular eastern and northern areas. One of the greatest challenges for HADR operations is coordination between civil and military actors, both nationally and internationally. The Caribbean Disaster Emergency Management Agency (CDEMA) is the overall coordinator, but the involvement of many actors complicates coordination and cooperation. The Netherlands Ministry of Interior has a lead role in HADR activities when a disaster occurs on islands belonging to the Kingdom of the Netherlands. The Ministry of Foreign Affairs has the primary role in case of responding to international disasters. The lack of preparations and well-functioning organisations on the islands further complicates HADR operations. Organisational structures, responsibilities, procedures and rules should be clarified in more detail in order to reduce these problems.

There is likely to be an increase in first responder military HADR operations in the Caribbean. The permanent military presence of the Netherlands in terms of personnel is considered to be adequate. Furthermore, personnel reinforcement from the Netherlands can be carried out quickly by air transport. That being said, sending more extensive assistance by ship takes time (approximately ten days for crossing the North Atlantic Ocean). Reinforcing Dutch naval capacity in the Caribbean by planning naval presence and exercises in the hurricane season would help to strengthen the immediately available military capacity at the most critical time of the year. The composition of the fleet of permanently available ships in the area could also be reviewed; a second support ship would double the capacity. The current support ship (Zr. Ms. Pelikaan) is able to access small harbours; a second support ship could perhaps be larger in order to increase capacity for carrying personnel and goods. Similarly, slightly increasing the capacity of the coastguard ships (to be replaced by 2023) might be considered. Another measure could be to appoint local military liaison officers to build up knowledge of the local context and set up coordination arrangements to be better prepared for crises situations.

For the islands of the Kingdom in the southern part of the Caribbean – Aruba, Bonaire and Curaçao – the challenges posed by migration could imply a greater need for reconnaissance assets to spot and monitor migration movements, search and rescue capabilities to assist in emergency situations and an increased presence of the Royal Marechaussee for border protection. Also, when local law and order has collapsed in a disaster, the Royal Marechaussee could play an important role. This needs further consideration by the ministries (Interior, Justice & Security, Defence) in The Hague.

The Caribbean Working Group of the European Intervention Initiative (EI2) is an excellent format to improve international cooperation with other European countries that have overseas territories in the Caribbean or who are interested in assisting (France, Germany, United Kingdom plus Germany and Spain). EI2 focuses primarily on

reducing reaction and response time while at the same time increasing interoperability.[78] However, the danger of reinventing the wheel in terms of institutions and arrangements should be avoided: EI2 should make maximum use of available actors, organisations and capabilities.

Increasing energy independence – such as through solar energy – can raise objections from local authorities due to reduced tax income. Nevertheless, not only from the point of view of reducing GHG emissions but also recognising that energy supply on the islands is not always guaranteed, further developing energy independence at military facilities would be a smart measure.

The Arctic

The involvement of the Netherlands Royal Navy in the Arctic will most likely depend on the strategies or policies of multilateral organisations, the EU and NATO particularly. The geostrategic interests of China and Russia might clash with the vested interests of western countries – thus, the Arctic may become an area of military confrontation. This could have consequences for the Dutch navy, as its ships and submarines might have to operate in a very cold and icy environment. As part of deterrence activity, more frequent presence of military forces might be called for in addition to more and larger exercises. The Netherlands already participates in meetings of the Arctic Security Forces Roundtable (ASFR) and is open to discussing the military strategic dimension of the Arctic more explicitly at EU or NATO level. It is also an active observer in the Arctic Council, which is thought to positively contribute to cooperation in this region, despite security not being part of its mandate.

Middle East and North Africa (MENA)

Trends in the MENA region, combined with the impact of climate change, point to high risk of instability and conflict in this part of the world in the near future. Extreme heat, sand and dust storms, and lack of water and food will affect military operations in the area. As already experienced in Afghanistan and Mali, additional measures need to be taken to protect equipment and personnel against heat and dust. In-theatre maintenance requirements will be further stepped up; the lifespan of equipment might be reduced. Sand and dust storms affect air operations negatively; soldiers on the ground can become less effective due to associated health risks, in particular respiratory problems. Training and clothing need further attention.

78 See: Dick Zandee and Kimberley Kruijver, *The European Intervention Initiative – Developing a shared strategic culture for European defence*, Clingendael Report, September 2019.

Migration, including that co-motivated by climate change, will increase the need for adequate border protection of the Schengen area. The Royal Netherlands Marechaussee might have to increase its participation in Frontex or other operations to strengthen the protection of EU borders. Southern European countries might ask for the support of naval capabilities and air reconnaissance assets, including unmanned aerial vehicles.

4.4 Greenification

In 2015 the Netherlands Ministry of Defence published its first Operational Energy Strategy. This year (2020) the Defence Energy and Environment Strategy 2019-2022[79] has been released, combining the Operational Energy Strategy and the Defence Energy and Environment Policy Agenda. The strategy sketches the broad outlines of how the Ministry of Defence wants to reduce dependence on fossil fuels and to achieve a reduced carbon footprint. The three spearhead areas of action are energy, circular economy, and environment.

The greenhouse gas targets in the operational domain are a reduction of at least 20% by 2030 and 70% by 2050 compared to the 2010 level. In 2030 compounds should generate 50% of their own energy and by 2050 they should be fully self-sufficient in energy supply. A series of pilots and other activities is underway in the Netherlands and the Caribbean. In relation to infrastructure, the Ministry of Defence reduction target follows that defined in the national Climate Law: 95% by 2050 compared to the 1990 level. However, under current infrastructure plans the Ministry of Defence cannot realise this target, as the portfolio of measures falls short. It is estimated that 80% of the infrastructure has an energy label D or worse, while only 8% of buildings have an energy label A or A+.[80]

A concrete action plan has been announced but is delayed because it takes longer than planned to assemble data on energy consumption and energy transitioning. These data are needed to establish a baseline for the development of a package of measures. Interaction with other government sectors takes place in the Interdepartmental Working Group Energy. The Ministry of Defence has identified more than 70 initiatives. A selection will be made for introduction in the 2020 budget cycle. Priority will be given to win-win measures, combining reduction of the greenhouse footprint with increased military effectiveness. The knowledge base must be further

79 *Brief van de minister van Defensie Drs. A.TH.B. Bijleveld-Schouten en de staatssecretaris van Defensie Drs. B. Visser aan de Voorzitter van de Tweede Kamer der Staten-Generaal over Defensie Energie en Omgeving Strategie 2019-2022*, 27-09-2019.

80 *Brief van de straatsecretaris van Defensie B. Visser aan de Voorzitter van de Tweede Kamer der Staten-Generaal*, 4 juli 2019, Kamerstuk 33 763, Nr. 151.

improved in order that the best options can be chosen. At the same time, the MoD should learn from efforts in other sectors and assess which initiatives it should join, for instance in the context of the national climate agreement.

The biggest challenge is to ensure that the topic remains on the radar: a new mindset is required to consider options for reducing transport and to become more self-sufficient, for example in water and food supplies during local operations. Additional requirements must be taken into account by defence and operational planners to prevent surprises for the military in the field during operations. To raise awareness of the impact of climate change on the armed forces it seems that a broader campaign needs to be launched, involving different defence communities.

5 Approaches taken by other countries

The global nature of climate change will leave no single country unaffected. However, depending on geographical location, countries across the world will face different challenges. Sea-level rise will predominantly affect coastal states. Storms, hurricanes and cyclones might further spread from areas where they have occurred for a long time and where they will increase in intensity. Forest fires occur on all continents. Drought and desertification are spreading, even into southern Europe.

This variety of climate change effects argues for a geographically wide selection of countries in order to assess how ministries of defence are addressing the impact of climate change. The selection is also dependent on the approach and measures countries are taking in response to climate change. One cannot learn from case studies if there is nothing to be studied. In other words, the selection was also made on the basis that ministries of defence in those countries were already taking climate change into consideration.

Based on these criteria, 11 countries were assessed in terms of what their ministries of defence are undertaking (or planning to undertake) with regard to the impact of climate change: six European countries – Finland, France, Germany, Norway, Sweden, United Kingdom – and five non-European countries – Australia, Canada, Jordan, New Zealand, United States. In all 11 case studies the same research methodology was applied: a scan of relevant government documents (in particular of ministries of defence) and available literature plus interviews with climate change and military experts, within and outside of the ministries of defence. The following six questions were asked during the interviews:

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?
2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?
3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?
4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?
5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?
6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The 11 case studies are documented in the Annex. This chapter provides the assessment of the approaches taken by the 11 countries to address the impacts of climate change on their armed forces, following the structure of the six questions.

5.1 Inclusion of climate change in national and international risk assessment

The geographical location of a country has a major impact on its risk assessment. For instance, countries with overseas territories must deal with climate change impacts in various regions of the world. France and the UK have major concerns about their overseas territories, in particular in the Caribbean, the Indian Ocean and the Pacific Ocean. Sea-level rise, storms, hurricanes and forest fires endanger the security of their overseas territories. In particular, inhabitants of small islands in the South Pacific are threatened not only by lack of food and clean water and the spread of diseases, but also economically such as by reduced fish resources, which could lead to violence or migration. The latter is also a major concern to Australia and New Zealand, as many South Pacific islands are nearby. Both countries consider their own territory endangered by the rising sea level, potentially resulting in coastal erosion, increased soil salinity and a reduction of productive land. New Zealand is affected by natural disasters on land (volcano eruptions, earthquakes, etc), while Australia has to deal with the risks emanating from rising temperatures and long periods of drought – e.g. leading to energy blackouts, wildfires, and shortages of water and food caused by poor harvests.

The US looks at the increasing risks to national territory (disasters, in particular flooding and other hurricane effects) and pays considerable attention to the geostrategic impact of ice melting in the Arctic region. The latter also applies to Norway. Canada is facing a multitude of challenges from the Arctic ice melting, including coastal erosion, flooding, impact on food resources, land- and rockslides, etc. Heatwaves pose another risk category, in particular with regard to forest fires. Canada also expects an increase in numbers of migrants from elsewhere in the world due to negative effects of climate change. Finland and Sweden have placed Arctic security high on their lists of concerns, but both countries tend to assess the risks of climate change primarily in relation to their national territory and the Baltic Sea area. The rising sea level, storms and other weather extremes causing floods or rockslides (also caused by melting ice and snow) will have an impact on national security.

France is also worried about the Arctic, but predictably also by climate change effects in the Sahel zone, such as increased instability and conflicts due to food and water shortages. In France itself, rising sea level, heatwaves and drought, heavy rainfall and extreme weather are considered as major risks. The spreading of exotic insects, bringing tropical diseases to metropolitan France, is mentioned as another (health) risk. Increased flooding, endangering not only coastal areas but also inland low-lying areas,

is considered as a serious risk along with higher temperatures. The UK recognises sea-level rise, heavy rainfall and higher temperatures as climate change risks. Germany assesses the risks to national territory as mainly related to ice melting in the Alps (flooding of the Rhine), storms and sea-level rise. But equally, Germany acknowledges the serious security risks related to climate change effects elsewhere in the world, in particular in the Arctic and the MENA regions.

Jordan is mostly affected by the consequences of water shortage, which is considered a national security risk with effects such as refugee and migrant movements. The country is increasingly dependent on international water management arrangements, which are lacking in Middle East.

5.2 Security and defence strategies and policies

French and British security and defence strategies identify climate change as a factor affecting their armed forces, in particular in terms of emergency operations both at home and overseas. The UK emphasises a whole-of-government approach to tackle climate change, in a preventive manner and in terms of responses to emergencies and crises. Military planners are seconded to other key government departments. The Ministry of Defence is supported by the Defence Infrastructure Organisation and by the Development, Concepts and Doctrine Centre in identifying the consequences and measures for the British defence infrastructure, respectively, for assessing future trends. In France, the Directorate General for International Relations and Strategy elaborates the defence climate policy, supported by research activities of the Observatory on Defence and Climate. France also works closely with partner countries in the South Pacific, including Australia and New Zealand, as well as with several North African states, including by conducting joint defence studies on climate change impact.

The 2016 White Paper on German Security Policy and the Future of the Bundeswehr refers to climate change as a challenge to security policy, but addressing the consequences for the German armed forces in terms of operations has yet to be integrated into the planning system. The Bundeswehr Office for Defence Planning is addressing these issues, for example by scenario development.

Norway and Sweden have a total defence concept in which the armed forces are incorporated into civil emergency planning structures under civilian leadership. Until now, climate change has not been incorporated into defence planning documents in those two countries. It is likely that the next edition of the Norwegian Long-Term Defence Plan (2021-2024) will take the impact of climate change on the country's armed forces into consideration, based on a report from the Norwegian armed forces Defence Research Institute (FFI) published in February 2019. The Finnish National Defence

Strategy refers to the environmental effects of climate change and states that the armed forces must be ready to respond to the threats, if necessary on their own.

The 2017 Australian Defence White Paper labels climate change as a risk multiplier, exacerbating other security challenges. In terms of impact, the White Paper refers primarily to emergency operations. The Ministry of Defence has published three documents on defence environmental strategy, policy and planning.

New Zealand recently released a new defence strategy in which climate change is prominently included. It builds on the 2018 New Zealand Defence Assessment and outlines recommendations to advance Ministry of Defence work on climate change. Preparing and responding to the intensifying impacts of climate change in New Zealand and more widely in the Pacific are central to this new plan. Its Strategic Defence Policy (2018) also refers to climate change, leading to a possible increase in operations in the South Pacific and arguing for deepening partnerships with other countries in the region. The 2018 Defence Assessment on Climate Change points to an increased need for emergency operations in the region. A maritime security strategy or policy is currently under review.

Canada's latest defence policy (2019) mentions climate change as a national security threat, in particular related to the Arctic region. But Canada also sees climate change as a threat multiplier in countries already with weak government and scarce resources, conditions that potentially create more instability and conflicts.

The US was a frontrunner in planning for climate change effects on the armed forces. For example, the 2010 Quadrennial Defence Review recognised climate change as a national security threat. However, due to the political change in the White House (and the subsequent US withdrawal from the Paris Climate Agreement) climate change has disappeared from security and defence strategies and policies. The 2017 National Security Strategy makes no reference to climate change. However, in other documents climate change effects are still addressed, in particular as actual effects cannot be denied (such as the Atlantic Fleet sailing into open waters from the Norfolk Naval Station every time natural high tides occur, which happens on average ten times a year). Military base commanders are highly concerned about the vulnerability of US military installations, which is often related to a general lack of infrastructure maintenance and inadequate flood and disaster risk reduction measures.

5.3 National tasks (including overseas territories)

All 11 countries expect an increase of armed forces involvement in emergencies in national (or overseas) territories, acting alone as a first responder or in close cooperation with civil actors. Such civil-military cooperation in response to national

disasters is nothing new, but the armed forces might be called upon more often and with more capacities needed. Depending on the geographical location and the nature of the disaster, the most likely military emergency response operations will need to handle forest- or wildfires, floods, rockslides, search and rescue, power cuts, etc (for an overview see Table 1 below).

France expects calls on the navy for its constabulary missions (fighting against illicit trafficking, fishing, pollution, etc) near overseas territories in the Indian and Pacific Oceans. Australia and New Zealand also expect more involvement of their armed forces in responding to natural disasters as well as to law and order issues (illicit fishing, smuggling, migration, etc). Norway may relocate its Home Guard units in order to be based closer to the most endangered areas on national territory.

As the melting Arctic ice has geostrategic consequences, Norway expects an increased demand for surveillance and reconnaissance operations – at sea by naval and coastguard vessels, in the air with manned and unmanned aircraft – as well as more use of spatial data. The US expects more national HADR operations for its armed forces, such as search and rescue, but also increasing military involvement in the Arctic area for geopolitical reasons, including exercises with partner countries.

In Germany, the armed forces can provide military support to the Länder carrying the prime responsibility for disaster response when called upon to do so. Canada has already seen increased calls on the armed forces to respond to natural disasters, in terms of personnel as well as ships, aircraft, vehicles and other equipment that must be made available. The average number of military emergency operations was six per year in both 2017 and 2018, whereas in the spring of 2019 more soldiers were deployed domestically than overseas. A further increase is expected, in particular in search and rescue operations (currently already 9,000 calls annually).

The Jordanian armed forces have a dedicated Energy and Water Directorate to address issues related to environmental matters and operations. The forecast points to increased calls on the armed forces to assist civil authorities in disaster operations.

Table 1 Emergencies for which the military is likely to be called upon in civil-military operations on their national territories (including overseas territories)

1. Forest- and wildfires
2. Flooding
3. Rockslides
4. Search and rescue
5. Power cuts
6. Illicit activities
   Trafficking, smuggling, migration, fishing, pollution (Australia, France and New Zealand)
7. Surveillance and reconnaissance of the Arctic region
   (Particularly in the case of Norway and the United States)

5.4 International military operations

Humanitarian assistance and disaster relief (HADR) operations will increase, but in some countries this will not automatically lead to more involvement of national armed forces as international HADR missions are considered to be primarily a civilian and NGO matter. This is the case in Finland, Norway and Sweden. France and the United Kingdom are of the view that the armed forces might have to assist international emergency HADR operations more often, but both countries also expect that conflicts resulting from climate change will have an impact on crisis management operations. Deployed forces might be confronted by increasing human security problems (lack of food and water, diseases, etc), which will, for example, require more CIMIC (civil-military cooperation) activities. Germany has the same view.

Australia and New Zealand regard international operations in response to the effects of climate change as an extension of tasks on or near national territory: i.e. operations related to HADR and rule of law. In both cases, working closely with armed forces of partner countries in the region is a necessity. The FRANZ agreement stipulates military cooperation with France and Australia. New Zealand is extensively involved in activities in Antarctica, which is a demilitarised zone but climate change will have an impact on needs for military support such as air transport.

Norway underlines the increase in surveillance and reconnaissance operations due to the melting of the Arctic, which is driven by the geostrategic impact of climate change in the region rather than by natural disasters. Canada expects greater demand for peace (support) or stabilisation operations as well as more HADR missions worldwide.

The regional commands of the US armed forces are already taking climate change effects into consideration in contingency planning for operations (Africa, Indian Ocean, Arctic). Extreme weather could reduce available flight hours, affecting transport of logistics and other mission support.

5.5 Personnel and equipment

The effects of climate change on personnel and equipment are dependent on where the armed forces are deployed, although geographical location is major factor in any case. Countries with a tradition of overseas deployments automatically take different climate circumstances into account, such as with regard to clothing and other personal equipment. Operating in desert areas, such as in the Sahel or in Afghanistan, requires dedicated training of crews to fly helicopters in ‘sandy and dusty’ environments. Maintenance is also affected by such dire operational conditions.

France seems to be most advanced: since the late 1990s climate change, together with other environmental conditions, have been taken into account by the Directorate General of Armaments in developing military equipment. Two examples are the FREMM frigates, with a reduced fuel consumption, and Eco Camp 2025, intended in particular to develop energy and water security of overseas military camps. The UK is perhaps the next in line. It reduces fossil fuel consumption through increased virtual or synthetic training and through modernisation of equipment. Operations in areas with higher temperatures will set improved cooling demands for aircraft, ships and vehicles. The Defence Equipment & Support (organisation) is taking climate change impacts into account and environmental requirements have been defined in a publication for the defence industry.

Finland, Norway and Sweden are taking the effects of climate change into account, but primarily for military operations on national territory or adjacent sea areas (the Baltic Sea and the Arctic waters), both in terms of personal equipment and weapon systems. Norway is investing more in the navy, for example in new maritime patrol aircraft and in coastguard vessels for an increased presence in the Arctic. Improving communication in the Arctic by using satellite technology is another defence planning requirement based on the changing climate conditions in the High North. In Finland, milder climate conditions in the south of the country could have an impact on training conscripts, who face less snow and ice than they would have in the past. Sea-level rise is already a criterion for planning new infrastructure. The Finnish Squadron 2020 project states that no new infrastructure will be built below +3 meters above the (current) sea level. Naval ships should be able to sail in storms with ice conditions.

Australia is also looking at the consequences of sea-level rise, flooding, storm surges and coastal erosion for the infrastructure of the armed forces. Rising temperatures and heatwaves will have a profound effect on the mental and physical health of personnel. A peculiar requirement regards the availability of more cultural advisers to the military, specifically trained in refugee experiences and resettlement. The Australian Parliament played a proactive role in recommending that the Ministry of Defence identify and take into account climate change effects. In New Zealand, climate change is a factor influencing the Defence Capability Plan and the Defence Equipment Plan. For example, New Zealand will upgrade surveillance and communications systems, and will procure a second ship equipped for HADR operations, a new patrol vessel capable of operating in Antarctica, and other equipment.

Canada already has a problem with recruiting military personnel. For that reason, the Ministry of Defence wants to enhance and expand the role of reservists to assist in responding to natural disasters on land and at sea.

In Jordan, high temperatures (40-45°C) have an impact on personnel and equipment. For example, fighter aircraft engines are affected, and this is currently addressed by adjusting the length and direction of runways. Clothing needs to be adjusted in order to be adaptable to changing circumstances, from extreme heat to heavy rainfall and flooding. NGOs are helping to train the military to adjust their behaviour to the changing environment, for example to be more selective in using scarce clean water in the desert. The Jordanian army has considerable experience of operating in water-scarce environments, from which other countries could learn.

The US has conducted a review of all its military installations in terms of climate change effects. Opening up (northern) sea routes will raise the procurement costs of vessels and other equipment. The lack of nuclear-powered icebreakers was a specific point of concern and a factor in the decision not to undertake a Freedom of Navigation Operation (FONOP) through the Arctic. It was realised that lack of icebreaking capacity and dependence on Russian search and rescue would be too much of a risk. On national territory, extreme heat – in particular in the south – will affect training and exercises. Other types of extreme weather can have the same effect.

5.6 Greenification of the armed forces

Several of the 11 case-study countries have sustainable energy targets, often related to government-wide defined objectives (for an overview see Table 1). France launched a Sustainable Defence Strategy in 2016, defining a number of challenges and related goals for the Ministry of the Armed Forces. The UK has a Sustainable MoD Strategy, which directs the concrete measures taken; energy reduction takes a prominent place. The Modernising Defence Programme describes how the Ministry of Defence can deliver better capabilities and value for money in a sustainable way.

Norway has taken very little action in making the armed forces greener. There is one green compound (energy production based on biomass fuel). On the contrary, Finland has a national target of heating all government buildings without using fossil fuels by 2025. The Ministry of Defence is bound to realise this target for all its buildings. Planning is underway to reduce energy consumption of the armed forces while conducting operations.

Sweden is undertaking a study into making the armed forces greener. National targets need to be taken into account but are not binding for the armed forces. The Defence Material Administration (FMV) is working on reducing energy for military infrastructure, which accounts for about one-third of the Swedish armed forces' fuel consumption.

Australia is reducing fossil fuel consumption by the armed forces and infrastructure – the latter in particular by equipping buildings with solar panels.

New Zealand has defined general objectives to make the armed forces greener, but as yet no concrete targets have been set. The Ministry of Defence is, however, committed to establishing a method of measuring carbon emissions. When its emission profile is completed, the Defence aims to aid and assist emission reduction initiatives.

Like other countries, Canada has made progress on 'greening' its defence infrastructure and its commercial vehicles. Officially, the Ministry of Defence is exempted from national greenhouse emission targets, but as of autumn 2019 it has begun to publish its fleet emissions. The Defence Energy and Environment Strategy (2017) outlines a number of objectives and related goals for the contributions of the Canadian armed forces to greenification.

The US armed forces are making an attempt to reduce the carbon footprint, despite the country stepping out of the Paris Climate Agreement. The US navy, for example, has introduced a green programme to reduce its reliance on fossil fuels.

A particular contribution of the Jordanian armed forces has been the planting of 250,000 trees in the country (such as in fields cleared of mines) and 2.5 million trees in military camps across the country to prevent desertification. Jordan's military also participates in cross-border environmental conservation projects with neighbouring countries which help to strengthen the cooperation between various communities and, thus, has a peacebuilding effect.

Table 2 Defence sustainable energy targets

	Greenhouse emission	Fossil fuel	Other
Australia	**-8% (2019)**	-	-
Canada	-40%[81]	-50%(2030)[82]	30% electric[83]
Finland	-30% (2020)[84]	-	-20% energy in buildings
France	-40% (2030)	-40% (2030)[85]	50% electric/hybr. vehicles (2030)
Germany[86]	-	-	-
Jordan	-	-	-
Netherlands	-20% (2030)[87]		By 2030 compounds should generate 50% of their own energy By 2050 they should be fully self-sufficient in energy supply
New Zealand[88]	-	-	-
Norway	-	-	-
Sweden	-	-100% (2045)[89]	-
United Kingdom	-30% (2020)[90]	-10% (2026)[91]	-
United States	-	-	-

81 Compared to 2005 levels.
82 At deployed compounds.
83 For light vehicles to run on electric energy fully or partially.
84 Compared to 2010 levels.
85 Both compared to 2012.
86 No specific Defence targets but for buildings the Ministry of Defence applies the national CO_2 reduction targets (-55% by 2030, -70% by 2040 and -80-95% by 2050; all compared to the 1990 level).
87 Compared to 2010 levels.
88 No specific Defence targets but the MoD must apply the national zero carbon emission target (2050).
89 National target, not binding on the Swedish armed forces.
90 Target set by the Greening Government Commitment. A percentage of 36% has already been realised.
91 The original target of 18% reduction against the 2009-2010 baseline was exceeded in 2017-2018. The 10% reduction target for 2026 is based on the 2015-2016 baseline.

6 Conclusions and recommendations

In this chapter we bring together key findings and set out some generic conclusions. We end with specific recommendations for the Netherlands, both with regard to its own armed forces and also with regard to its positioning on climate change in the EU and other organisations it is part of.

6.1 Main conclusions

This report illustrates that often climate change not only acts as a threat multiplier in theatres of operations, but has direct implications for military capabilities and strength, as it can lead in many cases to additional calls for assistance to civil actors in the home territory. Extreme weather events can place a substantial additional burden on the military's overall capacity to act and can dilute the value of military assets, as testified by the regular flooding of the Norfolk navy bases and the recent wildfires in south-east Australia.

The extent to which the military capabilities of countries are affected by climate change is related to how they respond and if they integrate climate change impacts into their defence strategies and policies, and more specifically into risk assessment, early warning, surveillance and operational preparations. It is also related to their efforts in climate adaptation, disaster preparedness and risk reduction, although some impacts might be difficult or impossible for the military to entirely brace themselves for. The military, moreover, contributes to climate change with its own emissions and where some countries have greenhouse gas emission reduction targets for the defence sector, others do not. It seems that countries not yet undertaking adjustments in relation to climate change, or being reluctant to do so, do not sufficiently realise its undermining impact on their military capabilities. The realisation by the US of not being able to safely undertake a freedom of navigation operation in Arctic waters due to a lack of nuclear-powered icebreakers and dependency on Russian search and rescue illustrates this lack of preparedness.

For the Netherlands, the general level of preparedness in relation to the risks presents a mixed picture. On the one hand, on its own territory in Europe, dyke protection and (extreme) weather predictions are such that short-term risks to military installations are limited, despite a large part of the country lying below sea level. The Dutch armed forces are well prepared to provide assistance when natural disasters occur in the country,

such as the flooding of rivers, as well as in the Caribbean region of the Kingdom. The Caribbean islands appear to be less prepared for sea-level rise, which has serious implications for economic and human security, as well as for military infrastructure such as the naval base at Aruba. With regard to operations outside national territory, the Netherlands is accustomed to operating under very different circumstances, from extremely cold (Arctic) to tropical (Caribbean) and very hot and arid areas (MENA region). However, practice has shown that the equipment is not always properly adjusted to such environments, in particular for operating in very hot weather. The contribution of the Dutch armed forces to decarbonisation is subject to specific reduction targets, but they have as yet barely been translated into specific actions.

With regard to the approaches and experiences of other countries, the proactive role of France stands out. It is most advanced in its thinking and actions to prepare for and address the first and second order drivers of climate security. New Zealand might also be referred to as an early mover, with climate change being the topic of a specific defence implementation plan. The UK, Finland and Canada are relatively ahead of the curve as well. The US carried out a significant amount of work to address climate change under the Obama administration, but under the Trump administration has lost speed and reduced climate change-related activity after the government's decision to withdraw from the Paris Climate Agreement. Jordan is very experienced when it comes to the ability to operate in hot and water-scarce regions. Its army has realised the potential contribution of nature conservation to peacebuilding efforts.

Sweden, Norway and Germany are a little behind, but their defence ministries seem open to stepping up efforts to address the security dimensions of climate change, in line with their diplomatic efforts in this field. On the contrary, Australia and the US seem most severely affected by first and second order drivers of climate security, but reluctant to take action because of their general political stance on climate change.

It would be highly interesting to see how climate change affects the military strength of other military powers, notably Brazil, China, India, Pakistan, Russia and South Africa, and whether they have yet undertaken action in this regard. This study has also found instances where more multinational cooperation is required, such as with regard to humanitarian assistance and disaster relief (HADR) in areas outside Europe. Furthermore, multinational cooperation could be stepped up to integrate climate change into early warning and risk assessment systems; the EU is working on this, but interviews produced little evidence of it being undertaken by the military in national capitals.

6.2 Recommendations

Based on the analysis of this report, we recommend the following actions for consideration by the Netherlands Ministry of Defence (some of which are also related to the Dutch position in the EU and international discussions on climate security).

1. Climate change in a direct way leads to more calls for military assistance at home and sea-level rise can endanger military installations and bases. In this respect, a risk assessment of the climate vulnerability of military infrastructure in Europe could be considered at EU level, for instance financed by the operational budget of the European Defence Agency.
2. Climate change can be a threat multiplier in countries outside the European continent and lead to more calls for domestic assistance. Another EU study, for example, financed through the Horizon Europe Programme could focus on the extra capacity and additional financing needed to respond to increased calls for HADR abroad, calls for military missions and calls to provide assistance at home. The European Defence Fund could be used for technology research and development of equipment able to be adapted to extreme weather conditions.
3. The geostrategic aspects of climate change in the Arctic area should be assessed in more detail. NATO could look into the required capacities and costs related to a stepped-up military presence in the High North. Furthermore, an analysis could be conducted of the vulnerability to climate change of the military in other countries.
4. Climate change is already included in some early warning and risk assessment systems, but more could be done to assess it with regard to potential crises and in the operational planning of operations. The drivers of climate change should be taken into account along with the potential risks associated with energy transition.
5. Multinational cooperation regarding HADR lacks good rules and procedures, and this needs to be addressed. Civil-military coordination is itself complicated and the involvement of a large number of countries complicates activities and procedures even more. The Netherlands could take the lead in developing frameworks and rules for HADR at multinational level – e.g. in the context of the European Intervention Initiative – and in the EU.
6. The defence sector could consider taking more of a leadership role in energy transition. At both national and EU levels (i.e. Horizon Europe) more research and development funding could be allocated for innovations aimed at reducing the military's carbon footprint and its use of (natural) resources at home and abroad. In such research, synergies could be explored with other objectives, such as reducing the inefficiency and costs of military operations, and the military not adding to local resource stress.
7. In the planning and execution of operations, the military should focus more on how interventions on natural resource management, climate adaptation and provision of renewables could help to win the 'hearts and minds' of local populations and reduce tensions among groups at conflict. Officers with climate-security expertise should be included in units deployed to climate risk zones to work closely with diplomatic and

development actors. In short, climate security should be included in any integrated or comprehensive approach.

8. Multinational cooperation formats, the EU and NATO should be used proactively to exchange national defence ministries climate security policies, measures and experiences. Ultimately, the EU and NATO, working closely together, could develop a climate security strategy.
9. The next edition of the Netherlands Integrated International Security Strategy and its new Defence White Paper to be released in 2020 should include climate change as a strategic security threat. In addition to recognising the threat, the strategy and White Paper should present directions for addressing it.
10. Climate security should be incorporated as a standard factor to be taken into account in defence planning and equipment procurement processes of the Netherlands Ministry of Defence.

Annex: Country studies

Australia

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Climate change-related effects will have a significant impact on the Australian economy, national security, society and environment in the near future.[92] The Australian Department of Defence ('Defence') views climate change as a complex national security risk that poses increasing national, regional and local challenges. The consequences will differ throughout Australia, as eastern and southern Australia are populated areas engaged in a large proportion of the country's economic activity. The rangelands – also known as 'the outback' – only include a small number of large villages, no cities, but are home to many indigenous people and encompass important mining sites, tourist areas and agricultural land.[93] The challenges encompass rising temperatures, sea-level rise, and an increasing number of extreme weather events, including cyclones and droughts.[94]

Rising temperatures and sea-level rise, exacerbated by extreme weather events, have the most severe consequences for national security. Rising temperatures can cause disturbances in cities, such as power blackouts caused by greater demand for air conditioning and increased transmission loss in electrical wires, higher risk of wildfires, and food and water shortages caused by poor harvests and increased numbers of exotic species ruining harvests.[95] In January 2019, heat records were broken all across Australia, illustrating the growing concerns about the impact of rising temperatures on national security.[96] Although the El Niño Southern Oscillation (ENSO) weather event also had a significant role in this, the Bureau of Meteorology also stated that '*the long-term increasing trend in global air and ocean's temperature*' was a factor in the hotter-than-average summer.[97]

92 Australian Climate Change Science Programme, 2016. Available online.

93 Climate Change in Australia and The Commonwealth Scientific and Industrial Research Organisation, impacts & adaptation information for Australia's NRM Regions, June 2019.

94 Australian Government Department of Defence, *Defence White Paper 2016*, p. 56.

95 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 11.

96 *The Guardian* 'Australia breaks weather records with hottest ever summer', February 2019.

97 Ibid.

Simultaneously, the rising sea-level will increase coastal flooding, coastal retreat, erosion and beach losses, causing a severe risk to critical infrastructure and cities in the most populated areas. It also affects – and worsens – food and water shortages, as seawater will contaminate freshwater aquifers and lead to increased salinization.[98]

In its close vicinity, Australia's neighbours, including many of Pacific islands, are directly threatened by sea-level rise.[99] That might lead to (relatively) small migration influxes, but poses more fundamental ethical questions about post-disaster assistance and regional responsibility to populations hardest hit by the impacts of climate change. As Australia has an extremely strict refugee policy and incarcerates refugees in offshore detention centres, any rising number of refugees could put more pressure on national security, and climate change might exacerbate the complexity and unpredictability of migration movements.[100]

In terms of its general support for an ambitious climate policy, Australia, as a traditional coal state, is a strongly divided country, with the Labour Party advocating a strong climate policy and the Conservatives arguing against.[101] In the past 20 years, we have seen several profound shifts, with the country being seen either as a climate action frontrunner or a laggard (and even climate-change denier). The 2019 elections were labelled the climate change elections, with emission reduction, renewable energy and environmental protection central in national debates.[102]

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?

The Australian Ministry of Defence is closely involved in environmental policies and emphasises the important role of the Australian Defence Force (ADF), not only in its activities but also in ensuring the long-term sustainability of ADF capabilities.[103] The Australian government has framed natural disasters as a security challenge and emphasises the importance of regional response and collaborative efforts to build resilience and facilitate adaptation. The Department of Foreign Affairs and Trade is

98 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 9.

99 UNESCAP, EU, ILO, UNDP, Climate Change and Migration Issues in the Pacific, 2014.

100 Jeff Sparrow, 'Australia's Orwellian anti-refugee system hints at what's to come for climate refugees', *The Guardian*, July 2019.

101 Damien Cave, 'It was supposed to be Australia's climate change election. What happened?', *The New York Times*, May 2019.

102 Adam Mortom, the climate change election: where do the parties stand on the environment, *The Guardian*, May 2019.

103 Australian Government Department of Defence, Environmental Management, 2016.

responsible for the ADF's coordination and participation in regional Humanitarian Assistance and Disaster Relief (HADR).[104] Defence has integrated climate risk management into its existing estate and infrastructure risk management and business processes, including undertaking studies to assess the risk of climate change to the Defence estate. In 2018, Defence entered into a Memorandum of Understanding with the Department of Environment and Energy, CSIRO (Commonwealth Scientific and Industrial Research Organisation) and the National Climate Change Adaptation Research Facility to develop guidance material for climate adaption on the Defence estate. The guidance will support investment decisions for short- and long-term sustainment of the Defence estate and training areas.

Defence considers climate change as a risk multiplier, as it exacerbates other security challenges.[105] Australia's 2017 Foreign Policy White Paper emphasised the climate change-related security challenges for Australia and the Pacific region.[106] The White Paper underlined the need to upgrade Australia's humanitarian aid, health and urban search and rescue teams and the transportation of relief supplies when natural disasters strike.[107] The Australian government decided to increase HADR support to $500 million a year to address crises and conflicts, of which $1,097.8 million is allocated for the Pacific region.[108]

In addition to this, the Ministry of Defence published three documents solely emphasising the need for action. The Defence Environmental policy outlines Australia's vision. Compliance, efficiency, trust and accountability are four pillars underpinning the vision and will have a guiding role in the decision-making process over the next 20 years.[109] The Defence Environmental strategy describes five strategic aims representing Defence focus areas and the ministry's efforts regarding environmental management issues across a 20-year horizon.[110] Third, the Defence Environmental Strategy outlines a framework for implementation, communication, monitoring and reporting for a period of five years.[111]

104 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 36.

105 2016 Defence White Paper/Strategic Guidance, p. 2. Available online.

106 Australian Government Department of Defence, Defence White Paper 2017, p. 33.

107 Australian Government Department of Defence, Defence White Paper 2017, p. 87.

108 Australian Government Department of Defence, Defence White Paper 2017, p. 90.

109 Australian Government Department of Defence, Environmental policy, June 2016.

110 Australian Government Department of Defence, Environmental Strategy, June 2016, p. 7.

111 Australian Government Department of Defence, Environmental Strategy, June 2016, p. 3.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

On a national level, climate change-related migration from the region and the need for (HADR) will be more common in the future and could threaten national security.[112] While this is being coordinated by the Department of Foreign Affairs and Trade it is dependent on the Australian Defence Force (ADF), as it provides logistics, assists in the transportation of food, material and staff, and (re)builds required infrastructure.[113] Moreover, the armed forces undertake Australian government emergency assistance tasks to support the state and territory jurisdictions, often referred to as Defence Assistance to the Civil Community (DACC). It is beneficial if the armed forces support state, territory and Commonwealth agencies, as the ADF can deploy its personnel and equipment at short notice and the ADF can plan, coordinate and conduct ad hoc emergency operations, e.g. for bush fires and floods.[114] In addition to this, search and rescue actions will be needed more frequently, including specialised fleets or air and sea patrols to monitor and protect maritime areas, as resource scarcity could lead to illegal border crossing, interstate disputes over fisheries, and piracy and smuggling.[115] To illustrate this, the Royal Australian Navy can mobilise its amphibious vessels, the Australian Regular army has control over specialised command and control functions, and (medical) transportation, and the Royal Australian Air Force can transport personnel, equipment and aid, including the Australian Medical Assistance Team and Urban Search and Rescue teams.[116]

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

The Australian Ministry of Defence cooperates closely with the defence ministries of Chile, Fiji, New Zealand, Papua New Guinea and Tonga under the coordination of France.[117] Having an adequate infrastructure for military assistance in the Pacific is of

112 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 30.

113 Ibid. p. 31.

114 Department of Defence, Emergency Defence Assistance to the Civil Community, Audit Report No. 24, 2013-14, p. 11.

115 Ibid., p. 43.

116 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 38. and The Australian Air Force, *Recent History of Air Force Humanitarian Assistance*, 2016.

117 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 6.

paramount importance to move goods, services and emergency relief.[118] All defence ministries recognise the importance of regional army cooperation in HADR, particularly as HADR will become more difficult in the future due to shorter intervals between disasters and the wider range of where responses are needed, ie., in one place or several places simultaneously.

In this respect, the FRANZ arrangement between Australia, France and New Zealand coordinates the civil and military teams engaged in HADR in the Pacific.[119] Additionally, the Indo-Pacific Endeavour, the flotilla that enhances Australian partnerships with regional forces, is the ADF's most important annual activity.[120] Interestingly, the Indo-Pacific Endeavour not only has a hard-power military-to-military and regional training aim, it also includes a soft-power element, serving as a floating public diplomacy tool to develop understanding and trust and effectively connect and share military data.[121] Australia's Pacific Maritime Security Program covers defence engagement in the South Pacific, for example on fisheries surveillance,[122] and the Pacific Quadrilateral Defence Coordination Group, made up of Australia, New Zealand, France and the US, focuses on developing multilateral approaches to enhance security and coordinate maritime surveillance.

Approximately 3,300 ADF personnel are deployed in 12 international operations. In these operations, insecurities driven by climate change play an increasing role, for example in Australia's contribution to maritime security in the Middle East and countering piracy in the Gulf of Aden.[123]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

With regard to personnel and equipment, Australia needs to prepare for direct impact on its defence infrastructure and bases, as numerous key defence installations are located at or just above sea level. Hence, sea-level rise, flooding, storm surges and coastal erosion are likely to have an impact on bases and training areas.[124] To be appropriately

118 Ibid., p. 19.

119 *Colonel Rupert Hoskin*, France and Australia: realizing our potential as like-minded strategic partners, *Australian Defence College & Centre for Defence and Strategic Studies*, November 2016.

120 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 37.

121 A Sea ride with Australia's Indo-Pacific Endeavour, *The Interpreter*, June 2019.

122 Linda McCann, *The Future of Australia's Pacific Patrol Boat Program: the Pacific Maritime Security Program*, Centre for Defence and Strategic Studies and Australian Defence College, August 2013.

123 Australian Government Department of Defence, current operations, 2019.

124 Australian Government Department of Defence, Defence White Paper 2017, p. 102.

postured for the future, new bases, wharves, airfields, training and weapon testing ranges must be developed in the short term. Urban development and capacity limitations should also be taken into consideration within existing infrastructure, as they also affect the ADF's ability to effectively execute missions.[125] In 2018 the Australian parliament requested an unclassified version of the work undertaken by Defence to identify climate risks to its estate, HADR and military missions and threats occurring to those vital military parts and activities at the same time.[126]

Moreover, the ADF needs to actively prepare itself to act in more challenging circumstances caused by rising temperatures and prolonged heatwaves. These circumstances could affect the short- and long-term mental and physical health of personnel.[127] Additionally, as (temporary) migration caused by climate change and national disasters will become more common, the military is in need of more personnel to act as cultural advisers specifically trained in refugee experiences and resettlement.[128] To prepare for climate change-related impacts, the Australian parliament recommends creation of a climate security leadership position in the Home Affairs Portfolio to assist in risk reduction, infrastructure planning, community health and well-being, and emergency management, and a senior leadership position to facilitate domestic and international HADR.[129]

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The Australian Ministry of Defence aims to become a leader in sustainable environmental management. To reach this goal, it has created programmes to build energy resilience, improve energy efficiency, and reduce energy costs and greenhouse gas emissions. This is challenging, as around 80% of Defence total energy consumption consists of fuel, and the other 20% is used for electricity and gas in offices and estate facilities.[130] Programmes to reduce energy consumption have been implemented, such as the installation of solar panels across three Defence sites in the Northern Territory and Queensland in 2016.[131] The Australian navy has authorised the use of alternative fuels on

125 Ibid.

126 Parliament of Australia, Senate Standing Committees on Foreign Affairs, Defence and Trade, Implications of climate change for Australia's national security, May 2018.

127 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 31.

128 Ibid.

129 Parliament of Australia, Implications of climate change for Australia's national security, May 2018.

130 Australian Government Department of Defence, Defence environmental management, 2016-17.

131 Ibid.

its ships. The Ministry of Defence also undertakes environmental management activities, and tries to protect environmental values, particularly when Defence properties contain native vegetation, threatened species or cultural heritage sites. It also commissioned alternative energy (solar) systems at a number of Defence sites. As part of a whole-of-government approach, Defence will continue to investigate opportunities to incorporate alternative and renewable energy sources into its estate, systems and platforms, thereby improving resilience and reducing carbon emissions. Finally, Defence aims to factor UN Sustainable Development Goals (SDGs) and climate risk into its decision making, to ensure that equipment is fit for purpose in more challenging weather conditions.[132] Defence has implemented a renewable energy programme that aims to minimise energy costs, increase energy security and reduce GHG emissions.[133] Defence's total net carbon emissions from energy decreased by 8% between 2017/18 and 2018/19.

In 2018 the Defence Strategic Policy Committee approved a Strategic Policy Statement on climate change, thereby making climate risk assessments a factor in enterprise risk reporting. Defence is also developing a One Defence Energy Strategy which will measure Defence energy use and resilience to climate change, among other threats. Moreover, Defence has outlined its support of a climate adaptation partnership with the Department of Environment and Energy in a Memorandum of Understanding.[134]

The Defence Environmental Strategy of 2016outlines the five strategic aims of the Australian Defence, detailed in the Environmental plan with actions, accountabilities and timeframes for the coming five years. All strategic aims have the goal of reducing the footprint of the military over the coming 20 years. The first strategic aim is to achieve sustainable estate across Defence maritime, land and aerospace areas, activities and operations. The second aim is to understand and manage its environmental impact through maintaining proactive relationships with environmental regulators and other stakeholders, and improving the environmental impact assessment process. The third aim covers pollution prevention, contamination management and site remediation to minimise future pollution risks and manage existing contamination risks. The fourth aim covers improving efficiency in Defence resource consumption and strengthening resource security by, among other things, minimising operational costs (using less water/energy), transitioning to cleaner energy and integrated water management, and improving the monitoring of energy and water use. The last strategic aim is heritage management as it relates to the heritage value of the Defence estate.

132 2016 Defence White Paper/Strategic Guidance, p. 10. Available online.

133 Australian Government, Department of Defence, Defence Estate Energy Policy, n.d.

134 2016 Defence White Paper/Strategic Guidance, p. 2. Available online.

Canada

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Climate change will affect the environment, buildings and infrastructure, food supply and the socioeconomic fabric of Canada.[135] Impacts will vary depending on the state of readiness for adaptation to climate change, with the North, coastal communities and urbanised population each undergoing very different changes.[136] Rising temperatures, changes in seawater levels and the atmosphere's ability to hold more moisture will have an impact on the frequency of extreme weather events. Areas that have historically seen snowfalls in the winter months are beginning to experience shorter and milder winters with more frequent ice storms. Ice coats trees and damages power lines, leading to blackouts in a country where electricity is transported mainly through exposed power lines. Floods have become more frequent due to sudden large snowmelt. The number of forest fires has increased, as has their intensity, due to prolonged heatwaves and drought. This has led to frequent requests from the public for military assistance and soldiers are being tasked to provide assistance as first responders.

Receding ice has exposed shorelines to wave action brought on by stronger winds. This has led to erosion, land loss and endangered coastal communities. Moreover, the rising temperature has thawed large areas of permafrost, exposing infrastructure and buildings to frost heave and sinking due to unstable footings. Melting sea ice could pose a threat to ecosystems and biodiversity of wild game and fish that many communities, including indigenous communities, rely on as food sources.[137]

Extreme weather events are affecting infrastructure, imposing economic and social costs and changing the profile of search and rescue operations as more people move to the North.[138] The latter will most likely present itself as ways of life become more dangerous, such as less predictable sea ice to hunt on.[139]

Alongside the negative impacts threatening natural and human systems in Canada, the opening of Arctic waters for larger areas and longer periods of time presents a new national security threat. As exploitation of natural resources, as well as travel,

135 The Expert Panel on Climate Change Risks and Adaptation Potential, Canada's Top Climate Change Risks, July 2019, p. 11.

136 StatCan (Statistics Canada). Canada Goes Urban, 2018.

137 The Expert Panel on Climate Change Risks and Adaptation Potential, Canada's Top Climate Change Risks, July 2019, p. 8.

138 A collaborative report from Auditors General, Perspectives on Climate change action in Canada, March 2018, p. 39.

139 Ibid.

become more attractive in the North, Canada's national security policy and operations will be affected.[140] The long-standing disagreement between Canada and the US over ownership of the North-West Passage well managed by the two countries. With regard to the Arctic Sea, Canada, Denmark and Russia have submitted competing claims to the UNCLOS Commission on the limits of the continental shelf; a verdict on these complicated geographical claims not expected for a decade. In the meantime military build-up in the Arctic is on the rise, with Russia and China increasingly interested in development of the Northern Route. It is unclear at this moment whether increased Russian and Chinese engagement on some matters will extend to cooperation in the Arctic.

Lastly, melting sea ice will lead to a more accessible North and adjustments to national security policy and operations will be needed to deal with increasing economic interests and increasing migration to the north. Changing environments will also force people to move in the coming decades and Canada is, and will remain, a popular destination for migrants, especially with new areas becoming more viable for habitation. As climate change refugees do not yet have legal status recognised in international law, dealing with the huge numbers of climate refugees will pose an additional challenge to national security.[141]

2. Security and defence strategy and policies: is climate change taken into account by the Department of National Defence?

The Canadian Department of National Defence acknowledges that climate change will work as a threat multiplier, aggravating existing vulnerabilities and exacerbating sources of tension such as weak governance and resource scarcity respectively. Internationally, climate change should therefore be seen through a security lens and its impact on international missions should be analysed.[142]

In Canada's defence policy, *Strong Secure and Engaged*, the impact of climate change is mentioned as a national security threat, especially in the context of a changing Arctic region, the aggravating effect on existing vulnerabilities internationally such as weak governance, and the (inter)national effects of extreme weather events.[143] The Department of National Defence emphasises that the changing global security

140 Canada's Department of National Defence, Strong Secure and Engaged – Canada's defence policy, May 2019, p. 50.

141 Ray Snook, 'Climate Change and its implication for the Canadian Forces', *Canadian Naval Review*, Vol. 6 (2), 2010, p. 12.

142 Canada's Department of National Defence, Strong Secure and Engaged – Canada's defence policy, May 2019, p. 51.

143 Ibid., p. 52.

environment transcends national borders, thereby emphasising that Canada's overseas missions are also of paramount importance to security at home.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

Operation LENTUS is the response of the Canadian armed forces to domestic natural disasters. It provides aid to provincial and territorial authorities, responds effectively to the crisis situations, such as forest fires, floods, ice storms or hurricanes, and stabilises natural disaster situations appropriately. The number of deployed people has ranged from 60 to 2,600 in the last few years; ships, vehicles, aircraft and other equipment have also been deployed. Military support could also include pre-disaster planning, such as filling and distributing sandbags, evacuating people and assisting law enforcement to distribute information to communities.[144]

On national territory, climate change presses hard on the capability of the Canadian armed forces. In 2016, the Canadian military had to assist only once, in response to a wildfire in Fort McMurray. In 2017 and 2018, there were six national deployments, especially in flood and wildfire emergencies. In spring 2019 more soldiers were deployed to assist domestically than were deployed overseas.[145] In domestic emergencies, military support for law enforcement and rapid disaster response are needed more frequently and this situation is likely to continue. In most northern territories, the mobility and reach have improved, but extra personnel will be needed in the near future.[146]

In addition to this, Canada is responsible for more than 18 million square kilometres of land and water, including three oceans, three million lakes and an immense river system. The need for search and rescue operations will increase as climate change-related natural disasters will occur more often. Currently, the Canadian armed forces respond to over 9,000 search and rescue calls annually and currently has just 950 personnel to deploy for these calls.[147] Lastly, the capacity of Operation DRIFTNET will be under pressure as illegal fishing increases due to changes in fish migration caused by climate change.[148]

144 Government of Canada, Operation Lentus, 2019.

145 Darren Major and Salimah Shivji, Canada's military feeling the strain responding to climate change, CBC, June 2019.

146 Canada's Department of National Defence, *Strong Secure and Engaged – Canada's defence policy*, May 2019, p. 60.

147 Canada's Department of National Defence, Strong Secure and Engaged – Canada's defence policy, May 2019, p. 87.

148 Government of Canada, Operation DRIFTNET, 2019.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Canada expects a greater demand for peace and stabilisation missions worldwide, and more deployments for overseas natural disasters (Contingency Plan Renaissance). The most recent deployment was aid provided after Hurricane Dorian hit the Bahamas. With regards to the Arctic, Canada wants to modernise the NORAD deal with the US to create a front and deal with an increasingly accessible Arctic region. Furthermore, the prime minister's most recent mandate letter to Canada's Minister of National Defence calls on Defence to '*expand Canadian defence cooperation and training assistance, in particular by drawing on the expertise of the Canadian Armed Forces to help other countries at greater risk of disasters due to climate change*'. Achieving this objective requires a broad approach that leverages initiatives like the Military Training and Cooperation Program (MTCP), as well as exercises led by the armed forces that incorporate natural disaster scenarios and the need to cooperate with civilian authorities.

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

General Vance, Canadian Chief-of-Defence, has acknowledged that the Canadian armed forces must expand to adapt to changing defence and security challenges.[149] To deal with the rising domestic demand on the army to assist at times of natural disaster, the Canadian Department of National Defence has enhanced the role of the Reserve Force. More than 1,500 people are hired through a fast-track recruitment process. The assigned roles of the Reserve Force units have been expanded to include light urban search and rescue tasks, combat capabilities such as direct fire, and naval security teams to assist the military.[150] This will mean that soldiers just returned from overseas deployment will not necessarily need to be immediately deployed on national territory.[151] With regard to infrastructure, the government of Canada invests to repair and protect infrastructure from natural disasters such as floods and wildfires; $9.1 billion has been invested in bilateral agreements with provinces and territories to support green and resilient infrastructure. However, this is not enough, as many municipalities and government infrastructure and buildings are not yet sufficiently resilient to climate change impacts. In addition, $2 billion has been invested in a

149 Canada's Department of National Defence, Strong Secure and Engaged – Canada's defence policy, May 2019, p. 60.

150 Ibid., p. 74.

151 Darren Major and Salimah Shivji, Canada's military feeling the strain responding to climate change, CBC, June 2019.

Disaster Mitigation and Adaptation Fund to design largescale infrastructure projects to build resilient infrastructure for the future. While these projects are not directly funded by the Department of National Defence, they will have an impact as the military is often asked to help when infrastructure is damaged by natural disasters or extreme weather events.[152]

Regarding equipment, the Canadian Department of National Defence wants to update the north warning systems (NWS) in cooperation with the United States.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

In recent years, the Department of National Defence has made significant progress in including more sustainable initiatives in its policies. The most notable has been in the 'greening' of new buildings, infrastructure and the light-duty commercial fleet where GHG emissions have decreased by 31% since the 2005 baseline. The Treasury Board of Canada published data on greenhouse gas emissions from federal real estate and commercial fleets in autumn 2019. The data includes total emissions from national safety and security equipment. The Department of National Defence will also invest $225 million by 2020 in infrastructure projects with greening components to help reduce its carbon footprint.

With regard to GHG emission reduction targets, the government adheres to the UN Framework Convention on Climate Change and GHG emissions reduction targets. The Federal Sustainable Development Strategy requires all federal departments, including the Department of National Defence, to reduce its GHG emissions to 40% below 2005 levels by 2030 and 80% by 2050. Like other departments, Defence has set a target of 30% of its light-duty commercial fleet being hybrid or electric vehicles by 31 March 2020.[153]

The Department of National Defence has designated energy managers for each base and wing to improve energy efficiency, which will also help reduce GHG emissions. Energy managers analyse energy use and identify opportunities for greater efficiency, and also work with building occupants to improve energy efficiency behaviours. Additionally, the federal government negotiates with utility companies to obtain green electricity as well as offer opportunities to clean technology companies to further help reduce emissions.[154] To continue this progress, the *Defence Energy and Environment*

152 Government of Canada, Climate change adaptation plans and actions, 2019.

153 Department of National Defence, *Defence Energy and Environmental Strategy*, 2017, p. 9.

154 Ibid., p. 10.

Strategy was developed to align with the Federal Sustainable Development Strategy and is on a 3-year revision cycle. It includes four green objectives: less energy waste; cleaner energy; a reduced Defence environmental footprint; and better-managed energy and environmental performance.[155] The Canadian government supports transparency and requires federal departments to report on their sustainable development strategies. Results are reported to parliament and published annually in the Departmental Results Report available on a public website.[156]

Finland

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Finnish security policy is closely tied to the country's history, geographic location and non-membership of NATO. National territorial security is the absolute priority. Finland is one of the few European countries that has active conscript service. It has a large pool of reservists and mobilisable soldiers. As a consequence, the Finnish armed forces are primarily focused on national defence tasks. Finland is a traditional contributor to overseas operations, particularly in UN contexts, but numbers are limited. Defence planning and procurement programmes are driven primarily by requirements for national defence tasks.

This implies that the challenges of climate change are also primarily assessed in view of the effects on national territory, on the Baltic Sea and in Arctic areas.[157] Geopolitical shifts as a result of climate change are considered to be a primary challenge. With regard to national territory, storms and other severe weather events are seen as the main risk factors. Coastal areas – including ports – are potentially threatened, in particular by the combination of rising sea levels and increasing number of storms. The same could be the case with the combination of melting ice and strong winds or storms.[158] The risk of forest fires will also increase but Finland already has a well-functioning monitoring system.

The government takes into account the potential impact of climate change in the Middle East and Northern Africa (Sahel zone), with refugee flows being the most significant effect.

155 Department of National Defence, *Defence Energy and Environmental Strategy*, 2017.

156 Canadian Federal Departments – Departmental Results Reports on Treasury Board of Canada website.

157 *Government Report on Finnish Foreign and Security Policy*, 2016, p. 17.

158 *Climate change impacts, adaptation measures and vulnerability assessment*, Statistics Finland, 2016, p. 159. (http://www.stat.fi/tup/khkinv/luku6)

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?

The approach to climate change adopted by the Finnish Ministry of Defence (MoD) is driven by national climate security policy and goals. Government change can lead to new concrete measures. For example, the current government has decided to set a new and ambitious target of a carbon neutral Finland by 2035. The target is not binding but does influences the policies of various ministries such as the MoD. The current Finnish National Defence Strategy defines environmental hazards as constituting a wide-ranging threat to Finland's security. It argues for more effective ways to respond to such threats.[159] The armed forces must be prepared to prevent and, if necessary, repel such threats on their own. Also, they should be prepared to cooperate internationally and develop their ability to receive support. The National Defence Strategy is being updated (but is not yet available). The impact of climate change is most likely to take a more prominent place in the new edition of the strategy.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

The Finnish armed forces have a legal obligation to support civilian authorities when disasters occur on national territory (or near national territory). Potential increasing number of storms and other climate-related events might lead to more calls on the armed forces, in particular as a first responder when civilian means are insufficient or not immediately available. Furthermore, the maintenance of roads and other infrastructure is likely to be needed most often as temperature changes and heavy rain will lead to a increasing need for repair and reconstruction. Power cuts as a result of storms, in particular in remote areas, can lead to more calls on the military to provide the first assistance. As a consequence, Finland aims to further improve its national defence and crisis resilience. In addition to preparation and contingency planning for responding to security threats, attention will be focused on adapting to, or recovering from, a range of disruptions and disturbances, such as natural disasters.[160]

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Climate change will lead to a higher demand for international military and civil crisis management. This comprises development, early warning and conflict prevention,

159 *Finnish Ministry of Defence Strategy 2025*, 2006, p. 13.

160 Government Report on Finnish Foreign and Security Policy, p. 30.

and military and civil crisis management in the acute phase, as well as post-conflict stabilisation and reconstruction.[161] However, it is expected that climate change will have very little impact on Finnish contributions to overseas operations, as the government considers such operations to be a secondary priority. Of course the Finnish armed forces will have to make some adaptations, for example if deployed to hot environments (e.g. with regard to clothing), but this is not a defence planning factor as such. In terms of an increased call to contribute to overseas humanitarian disaster relief operations, Finland considers this to be primarily a responsibility for civilian organisations and NGOs.

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

Training is likely to be affected by climate change. In particular the training requirements of 20,000 conscripts continuously called up for the standard six months of military service will need to be reassessed. The defence forces must be able to fulfil their duties in all situations, and different climate conditions in the north and the south of the country will affect training.[162] The same applies to clothing and equipment.

Possible consequences are taken into account in the planning of infrastructure and equipment. For example, in the Squadron 2020-project it is stated that no new infrastructure will be built below +3 metres above (current) sea level in order to take into account sea-level rise.[163] For procurement of naval ships, requirements to sail in storms and ice conditions will be taken into account. As far as the danger of forest fires is concerned, the initial assessment points to the conclusion that existing infrastructure for ammunition storage can withstand the potential danger.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The Finnish Ministry of Defence implements nationally defined policies and concrete targets. Several measures have already been taken. For example, one national target is to ensure that government buildings are heated without fossil fuels by 2025. The Finnish MoD has undertaken measures to achieve this target.

In 2014 the Finnish Defence Forces published an energy and climate programme, which included a target of reducing greenhouse gas emissions by 30% by 2020 compared

161 Finnish Ministry of Defence Strategy 2025, p. 10.

162 *The Finnish Defence Forces and the environment*, The Finnish Defence Forces. (https://puolustusvoimat.fi/en/fdf-and-the-environment)

163 For more information see: *Squadron 2020 - The Finnish Defence Forces' strategic project*, 2017.

to 2010 levels. It also sets a target of 20% energy savings in properties used by the armed forces compared to 2010 levels. This must be achieved by 2020.[164] Measures will focus on improving the energy performance of buildings. Furthermore, the operational energy performance of the armed forces will be improved so that in future the same level of performance can be achieved using less energy.[165] The Finnish armed forces work on environmental protection in cooperation with, among others, the Construction Establishment of Defence Administration. The latter aims to improve material efficiency by procuring durable products.[166]

Although it is more complicated for anything that moves (ships, aircraft, vehicles), climate change is taken into account in procurement planning. However, to a large extent Finland is dependent on buying equipment from foreign suppliers. It is expected that producers abroad will take the necessary measures, as many countries are interested in manufacturing greener equipment. It should be noted that solar energy can play only a limited role in Finland due to its weather conditions and the long dark winters. Growing attention is being paid to using other non-fossil fuels, for example Finland's enormous forest assets (wood).

France

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

France considers climate change to be 'at the forefront' of the security risks it is facing.[167] The impact on the country's security is related to its national territory as well as to regions and countries where France might or could be engaged through humanitarian disaster relief or crisis management operations. The country itself is particularly vulnerable because of the vast extent of its overseas territories. France has the second largest Exclusive Economic Zone (11.2 million km²) of all countries in the world and 2.8 million French nationals live in overseas territories, from the Caribbean to the Indian Ocean and the South Pacific.

164 *Government Report on Medium-term Climate Change Policy Plan for 2030*, 2017, p. 74.

165 Government Report on Medium-term Climate Change Policy Plan for 2030, p. 74.

166 *The defence administration's commitment to sustainable development – Responsible Security*, The Finnish Ministry of Defence. (https://www.defmin.fi/en/administrative_branch/the_defence_administration_has_pledged_to_sustainable_development)

167 *Défense et climat – La France s'engage / Defence and climate: France is committed*, Direction générale des relations internationales et de la stratégie / Directorate General for International Relations and Strategy, 2018.

A wide range of climate change effects are taken into account, as these might differ from region to region. In the Caribbean, hurricanes are the main challenge; the same is the case in the Indian Ocean, where forest fires also occur (e.g. on La Réunion). In the South Pacific, the number of challenges is even higher: degradation of fish resources, cyclones and storm surges, flooding, etc). Sea-level rise is considered particularly threatening for the small island states in the South Pacific in terms of human security (food, water, etc), health (diseases), competition for resources (with danger of escalation), violence due to mismanaged adaptation or migration, and land disputes.[168] Forest fires and heavy rainfall, potentially causing mud, rock or landslides, are considered the most significant risks for the homeland territory – as well as the rising sea level. In mainland France, major forest fires, floods and other exceptional natural disasters happen increasingly. The same applies to heatwaves and drought. Spreading and adaptation of new insect varieties (i.e. the tiger mosquito) to the metropolitan territory spread tropical diseases (dengue, chikungunya, malaria) is a developing health security factor.

Outside national territory, the Sahel and the Arctic are the two areas of most relevance to France. Climate change will have a profound effect on security in the Sahel due to its deteriorating impact on scarce land, water and food – leading to a further increase of instability and violence. The melting of Arctic ice has geopolitical implications, as the area is becoming contested territory between states bordering the Arctic and other interested countries. Overlapping territorial claims and access to new sea lanes and natural resources increase tensions between the great powers, of which some are traditional allies of France and others are regular counterparts, for instance in the UN Security Council.

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?

The 2017 version of the French Defence and National Security Strategic Review identifies climate change as one of the five 'multiple weaknesses aggravating crises' – the other four being demographic and migration pressure, sanitary risks, energy rivalries and organised crime. Climate change events will trigger emergency operations requiring support from the armed forces, in particular in overseas departments and territories. The most vulnerable regions mentioned in the document are the Sahel, Southeast Asia and Pacific Ocean small island states, while it also states that the Arctic 'may one day become an area of confrontation'.[169] The 2017 Strategic Review contains no indications or details of what these climate change effects will imply for the French armed forces.

168 François Gemenne, Bastien Alex, Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019.

169 *Defence and National Security Strategic Review 2017*, pp. 29-30.

However, in recent years a defence climate security policy has been elaborated further by the Directorate General for International Relations and Strategy, whose work is supported by the Observatory on Defence and Climate.

The Observatory on Defence and Climate is a four-year research programme dedicated to climate change issues related to security and defence. It was launched in 2016, after the First International Conference of Defence Ministers and High Officials on Climate Change and its implications for Defence, held in Paris in October 2015 (several weeks before the COP21). The Observatory is a key enabler for developing awareness of the impact of climate change on defence missions within the ministry, elaborating step-by-step risk-mapping and helping to develop international cooperation through joint studies between defence partners. The Observatory also brings together other climate researchers in a national and international network and helps to broaden the pool of skills at national level. The Ministry of Defence (MoD) finances the Observatory with €1.4 million over the 2016-2020 period.

Strategic level documents are taken into account in preparing for future operations and adapting infrastructure and equipment procurement, although this is not yet carried out in a structural planning method. The structural approach is in the phase of risk-mapping and identifying potential climate change impacts, for which the growing number of risk studies provide essential input. France works closely with partner countries, for example with Australia, New Zealand and other countries within the South Pacific Defence Ministers Meeting (SPDMM) format[170] on defence engagement and regional cooperation. In 2017, France proposed to SPDMM partners that they initiate a joint study on the security and defence impacts of climate change in the South Pacific by 2030, focusing on three domains: resilience of critical infrastructures, impact on HADR operations and on maritime security. Driven by the Observatory, the study and its recommendations were approved by SPDMM in May 2019.[171] Another cooperation format used for addressing climate change and the armed forces is the 5+5 Defence Initiative, made up of five south-western European countries and five North African states addressing security and defence issues in the western Mediterranean. France proposed a joint study on the security impact of climate change in the 5+5 Defence Initiative area of interest; the study was approved in 2017.[172]

170 The South Pacific Ministers Meeting, initiated in 2013, holds annual meetings of defence ministers from Australia, Chile, Fiji, France, New Zealand, Papua New Guinea and Tonga.

171 For the study see: https://www.defense.gouv.fr/dgris/recherche-et-prospective/observatoires/observatoire-geopolitique-des-enjeux-des-changements-climatiques.

172 France, Italy, Malta, Spain and Portugal + Algeria, Libya, Mauritania, Morocco and Tunisia.

3. National(support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

The calls on the French armed forces to support emergency operations in the mainland (forest fires, effects of flooding) are likely to increase. Every summer, the French military fights forest fires in southern France through mobilisation of its Operation Hephaistos. The spreading of new diseases has been taken into account by the French armed forces since the early 2000s. As France's overseas territories are most vulnerable to the impact of climate change, the military – those deployed permanently as well as reinforcements – can also expect to operate more often in emergency situations in those areas. As the French navy is implementing constabulary missions (fighting against illicit trafficking, illegal, unreported and unregulated (IUU) fishing, voluntary pollution, etc) due to the absence of coastguards; these missions will increasingly be affected by the consequences of climate change. For instance, the displacement of fish resources due to the warming and acidification of oceans will lead to IUU fishing constantly moving, thus affecting French navy areas of operations. It will be particularly evident in the Indian and Pacific Oceans.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Outside French territory new conflicts may arise and, where these occur in areas of extreme drought or flooding, there will be an added requirement for addressing human security problems (lack of food, water, diseases, etc). CIMIC (Civil-Military Cooperation) activities are most likely to increase. The higher number and increasing severity of humanitarian crises will require a greater mobilisation of military forces. All of this 'could lead to a change in the distribution of the missions and intervention capabilities of the armed forces'.[173]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

Due to the traditional expeditionary nature of French military activities, local circumstances are always taken into account when preparing for deployments. In that sense, climate change is simply an additional factor that will be (almost automatically) taken into account. With regard to equipment, eco-design is favoured in order to limit environmental impact; research and development (R&D), in particular by dual-use technological innovation (materials, energy, etc), is used for that purpose. Already

173 Défense et climat – La France s'engage, p. 7.

since the late 1990s the Directorate General of Armaments (Direction Générale de l'Armement – DGA) has taken climate and environmental conditions and requirements into consideration in the development of military equipment. An example is the class of new FREMM frigates, which have been equipped with electric propulsion and hybrid architecture, reducing fuel consumption while at the same time extending operational range. Another example is provided by the service in charge of defence infrastructure. In 2018 it initiated its Eco-Camp 2025 programme, a concept intended in particular to develop energy and water security in overseas military camps, thus reducing the dependency to logistics flows, which are potentially vulnerable to hostile actions (e.g. attacks by terrorist groups attacks in the Sahel).

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

In 2016, an updated Sustainable Defence Strategy 2016-2020 was launched,[174] aligning the actions of the Ministry of the Armed Forces with the National Ecological Transition Strategy for Sustainable Development. The updated strategy defines four challenges: to preserve natural environments and territories; to ecologically design infrastructure and equipment, and control the environmental footprint; to consolidate a socially responsible approach; and to continue establishing a structured governance, allowing the performant implementation of the ministry's sustainable strategy. For each challenge a number of goals have been defined for the MoD contribution to the national ecological transition strategy towards sustainability.[175] A concrete example of the implementation of the strategy is the new ministry headquarters, which has the largest photovoltaic roof in Paris and which uses of geothermal water.[176]

The energy objectives for the period 2010-2018 were: -15% energy consumption; -18% greenhouse gas emissions; and -30% use of fossil fuel energy. Long-term objectives are: reducing GHG emissions by 40% by 2030, compared to 1990; and

174 *Defence sustainable strategy 2016-2020 – Synthesis*, December 2016. The first one was initiated in 2012.

175 For challenge (1): first goal – take part in crisis management; second goal – preserve territories and environments; third goal – contribute in the medium term to achieve the sustainability of territories. For challenge (2): fourth goal – prevent risks and reduce the ministry's infrastructure carbon footprint; fifth goal – limit the environmental impact of military equipment and weapons systems. For challenge (3): sixth goal – guarantee solidarity and equality among Defence staff and relatives; seventh goal – contribute to strengthen social cohesion and solidarity, in France and between France and fellow citizens; eighth goal – achieve ministry staff adhesion at every level. For challenge (4): ninth goal – develop networking for sustainability; tenth goal – help improve knowledge of the ecological footprint; 11th goal – become involved in international cooperation for sustainability.

176 Défense et climat – La France s'engage / Defence and climate: France is committed, p. 13.

reducing fossil fuel consumption by 40% by 2030, compared to 2012. The Minister for the Armed Forces, Florence Parly, reiterated in September 2019[177] the ministry's four areas of environmental security policy: better anticipation of climate change security risks; reduced consumption of fossil fuel energy (energy renovation of social housing, 50% of electric and hybrid commercial vehicles by 2030); development of renewable energy (solar energy, alternative fuel); and contribution to protect biodiversity, particularly in defence land estate in metropolitan and overseas territories.

Germany

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Within Germany's national territory, climate change may have particularly serious implications for the Rhine River, due to melting glaciers. Furthermore, sea-level rise and increased storm surge height may cause flooding along Germany's North Sea and Baltic Sea coasts, allowing saltwater intrusion into inland areas, potentially contaminating fresh ground and surface waters.[178] In addition, the combination of heatwaves, drought, heavy storms, forest fires, beetle plagues and a fungi blight have destroyed parts of Germany's forests – in 2019 equivalent to more than 200,000 football fields.[179] Climate change may even lead to an increased risk of wild fires in the Alps.[180] Forests cover almost a third of Germany's landscape and, therefore, the issue of *waldsterben* (dying forests) are seen as a top priority.

Germany regards the global impact of climate change as a problem for national security. Consequences of climate change such as an increasing scarcity of water and other basic resources are becoming an existential threat for an increasing number of states and regions (particularly those that are fragile). This may lead to state failure, violent conflicts and migration.[181] According to Germany's Arctic Policy Guidelines, developments in the Arctic also affect German security interests.[182] Due to global

177 Discours de Florence Parly – 2e régiment étranger de génie – Saint-Christol, 5 September 2019, https://www.defense.gouv.fr/salle-de-presse/discours/discours-de-florence-parly/discours-de-florence-parly-2e-regiment-etranger-de-genie-saint-christol.

178 *Climate Impacts: Field of Action Water Resources, Water Management, Coastal and Marine Protection*, Umwelt Bundesamt, 4 September 2019.

179 K. Connolly, 'Part of German soul' under threat as forests die, *The Guardian*, 7 August 2019.

180 B. Berwyn, *Global warming is increasing forest fire risk in the Alps*, *Deutsche Welle*, 2 March 2017.

181 *Federal Government of Germany Guidelines on Preventing Crises, Resolving Conflicts, Building Peace*, 2017, p. 25.

182 *Germany's Arctic Policy Guidelines - Assuming Responsibility, Creating Trust, Shaping the Future*, August 2019, p. 23.

warming and the rapid melting of the polar ice sheets, the Arctic is of steadily growing geo-ecological, geopolitical and geoeconomic importance for the international community. Furthermore, the Middle East and North Africa (MENA) region is an area of concern, and is considered particularly vulnerable with regard to political destabilisation, insecurity and conflict – situations that are remarkably accelerated, in part, by climate change.[183]

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence?

The 2016 White Paper on German Security Policy and the future of the Bundeswehr (armed forces) refers to climate change as a challenge, but in terms of responding to these challenges the White Paper refers only to diplomatic-political activities. This is particularly the case for advocating partnerships, using international organisations and forums such as NATO, the UN, EU and G7.[184] Furthermore, it argues for a whole-of-government approach. Until recently, the German Ministry of Defence (MoD) has paid very little attention to the impact of climate change to the Bundeswehr in terms of operational impact, in particular on personnel and equipment. But this is different now, as climate change appears more and more often on the agendas of EU and NATO ministers of defence meetings. Also, the upcoming German Presidency of the EU (2nd semester 2020) will have a role in giving more intention to the matter, in particular at the (Defence) Policy Directorate. Climate change impact is now part of strategic foresight and strategic awareness activities; it is also taken into account in the national capability development processes. A few minor programmes on mitigation address ecosystem conservation or facility management. But the role of the military on adaptation remains at the theoretical level or is case specific. Broader and more concrete adaptation strategies for the Bundeswehr are still lacking.[185] Input from the German Institute for Defence and Strategic Studies, a cooperation project of the Universität der Bundeswehr Hamburg, also plays a role. In its latest contribution, the Institute argues that the German Ministry of Defence must contribute to mitigation of climate change effects.[186] It calls on the ministry to start addressing the consequences for operations, personnel, and equipment procurement.

183 *Klimafolgen im Kontext - Implikationen von Sicherheit und Stabilität im Nahen Osten und Afrika*, Bundeswehr Office for Defence Planning, October 2012.

184 *Federal Government of Germany Guidelines on Preventing Crises, Resolving Conflicts, Building Peace*, 2017, p. 133.

185 Stefan Bayer and Simon Struck, *Strategische Ausrichtung von Streitkräften im Klimawandel*, German Institute for Defence and Strategic Studies, #GIDSresearch 1/2019, December 2019.

186 Professor Dr Stefan Bayer and Simon Struck, *Klimatschutzpolitik vro dem Scheitern*, German Institute for Defence and Strategic Studies, #GIDSstatement 4/2019.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

In Germany the Länder has prime responsibility for responding to natural disasters. However, when asked for assistance, the Federal Office of Civil Protection and Disaster Assistance (BBK) may support local and regional authorities and the Länder with federal capacities. Disaster relief on national territory is a civil matter. Historically, the Bundeswehr is not deployed for such tasks. However, in exceptional circumstances – largescale and severe disasters – the armed forces can be deployed for such national (support) operations, which might be the case more often in the future. Over the past ten years, floods of the Elbe and Danube rivers have affected Germany and have become worse since the flooding in 2002 devastated several regions. In 2013, there were up to 19,000 soldiers supporting flood relief operations throughout the regions during peak times.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Environmental stress caused by climate change will place higher demands on the Bundeswehr to contribute to international HADR missions and also to crisis management operations, including active military and civil-military contributions to national early warning processes, conflict prevention, crisis management, post-crisis assistance, and stabilisation in international organisations, alliances and partnerships.[187] So far, the Ministry of Defence has not identified more detailed consequences in terms of the sort of operations, geographical orientation, etc. The 2016 White Paper underlines the importance of early recognition of crises for effective involvement at an early stage and calls for combining national and international, state and non-state expertise to create a clear overall picture. This means using innovative methods and approaches, and also instruments and methods that would enable a wide range of information to be shared, analysed and evaluated, e.g. using 'big data' and advanced analytics.[188]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

The Bundeswehr, like other armed forces, is used to working in uncertain conditions as a result of alternating political environments and positions, but the impacts of a rapidly

187 White Paper on German Security Policy and the future of the Bundeswehr 2016, p. 91.

188 Ibid., p. 50.

changing environment will be additionally demanding.[189] As a consequence, Bundeswehr resources must be suitable for carrying out different tasks in different situations ('multirole capability'), which implies that both personnel and equipment must be able to deal with varying conditions. Operating in very hot climate zones, such as in Afghanistan and Mali, illustrated the shortcomings of equipment and resulted in increased awareness of adaptation needs. However, specific climate change effects have not been taken into account so far in planning and procurement processes. Adaptation is often done on an ad hoc basis when specific needs arise during operations in challenging climate conditions.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The German Climate Action Plan 2050 defines targets for specific sectors, including energy, buildings, transport, industry, agriculture, etc. Defence is not mentioned. The overall greenhouse gas emission reduction targets are -55% (2030), -70% (2040) and 80-95% (2050) – compared to the 1990 level.[190] The MoD is taking these targets into its infrastructure planning and some progress has been made in becoming greener. Within the MoD, more awareness of the impact of climate change on the armed forces is being raised and although there are no specific targets which the MoD has to follow, it is trying to fulfil energy efficiency targets.

Jordan

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Bordered by Israel and Palestine to the west, Syria to the north, Iraq to the east, and Saudi Arabia to the south(-east), three of Jordan's neighbouring states have active ongoing conflicts. Yet Jordan is considered an 'oasis of stability' in the Middle East. However, climate change may lead to a deterioration of this situation. There are links between water, climate change and migration – and Jordan is a country without water, with chronic regional water mismanagement and water scarcity making it prone to instability and increasing security risks.

Despite these challenges, Jordan remains a relatively stable country, making it a safe haven for refugees: Jordan has seen, and continues to deal with, a historically irregular

189 G. Nielsen, *Armed forces and the challenges of climate change*, *The European*, 7 August 2018.

190 *Climate Action Plan 2050 – Principles and goals of the German government's climate policy*, November 2016.

influx of refugees. The war in Syria has led to a regional refugee crisis – and this too is affected by climate change. With more than 650,000 Syrian refugees registered (and many more unregistered) with the UNHCR in Jordan,[191] the country's water resources have become increasingly strained, particularly in host- and border communities. The country has had to import water from neighbouring Israel; a controversial and politically sensitive, but necessary, move. The lack of water management in the Middle East is exacerbated by water scarcity and conflict in Jordan's 'neighbourhood'. Mount Hermon in the Israeli-occupied Golan Heights is a source of fresh water for Jordan. But excessive use of upstream water sources by Israel, Turkey and Syria, strains Jordan's water resources. Jordanian military experts recommend that water scarcity and management be integrated into conflict negotiations and peace treaties in the Middle East: the alternative would have a significant downstream effect on Jordan and could be contribute to deepening disputes and future conflict in the region – threatening Jordan's stability.

Climate change is also leading to increasingly higher temperatures, temperature variability, (unexpected) floods, and other natural disasters. This jeopardises the planning of operations, but is thus far not taken into account in risk assessment.

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?

Jordan's institutional approach is fragmented. The ministries of water, agriculture and health are the primary institutions tasked with climate change adaptation.[192] Disaster risk reduction lies primarily with the Civil Defence. Climate change is taken into account in the Civil Defence's disaster risk reduction strategies. The Civil Defence, however, is part of the Ministry of Interior, not Defence. It remains unclear as to the Ministry of Defence's explicit inclusion of climate change in its strategic policies. According to Jordanian military experts, the Defence department does not take climate change into account.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to its effects on national territory (including overseas)?

The Energy and Water Directorate within the Jordanian armed forces has several tasks to maintain the operations of the country's armed forces. Jordan is prone to flooding and during environmental disasters (such as floods), the army assists with the pumping

191 *Syria regional refugee response: Jordan*, UNHCR, September, 2019, https://data2.unhcr.org/en/situations/syria/location/36 (accessed September 2019).

192 The national climate change policy of the Hashemite Kingdom of Jordan 2013-2020, *Ministry of Environment*, 2013, p. 31.

of water and cooperates with the Ministry of Interior and its Civil Defence search and rescue operations. Increasing climate change-induced disasters will require the armed forces to dedicate more of their equipment and personnel to support communities.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Jordan contributes military and police officers to seven UN peacekeeping missions.[193] The greatest number are deployed with the United Nations African Union Mission in Darfur (UNAMID). This is a region where climate change is known to act as threat multiplier. It is remarkable that the army of Jordan also has invested in the Horn of Africa. Due to domestic droughts and consequent reduction of available agricultural land, the Jordanian army invested, through its military pension fund, in 9,000 acres of agricultural land in northern Sudan in 1999.[194] Apparently it considers northern Sudan less vulnerable to drought than Jordan.[195]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

Despite the absence of a climate strategy or policy, Jordan's armed forces are making some adjustments, such as in military training, operations and equipment. It is notable that some adaptation measures are not sustainable and may reinforce negative consequences of climate change. For instance, air cooling systems are used to mitigate rising temperatures, yet this contributes to emissions and increases the heat in area in which they are used.

Higher temperatures affect the exercises and operations of the armed forces. According to Jordanian military experts, soldiers and airmen need training to operate in higher temperatures; at temperatures of 40-45°C it becomes harder for humans and machines to operate. The increasing heat affects armed forces stationed or operating in areas with already relatively high temperatures. Heat and temperature variability cause Jordan's armed forces to plan for alternatives in daily operations, which means they must be prepared for several fast-changing circumstances.

193 UNAMID, MINUJUSTH, MINUSMA, MINUSCA, MONUSCO, UNMISS, MINURSO. See: https://peacekeeping.un.org/en/jordan.

194 Peter Schwartzstein, one of Africa's most fertile lands is struggling to feed its own people, Bloomberg, 2 April 2019.

195 *"Planning in the wind": the failed Jordanian agricultural investments in Sudan* (Justa Hopma, 2015).

The Royal Jordanian Air force is affected by longer periods of extreme temperatures of 40°C; the performance of fighter jets is significantly affected by temperatures of 40-45°C, meaning that, as happened in one case in Jordan, an additional runway at a military base was constructed to optimise engine performance at take-off. This additional runway runs in a different direction than the original, to adjust to changing winds and improve the lift gained during take-off, thereby compensating for poor engine performance due to heat. The extra kilometres of asphalt are an adaptive measure, but as the runway now absorbs more heat it paradoxically results in a slight rise in temperature on the airfield.

Clothing and equipment is adapted beyond traditional functional standards. The design of soldiers' clothing, for instance, needs to be optimised for higher temperatures and simultaneously the outfit must remain easily adaptable in the field to adjust for significant changes in temperature and unexpected floods. The effects of climate change push for these to be included in procurement and planning strategies, which is already taking place. Before soldiers operate or are stationed in the desert, they receive training on how to use minimal amounts of water (e.g. to not use drinking water for washing). This training, which is standard for the armed forces in Jordan, is delivered by NGOs, who also address other environmental concerns such as the use of wood for cooking, protecting the soil and not attracting animals with food remains. Jordan's military police check for violation of environmental (military) rules.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

There are no (published) emission reduction and reduced fossil fuel consumption targets in the Jordanian defence policy. The consequences of climate change, particularly increasingly high temperatures, are taken into account in the procurement of new equipment, such as clothing. But despite not focusing on emissions, the army, via its contributions to nature and the environment, does contribute to climate policy objectives. This contribution is relatively large as Jordan demilitarised in the aftermath of the 1994 peace treaty with Israel. This meant that soldiers could participate in other efforts which, traditionally, are not the responsibility of the armed forces. Below we give a few examples.

When tasked with removing mines in Jordan's border regions, the armed forces did this and planted trees in place of the mines; the army was already digging the ground and had the manpower that peacetime allows for. In the absence of war, the armed forces can engage in (re)forestation and development projects, in addition to their traditional responsibilities. The Jordanian army has been involved in the annual planting

of 250,000 trees in the country, and more than 2.5 million trees have been planted in military camps in Jordan, preventing desert encroachment.[196]

Jordan receives and purchases old or outdated military equipment. Good and bad equipment must be accepted; for example, US army vehicles used in the Vietnam war were sold to Jordan at affordable prices. These have a shorter lifespan and put the Jordanian armed forces in the position where they had to disassemble the various materials and separate toxic waste from the material. This led to workshops within the armed forces on how to disassemble batteries in a safe and environmentally friendly manner. Chemicals and plastics are separated to resell and recycle, thereby the Directorate of Military Production specialised in recycling (parts of) equipment.

In Jordan, most technological innovations have come from the armed forces, who have developed some of the country's key infrastructure. In the 1980s solar power was generated at border security posts. However, this created a serious problem: the solar systems revealed military positions, particularly in the desert, and became easily identifiable targets, weakening the army's effectiveness. Hybrid and electric buses are used for transportation of army personnel and, since 2010, Jordan has been working on making its military equipment more efficient and sustainable in the face of climate change.[197] In cooperation with Jordan's Royal Scientific Society, the army has contributed to the research and development for harnessing wind energy to generate electricity.[198]

The Jordanian armed forces play an important role in peacebuilding and encourage engagement in nature conservation. Local and grassroots environmental conservation projects can contribute to peacebuilding and help resolve stalemates; the Jordanian armed forces can facilitate cross-border exchanges. The 'Birds Know No Boundaries' initiative is a relevant example: birds do not recognise human-made borders and the cooperation of local communities might, despite their potential enmity, be possible because they are engaging with each other for a common objective. This initiated cooperation between Jordanian, Palestinian and Israeli communities. The Jordanian armed forces remove barriers to make cooperation and exchange between researchers (in this case, nature conservationists) possible. They subvert bureaucratic border and visa procedures by allowing farmers, political leaders and researchers to enter the normally off-limit border regions and to cross borders between Jordan, Israel and Palestine (the West Bank).

196 The Jordan Armed Forces, *The Hasemite Kingdom of Jordan Government*, n.d.
197 Alister Doyle, Jordan enlists army in climate fight, *Reuters*, 19 February 2010.
198 The Jordan Armed Forces, *The Hasemite Kingdom of Jordan Government*, n.d.

New Zealand

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Security issues in New Zealand are compounding climate change-related problems stemming from rising temperatures, melting ice, sea-level rise, ocean acidification, more frequent and intense weather events such as cyclones, floods, droughts and heatwaves.[199] These climate effects have environmental impacts on New Zealand, such as decreasing fish stocks, coastal erosion and increase in soil salinity and unproductive land. In particular, the changing distribution of fish stocks will press harder on New Zealand's national security as it could increase illegal maritime activities.

In 2018, the New Zealand Ministry for the Environment estimated that the rising sea level, coastal erosion and increased risk of floods would put $19 billion worth of assets at risk. This includes five airports, 46 kilometres of railroad, 2,212 kilometres of road and over 40,000 homes.[200] The social security impacts on New Zealand's population are loss of livelihood, water and food scarcity, loss of jobs, damage to community infrastructure and climate migration. Greater involvement of the military is foreseen in the near future to assist with climate change-related migration and humanitarian assistance/disaster relief operations both domestically and internationally. Lastly, the security implications are health-related crises, resource competition, violence from mismanaged adaptation or migration, and land disputes.[201] Climate change has already exacerbated marine water pollution, salinization and acidification of the ocean. Moreover, New Zealand has annual natural disasters, such as earthquakes, extreme weather events and volcano eruptions, which are exacerbated by the impacts of climate change.[202]

Climate change-related migration and displacement, especially from the Pacific, will also have an impact on New Zealand. Whether the migration is caused by sea-level rise, prolonged drought or reduced availability of natural resources, New Zealand is aware that climate change-related migration will increase in the future. As international law does not yet provide unequivocal binding direction to countries, the Pacific Small Island Developing States (SIDS) already rely heavily on Australia and New Zealand.

199 New Zealand Government, Ministry of Defence, *The Climate Crisis:* defence, Readiness and Responsibilities, November 2018, p. 6. New Zealand Government, Strategic Defence Policy Statement, 2018, p. 18.

200 Clem, K. R., Renwick, J. A. and McGregor, J. 'Autumn cooling of western East Antarctica linked to the tropical Pacific', *Journal of Geographical Research: Atmospheres*, 123, 89-107, 2018.

201 New Zealand Government, Ministry of Defence, The Climate Crisis: defence, Readiness and Responsibilities, November 2018, p. 6.

202 New Zealand Government, Strategic Defence Policy Statement, 2018, p. 18.

Therefore, New Zealand supports transparent inclusive dialogue and opts for early action to delay or avert damaging migration situations.[203]

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence (and how)?

The New Zealand Ministry of Defence and the New Zealand Defence Forces (NZDF) are taking climate change into account as they expect to face more frequent and concurrent operational commitments. In the Strategic Defence Policy statement 2018, it is argued that the national security of New Zealand is directly tied to stability in the Pacific.[204] Therefore, the NZDF emphasises that it must not only prepare for an increase in operations but also support research on climate change, (in)security and the impact on NZDF operations in the Pacific, Southern Ocean and Antarctica.[205] In addition to closer regional scientific cooperation and stability missions, the Ministry of Defence (MoD) emphasises the importance of the South Pacific Defence Ministers Meeting (SPDMM). In this meeting, attended by Australia, Chile, Fiji, France, New Zealand, Papua New Guinea and Tonga, the members reaffirmed that the SPDMM is the only forum for South Pacific defence ministers to engage on existing and emerging security threats. It also underwrites the importance of continued cooperation in building resilience and strengthening response mechanisms to natural disasters exacerbated by climate change.[206]

Complementary to the regional efforts and agreements, the 2018 Defence Assessment on Climate Change marks that climate change will lead to an increased need in humanitarian assistance and disaster relief (HADR) operations, stability, and search and rescue operations in the region.[207] To deal with emergencies, the Ministry of Civil Defence and Emergency management has founded the National Crisis Management Centre (NCMC), which coordinates preparation and response in any type of emergency, such as emergency water or electricity supply.[208] Additionally, the government has initiated a policy review to ensure that the country is 'fit for the future' with regard to maritime security and is in the process of developing a maritime security strategy that will secure marine economic and cultural environment interests.[209]

203 Cabinet Environment, Energy and Climate Committee, Pacific climate change-related displacement and migration: a New Zealand action plan, 2019.

204 New Zealand Government, Strategic Defence Policy Statement, 2018.

205 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 57.

206 South Pacific Defence Ministers' Meeting, Joint Communiqué, May 2019.

207 Ibid. p. 40.

208 Ministry of Civil Defence & Emergency Management, National Crisis Management Centre, October 2019.

209 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 52.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

As a supporting agency, the NZDF supports communities and other government agencies in the event of a largescale natural disaster with pre-disaster preparation and also with post-disaster assistance such as emergency aid and relocation of people. In the future, more national HADR operations will be necessary to handle the impact of climate change nationally. The MoD acknowledges the need to plan for and respond to civil defence emergencies arising from severe weather events related to climate change, especially because concurrent operational commitments may stretch resources and reduce readiness for other requirements.[210]

As well as HADR operations, the effects of climate change might require a more diverse pallet of aid. For example, the NDZF deployed army engineers to help rebuild the South Westland's Wahio River Bailey Bridge. In March 2019, the bridge was heavily damaged by torrential rain and a rock-filled flood.[211] The NDZF also plays a crucial role in supporting the government to deter, provide early warning, prevent and respond to a maritime mass arrival of migrants. Although the remote location of New Zealand serves as a buffer for mass immigration, resource competition and scarcity in the maritime domain could lead to challenges in New Zealand's exclusive economic zone (EEZ), for example smuggling and illegal, unreported and unregulated (IUU) fishing.[212] The NZDF closely cooperates with member nations of the Forum Fisheries Agency to counter disruptive maritime challenges.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Internationally, small island South Pacific states may come to rely more on New Zealand HADR, as they do not have their own capacity to deal with natural disasters exacerbated by climate change. Therefore, the emphasis of the New Zealand Ministry of Defence's international efforts will be on the South Pacific region. The NZDF assistance provided after Cyclone Gita in 2018 is an illustration of this. In order to conduct aerial surveillance of the damage, deliver relief supplies and help emergency response efforts New Zealand

210 New Zealand Government, Strategic Defence Policy Statement, 2018, p. 24.

211 New Zealand Transport Agency, NZ Defence Force, Downer help Transport Agency rebuild Waiho River Bailey bridge, April 2019.

212 New Zealand Government, Strategic Defence Policy Statement, 2018, p. 7.

sent a P3-K Orian Aircraft, six C130 flights, a 10-person interagency team and put aside $NZ2.33 million respectively.[213]

The MoD also prepares for stability missions in the Pacific, as the national security of New Zealand is directly tied to the stability of the Pacific. With its 'Pacific Reset', an updated overall approach to the Pacific, the MoD hopes to strengthen relationships with the Pacific states and identify challenges for the smaller islands caused or exacerbated by climate change.[214] Moreover, military cooperation between France, Australia and New Zealand in the Pacific was outlined in the FRANZ agreement.[215]

Alongside the focus on the Pacific, New Zealand's international efforts are strongly focused on Antarctica, including the Ross Sea Marine Protected Areas – the largest sanctuary in the world.[216] Climate change has a severe impact on this continent and international interest in the continent's natural resources has grown significantly over the years. In 2011, for example, Russia actively explored possibilities of extracting oil, gas and minerals.[217] Although Antarctica is a demilitarised zone, it asks the NZDF to provide assistance for the forthcoming summer season and for the United States Antarctic Programme. As weather conditions are challenging, the six C130 Hercules flights are sometimes postponed or turn around half-way due to rapidly changing weather conditions on the ice.[218]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

In order to deal with climate change, the NZDF published a $20 billion plan to upgrade Defence equipment to deal with the effects of climate change on its equipment and the region by 2030.[219] This includes: non-weaponised space-based surveillance and communications systems and drones; a second ship, similar to HMNZS Canterbury, to assist with humanitarian disasters; polar-ready Southern Ocean Patrol Vessel; and new maritime helicopters. Also, the number of soldiers will rise to 6,000 by 2035.[220]

213 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 40.

214 New Zealand Government, Strategic Defence Policy Statement, 2018, p. 31.

215 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 34.

216 New Zealand Government, Strategic Defence Policy Statement, 2018, p. 26.

217 Marco Visser, openen de Russen de wedloop om Antarctische bodemschatten?, November 2011.

218 New Zealand Military Force, Antarctica 1965 – present, 2019.

219 Michael Cropp, Defence Force 20bn upgrade: Climate change driven much of plan – minister Ron Mark, June 2019.

220 New Zealand Government, Defence Capability Plan, 2019, p. 17.

In the *Defence capability plan*, more than $1b is reserved for future tactical air mobility, between $300-600m for enhanced Maritime Awareness capability, and $100-$300m for operational and regulatory aviation compliance sustainment. The maritime capabilities investments include patrol and sealift communication upgrades ($25-$50m), ANZAC (Australian and New Zealand Army Corps) frigate life extension, and communication upgrade ($50-$100m). Planned investments in land capabilities cover network-enabled army, intelligence, surveillance and reconnaissance ($100-$300m), protected mobility ($300-$600m) and land force protection ($25-$50m). These investments are planned for 2020. The *Defence capability plan* also outlined decisions planned for 2026, 2027 and post-2030.[221]

The direct impact on the national armed forces is most visible in the Devonport Naval Base and Ngataringa Bay, as the area is particularly vulnerable to floods and rising sea levels.[222] Also, training areas and defence estate can be at risk, especially Whangaparaoa, Waiouru and Tekapo, and the government will work with partners to simultaneously deal with the consequences of climate change and protect native flora and fauna in the Defence estate.[223]

With regard to personnel and future strategies, Defence wants to elevate the international discussion on the security impacts of climate change in order to share lessons learned and best practice in improving resilience.

6. Greenification: what contributions are the armed forces making to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The MoD is aware of the contributions it could make to addressing climate change and is becoming more environmentally aware as an agency.[224] In the coming years, the NZDF intends to invest in research into developments in more sustainable military technology, especially regarding different types of fuel, energy storage and renewable energy. The MoD is also looking at adopting environment and sustainability considerations in procurements and capability planning processes. For example, limiting climate and environmental impact would be included in all military operational planning and reflected in practical responses such as providing water from a water point rather than

221 New Zealand Government, Defence capability plan, 2019, 2019.

222 François Gemenne, Bastien Alex and Alice Baillat, *Implications of Climate Change on Defence and Security in the South Pacific by 2030*, Observatory on Defence and Climate, May 2019, p. 26.

223 New Zealand Government, Ministry of Defence, Responding to the Climate Crisis: An implementation plan, December 2019, p. 13.

224 New Zealand Government, Ministry of Defence, The Climate Crisis: defence, Readiness and Responsibilities, November 2018, p. 10.

shipping pre-packed bottles.[225] Additionally, it wants to work towards a transparent report on its carbon emissions. Lastly, the MoD wants to put extra effort into discussing lessons learned on integrating climate change planning and environmental security into the military, and mitigate its environmental impact by designing options for more sustainable camps and bases.[226] The MoD perceives measuring its greenhouse gas emissions as key to benchmarking the starting point of its greenification.[227] The MoD does not yet have its own specific GHG emission reduction targets, but it has a Climate Change Response (Zero Carbon) Amendment Bill, which aims for zero carbon by 2050. This report also includes the NZDF.[228] Moreover, a policy to offset carbon emissions from domestic to international flights taken by MoD staff will be announced early in 2020. Measures to reduce GHG emissions already include simulations to replace real-life training situations, better engine technology, better building materials and components, and the use of solar or other alternative energy sources to minimise reliance on fossil fuels.[229]

Norway

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

Norwegian security policy is closely tied to the country's geographic location in the High North of Europe. As a consequence, the Norwegian government associates the security risks emanating from climate change predominantly with the melting of the ice in the Arctic region. One-third of the Norwegian landmass lies in the Arctic and 10% of the Norwegian population lives there.[230] For centuries, the northern part of the North Atlantic and its resources have been (geo-economically) crucial for livelihoods in the country. Oil, gas, fish and other maritime resources will continue to play significant roles in the Norwegian economy.

225 New Zealand Government, Ministry of Defence, Responding to the Climate Crisis: An implementation plan, December 2019, p. 8.

226 New Zealand Government, Ministry of Defence, The Climate Crisis: defence, Readiness and Responsibilities, November 2018, p. 10.

227 New Zealand Government, Ministry of Defence, Responding to the Climate Crisis: An implementation plan, December 2019, p. 14.

228 Environment Committee Government of New Zealand, Climate Change Response (Zero Carbon) Amendment Bill, July 2019.

229 New Zealand Government, Ministry of Defence, *Responding to the Climate Crisis: An implementation plan*, December 2019, p. 15.

230 Hilde-Gunn Bye and Andreas Osthagen, Why Norway and the US have different approaches towards their Arctic regions, *High North News*, 2018.

The melting of the ice will automatically increase Russia's influence, as the Northern Route, connecting the Atlantic with the Pacific, will become more navigable. From a military point of view, Norway's (and NATO's) primary security concern stems from the Russian Northern Fleet, with its home bases in the Barents Sea area (Kola Peninsula and adjacent regions). Two-thirds of the nuclear powered Russian naval assets belong to the Northern Fleet, including a large part of the Russian sea-based nuclear strategic deterrent. Formally, Russian military activity in the north is not viewed as directed at Norway.[231] However, the Northern Fleet will remain a primary security concern to Norway. Melting of the ice in the Arctic region will further increase access routes for Russian naval vessels to the Atlantic. From a NATO perspective, Norway will be a key country in responding to the challenges that Russia's Northern Fleet might pose.

The Middle East and Northern Africa (MENA), and the Sahel zone in particular, are considered by Norway as another geographic area where climate change will impact the deployment of the country's armed forces. The Norwegian armed forces are small and the contribution to crisis management operations in the MENA are limited. Nevertheless, the authorities are taking the associated risks into consideration. Instability and conflict can lead to increased demand for military operations (such as stabilisation).

Climate change is also posing risks to Norwegian territory. Storms, strong winds and heavy rain lead increasingly to mud- and rockslides, while extreme dry periods can cause more forest fires. Civilian authorities have the lead in addressing those challenges. Adapting Norwegian infrastructure to better deal with these risks requires an investment of 50 billion euro.

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence?

It is expected that the next edition of the Norwegian Long-Term Defence Plan (2021-2024) will take the impact of climate change on the country's armed forces into consideration. So far, this has not been the case.[232] In February 2019, the Norwegian Armed Forces Defence Research Institute (FFI) published a report on evaluating alternative paths for the future development of Norway's armed forces as a basis for the new Long-Term Defence Plan. The report was commissioned by the Norwegian Ministry of Defence.[233] Climate change is mentioned as a factor of influence for the country's armed forces, posing challenges to which they might have to respond.

231 Statement by Tone Skogen of 28 February 2018 on the Norwegian Security Policy – including participation in the CSDP at the EU Parliamentary Subcommittee on Security and Defence.

232 See: Norwegian Ministry of Defence, *Capable and Sustainable – Long Term Defence Plan*, 17 June 2016. Norway does not have a security and defence strategy.

233 Skjelland, E., a.o., *Hvordan styrke forsvaret av Norge? Et innspill til ny langstydplan (2021-2024)*, Forsvaret forskningsinstitutt. The report is written in Norwegian apart from a short summary in English.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

Due to the melting ice, larger areas must be monitored and put under surveillance. Climate effects on national territory will also require increased responsiveness. The FFI report mentions several possible measures. One of them is to further strengthen capabilities for collecting and processing data. As yet, Norway does not have dedicated military space assets, but has four microsatellites in space for tracking shipping. Space Norway, a government-owned company, is developing communication satellites for use in the Arctic region by civilian and military customers, to become operational in 2022.[234] Increased naval presence will also enhance surveillance capabilities, and contribute to handling crises if they occur. Thus, there will be an increased need for manned and unmanned aircraft. Strengthening the coastguard will allow for more cooperation with Russia on tasks such as fishing oversight and search and rescue. But at the same time, Russian military activities in the Arctic will demand that the Norwegian armed forces to be prepared for dealing with those challenges.

Climate change will open the Arctic to new human activity, including commercial activities and the exploitation of resources. As a consequence, there is a growing awareness of the lack of sufficient surveillance capabilities for safeguarding Norwegian interests and for the purpose of enforcing sovereignty.[235] When human activities in the Arctic increase, there will be a growing demand for surveillance of territorial waters and the Exclusive Economic Zone, for search and rescue operations, and for environmental protection activities.

Norway's Total Defence Concept defines the civil and military responsibilities, tasks, organisation and cooperation structures for national security.[236] The National Total Defence Forum, in which civilian and military authorities are represented, acts as the coordinating body. As civilian protection will remain the responsibility of the civilian authorities, any change in the contribution of the Norwegian armed forces will automatically become part of these coordination arrangements.

234 Space Norway: https://spacenorway.no/home/.

235 Luszczuk, M., 'Military Cooperation and Enhanced Arctic Security in the Context of Climate Change and Growing Global Interest in the Arctic', in: Heininen L. (eds), *Future Security of the Global Arctic: State Policy, Economic Security and Climate*, Palgrave Pivot, London (2016), p. 40.

236 Norwegian Ministry of Defence and Norwegian Ministry of Justice and Public Security, *Support and Cooperation – A description of the total defence in Norway*, 8 May 2018.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

The focus on the Arctic area will lead to less Norwegian contributions to crisis management operations in the MENA area, considering the small size of Norway's armed forces. Operations in the High North will dominate and larger areas will need to be put under surveillance, both at sea and in the air.

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

Under extreme weather conditions military assets can safely operate in the Arctic region. In Norway, the navy and the coastguard[237] both have a presence in the High North. The Joint Headquarters of the Norwegian armed forces and the headquarters of the Norwegian army are located north of the Arctic circle. The recently published Norwegian defence budget is also in line with the country's focus on the High North, proposing the allocation of more resources to the navy, investing in new maritime patrol aircraft as well as in coastguard vessels for an increased presence in the Arctic region.[238] The procurement plan for the Norwegian armed forces marks the acquisition of new maritime patrol aircraft as one of three priorities (the other two being the F35 and submarines).[239] The climate change challenges on Norwegian territory might have consequences for the Home Guard in term of its relocation to high-risk areas.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

In terms of becoming greener, the Norwegian armed forces have taken very few measures so far; there is one green compound (biomass fuel). However, political pressure is increasing. For example, the Labour Party argues for zero CO_2 emissions by the Norwegian armed forces by 2030.

237 The coastguard is a maritime military force that is part of the Royal Norwegian Navy.

238 Statsbudsjettet: Øker det militære nærværet i nord, *High North News*, n.d.

239 Forsvarsdepartementet, *Future acquisitions for the Norwegian Defence Sector 2019-2026*, March 2019.

Sweden

1. Risk assessment: which climate changes are considered most significant inn their impact on your country's national security?

According to the national security strategy, climate change affects Sweden's security both directly and indirectly. International impacts are considered to be as significant as impacts on national territory. Clearly, the potential effects in Sweden itself and the nearby areas take a prominent place in the country's approach on how to deal with the effects of climate change. Sweden's climate has already become warmer, with more precipitation.[240] Heavy rain and floods are expected to increase in intensity. This will have implications for some areas (Mälardalen, Vänern, Göta älvdalen and Gothenburg).[241] Flooding and saltwater intrusion could also increase as a result of rising sea levels, particularly in low-lying coastal areas in the Baltic Sea region. Furthermore, the expectation is that warm and dry weather will lead to an increased risk of forest fires.

Sweden's most northern territory is facing some of the world's most intense temperature rises and increased precipitation, which could lead to greater water flows, changes in soil conditions and more extreme weather patterns. Furthermore, climate change leaves Sámi culture and industries particularly vulnerable, as they traditionally have strong links to the surrounding natural environment. Sweden's Arctic strategy aims to strengthen the long-term capacity of these communities and of the surrounding environment to help them adapt to a changing climate.[242] This will improve resilience to climate change and create conditions for long-term sustainable development in the region. As well as the Arctic, the MENA region is another area of concern to Sweden's national security. Sweden is one of the major donors of development and humanitarian aid to Mali and the Sahel region where it, inter alia, contributes to environmental improvement, reduced climate impact and improved resilience to environmental impacts, climate change and natural disasters in the area.[243]

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence?

In January 2017, the Swedish government introduced its new National Security Strategy, including climate change and its effects as a growing threat to national and global security.[244] However, climate security risks are not specifically imbedded in the Ministry

240 Nima Khorrami, Sweden's Arctic Strategy: an Overview, *The Arctic Institute*, 16 April 2019.

241 The National Security Strategy of Sweden by the Government Offices of Sweden, 2017, pp. 25-26.

242 Sweden's strategy for the Arctic region by the Government Offices of Sweden, 2011, p. 16.

243 Regional Strategy for Sweden's Development Cooperation with the Middle East and North Africa (MENA) 2016-2020 by the Government Offices of Sweden, 2016, p. 3.

244 See footnote 2.

of Defence policy but rather in the Swedish civil emergency planning, coordinated by the Swedish Civil Contingencies Agency (MSB). Sweden has a total defence concept (totalförsvaret), which was modernised as a coordinated effort of the Swedish armed forces and the MSB in 2015. The totalförsvaret prepares Sweden for heightened contingency and comprises civil and military defence, as it aims to actively involve the whole of society during a war or other situation of high alert. A number of steps have been taken over the past ten years to strengthen society's contingency planning and the ability to prevent, withstand and manage crises, including the establishment of a crisis organisation in the government offices, a stronger crisis and consular organisation in the foreign service, and the establishment of the MSB.[245]

With regard to climate security, there is are more calls by these civil emergency authorities for the armed forces to assist in cases of natural disasters in and nearby their territory. At national level, the Swedish 'emergency preparedness system' is based on the principle of responsibility, meaning that whoever is responsible for an activity under normal conditions maintains the corresponding responsibility and initiates cross-sector cooperation during emergencies. During peacetime, the objectives of the Swedish civil emergency planning are to minimise the risk and consequences of emergencies, enhance and support societal preparedness for emergencies, and coordinate across various sector boundaries and areas of responsibility.[246] The MSB is responsible for issues concerning civil protection, public safety, emergency management and civil defence as long as no other authority has responsibility.[247] Relating to climate change issues, the MSB could coordinate prevention and management of disasters and crises in the present and future climates.

In 2018, the Swedish Climate Security Hub, a cross-institutional knowledge hub on the security implications of climate change was launched during the 2018 World Water Week in Stockholm. It will provide science-based support for managing climate-related security risks and is supported by the Swedish Ministry of Foreign Affairs.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

The Swedish armed forces are obliged to support civil authorities in cases of emergency, such as flooding, storms and forest fires. In July 2018, the MSB requested assistance in activating the EU Civil Protection Mechanism for the forest fires raging across the country.

245 The National Security Strategy, 2017, p. 26.

246 Sweden – Disaster Management Structure, *Vademecum – Civil Protection*, n.d.

247 Government Offices in Sweden, Swedish Civil Contingencies Agency, *Swedish Government*, n.d.

4. International military operations what consequences does climate change have for international operations (types, geographical orientation, etc)?

Climate change could lead to a greater call for humanitarian assistance. Sweden has long been an important actor in humanitarian aid and in 2016 was the seventh largest bilateral donor in the world, providing approximately 2.7% of global humanitarian support.[248] The overall objective of Swedish humanitarian aid is to save lives, alleviate suffering and maintain human dignity for the benefit of people in need who have been, or are at risk of becoming, affected by armed conflicts, natural disasters or other disaster situations. Swedish humanitarian aid is often channelled through its priority multilateral organisations, including the United Nations. In January 2017, the Swedish government adopted a new strategy for Sweden's humanitarian aid via the Swedish International Development Cooperation Agency for the period 2017–2020.

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

In May 2019, the Swedish Defence Commission presented its white book on Sweden's security policy and the development of its military defence, including a proposal to further enlarge the Swedish armed forces. In the assessment of the Commission, the total number of positions in the fully mobilised war-time organisation would amount to around 90,000 people, including the Home Guard and civilians. To this day, there are about 60,000 people in the war-time organisation, which means that 8,000 conscripts enter annually.[249] Furthermore, climate change will have implications for equipment. The consequences thereof are already under consideration (e.g. Swedish military clothing is outdated, must become less warm).

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)

The Swedish government has integrated environmental concerns into military planning. A study is ongoing on how to make the Swedish armed forces more green. The Swedish government has itself set a number of environmental targets and has tasked the armed forces with taking up its role in achieving them. Improvements in the energy field could have a positive impact on the environment in several respects and, at the same time, create synergies that support the armed forces in enhancing their operational

248 Government Offices in Sweden, New Strategy for Humanitarian Aid, *Swedish Government*, n.d.

249 Unofficial summary of the Swedish Defence Commission's white book on Sweden's Security Policy and the Development of the Military Defence 2021-2025, p. 7.

capabilities and ensuring the security of their energy supply.[250] According to the Swedish armed forces Environmental Policy the defence sector is 'working towards a sustainable development where environmental concern is integrated in all activities, nationally as well as internationally'. Several efforts have been made, including the project for the armed forces to be fossil fuel-free by 2045, which is in line with Sweden's goal of being climate neutral by 2045. This target is also based on security policy. Furthermore, work is being carried out in cooperation with the Defence Materiel Administration (FMV) on more efficient use of energy related to infrastructure (barracks, buildings, etc). This accounts for about one-third of the Swedish armed forces' total energy use, which is another target area. Energy efficiency and energy savings provide increased security of supply and increased sustainability. The synergy effect is that the Swedish armed forces benefit from more effective energy use than previously and that energy supplies last longer.

United Kingdom

1. Risk assessment: which climate changes are considered most significant in their impact on your country's national security?

The impact of climate change to the UK's security is related to its national territory, overseas territories and other regions and countries where the UK is engaged through humanitarian disaster relief or crisis management operations (e.g. in Commonwealth countries, the MENA region, etc).[251] The UK is particularly vulnerable because of its overseas territories: the threats faced by its 14 overseas territories have increased in scale, diversity and complexity. These include the South Atlantic (St Helena and Tristan da Cunha), the Caribbean (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands), the Western Pacific (Pitcairn Islands) and the Indian Ocean (British Indian Ocean Territory).[252] These territories are located in four distinct ocean basins with local climates strongly linked to ocean conditions and influences such as El Niño.

The UK Global Strategic Trends document identifies a number of impacts on British territory caused by climate change: warmer winters and hotter summers; sea levels around the coast are rising by around 3mm a year; and there is emerging evidence

250 The Swedish Armed Forces Environmental Report by the Swedish Armed Forces, 2017, p. 14.

251 *National Security Strategy and Strategic Defence and Security Review 2015 – a Secure and Prosperous United Kingdom*, November 2015, p. 25.

252 Steven Wade, Adam Leonard-Williams and Kate Salmon, *Assessing climate change and its likely impact on selected UK Overseas Territories: Inception Report*, October 2015. (https://assets.publishing.service.gov.uk/media/57a08979e5274a31e00000d2/Inception_2710_EOD_Final.pdf).

of changing rainfall patterns.[253] The UK Climate Change Risk Assessment of 2017 has set out several priority areas for the UK and the devolved governments (Scotland, Wales, Northern Ireland) to act upon, including flooding and coastal change risks to communities, businesses and infrastructure, and risks to health, well-being and productivity from higher temperatures.[254] Furthermore, the MoD is one the UK's largest landlords, owning and holding rights to over 431,300 hectares of the UK land mass. The impacts of climate change are being felt on the MoD estate. Some coastal sites have experienced increased flood events in low-lying areas, but more extreme weather has also led to an increase in building and rural maintenance work.[255]

2. Security and defence strategy and policies: is climate change taken into account by your country's Ministry of Defence?

The UK government has set out its commitment to actively contribute to a sustainable global society both domestically and internationally, and the MoD plays an instrumental role in the ability to achieve this. Climate change is treated as a national security policy: the UK is investing £5.6bn in international climate finance to encourage ambitious action from all sectors around the world, and has committed to achieving net zero emissions by 2050. The UK National Security Strategy of 2015 has set out several commitments for the MoD to tackle climate change, including extending (inter)national cooperation and building resilience on these global issues.[256] The response to, and recovery from, an emergency is carried out first and foremost at local level and the armed forces support civil authorities when needed in times of emergency. The MoD will place military planners in key government departments to give the military a wider and more formal role in supporting national resilience contingency planning.

In response to increasing risks to defence infrastructure, the Defence Infrastructure Organisation (DIO) developed the Climate Impact Risk Assessment Methodology (CIRAM) in order to take steps to identify the estate's vulnerabilities on a site-by-site basis and build adaptive capacity where required. The findings highlight the need for interdepartmental communication and planning, and recognise areas that need to be addressed to protect vital defence infrastructure.

253 *2018 Global Strategic Trends – Sixth edition*, October 2018, p. 13.

254 *UK Climate Change Risk Assessment 2017*, p. 3.

255 Ben Sears, Battling the Elements – adapting to climate change on the UK's defence estate, *Acclimatise*, 20 December 2018.

256 Ibid., p. 65.

Lastly, the 2018 Global Strategic Trends document was published by the Development, Concepts and Doctrine Centre (DCDC)[257] to help the MoD and cross-government partners to identify future developments, spot potential disruptions and detect weak signals that need to be evaluated, enabling them to improve strategic foresight.[258]

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

Over the past year the UK's armed forces have provided aid and assistance to civil authorities handling crises at home (e.g. wildfires, winter snowstorms, etc).[259] Climate change will likely lead to an increase of military assistance to civil authorities.[260] Due to the effects of climate change in the UK, the Commonwealth and the Overseas Territories, the armed forces will contribute to the government's response to crises by being prepared to support HADR and conduct rescue missions in these areas.[261] The UK is continuing to enhance the armed forces' ability to prepare for, respond to and recover from disruptive challenges.[262]

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

In 2018, the UK responded to a number of humanitarian crises abroad, for example the October 2018 earthquake in Indonesia. For tackling the underlying causes of conflict and fragility the UK is increasingly channelling humanitarian aid expenditure towards fragile states.[263] Climate change may also exacerbate migration and other security challenges that could lead to an increased calls on the armed forces for humanitarian aid or crisis management operations.

257 The DCDC is think tank that falls within the MoD. The Global Strategic Trends provides a strategic context for the MoD and wider government, who are involved in developing long-term plans, policies and capabilities.

258 *2018 Global Strategic Trends – Sixth edition*, October 2018, p. 3.

259 *National Security Strategy and Strategic Defence and Security Review 2015 - Third annual report*, July 2019, p. 23.

260 *Sustainable MoD – Annual Report 2017/18*, November 2018, p. 18.

261 *National Security Strategy and Strategic Defence and Security Review 2015*, p. 29.

262 Ibid., p. 23.

263 *National Security Strategy and Strategic Defence and Security Review 2015 - Third annual report*, July 2019, p. 37.

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

The main challenge for the MoD is to reduce consumption and increase efficiency while maintaining operational effectiveness. Energy savings achieved in the UK have in part been offset by an increased use of virtual or synthetic training (e.g. Combat Air of the Air Command[264]) and increased use of modernised equipment. Climate change will likely affect the environments in which the armed forces operate. Equipment will need to be capable of operating in harsher climatic and environmental conditions. For example, higher ambient temperatures will alter equipment performance (of aircraft, ships and vehicles), leading to demands for improved cooling. The increasing frequency of extreme weather events could disrupt manufacturing facilities and supply chains.[265] The Defence Equipment & Support (DE&S) established two new steering groups to strengthen governance and drive environmental improvements. Another notable initiative was the publication of Defence Standard – Environmental Management Requirements for Defence Systems, which will provide the MoD with assurances that defence industry suppliers are operating suitable systems for managing environmental requirements.[266]

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

Many MoD strategies and programmes contribute directly or indirectly to the sustainability priorities as laid down in the Sustainable MoD Strategy 2015-2025. Its main objectives are: (1) act to make resource use and assets sustainable; and (2) evolve to make our business resilient to current and future social, economic and environmental changes. Many initiatives and strategies have been set up by the MoD, of which the most important will be outlined. First, energy is critical to the delivery of military capability and to aid this the MoD is working on ways to improve the efficiency of energy consumption and reduce reliance on fossil fuels.[267]

Having exceeded the original target of an 18% reduction in fuel consumption from a 2009-2010 baseline, a new 10% efficiency improvement target by 2025-2026 has been set. In 2017-2018, the MoD consumed 664 million litres of fuel, a 10% reduction from a 2015-2016 baseline, making good progress towards the 2025-2026 target. The result stems from initiatives such as synthetic training and equipment modernisation

264 *The Defence Equipment Plan 2018 - Financial Summary*, November 2018, p. 26.

265 Sustainable MoD – Annual Report 2017/18, p. 31.

266 Ibid., p. 37.

267 Ibid., p. 25.

(e.g. Type 23 Hydrodynamic improvements[268]) and the establishment of the Modernising Defence Programme (MDP) that considers how the MoD can deliver better military capabilities and better value for money in a sustainable way to support national security objectives.[269] Furthermore, the Greening Government Commitment target is for a reduction of 30% of greenhouse gas emissions by 2020.[270] Current performance shows a reduction of 36%. The drive to greater energy efficiency was obtained by a combination of targeted investment together with coordinated awareness and behaviour change campaigns (e.g. Waste Working Groups, Army Energy Review).

United States

1. Risk assessment: which consequences of climate change are considered most significant in their impact on your country's national security?

The impact of climate change-related effects on United States (US) national security are severe and diverse due to regional climate variations. The US critical infrastructure, the lives of citizens, the economy and energy security are directly threatened by climate change. Increased intensity of extreme weather, such as heatwaves, droughts, heavy precipitation, and increasing number of hurricanes will cause flooding, sea-level rise and wildfires to occur more often.[271]

Droughts and heatwaves have a direct effect on the US energy infrastructure, as power plants across the US need water supplies.[272] Hurricanes such as Maria, Harvey and Sandy threaten the lives of millions and leave trails of economic damage of billions of dollars. Rivers overflow their banks due to heavy precipitation, leaving huge swathes of plains under water, particularly in the Midwest.[273] To illustrate the regional variations, it is interesting to compare three major cities: St Louis, Houston and San Francisco. St Louis will experience flooding, extreme heat, severe rainfall, and droughts in the farmlands. Houston will see more extreme hurricanes and soaring temperatures. San Francisco will be threatened by rising sea levels, more wildfires and extreme drought exacerbating the wildfires.

268 Ibid., p. 27.

269 *National Security Strategy and Strategic Defence and Security Review 2015 – Third annual report*, p. 9.

270 *National Security Strategy and Strategic Defence and Security Review 2015 – Third annual report*, p. 28.

271 Environment and Energy Study Institute, *The national security impacts of climate change*, Issue Brief, December 2017, p. 1.

272 Margaret Cook, Carey King, Todd Davidson and Michael Webber, 'Assessing the impact of droughts and heat waves at thermoelectric power plants in the US using integrated regression, thermodynamic, and climate models', *Energy Reports*, vol. 1, November 2015.

273 Allegra Kirkland, Jeremy Deaton, Molly Taft, Mina Lee and Josh Landis, *What climate change will do to three major American cities by 2100*, NexusMedia, October 2019.

Climate change-induced migration is also a risk to national security. This risk is divided into direct risks, indirect risks and third-order risks. Direct risks include infrastructure and operational impacts to military forces and critical infrastructure and global humanitarian assistance. Indirect risks are disruptions to the global economy caused by mass migration. Third-order risks are related to climate change as a threat multiplier, hence conflicts caused or exacerbated by an influx of refugees or intensifying tensions over scarcity of natural resources.[274]

Lastly, the changing Arctic region is thought to have an impact on US national security. China introduced its 'Polar Silk Road' strategy and Russia is expanding its military and commercial presence in the region.[275] This new dynamic may lead to a strategic competition as natural resources slowly become available in the region. Arctic security may have direct implications for US national security interests, as it represents a potential vector for both attacks on the homeland and US power projection.[276] There are also some unresolved disputes with Canada over access to sea lanes.

2. Security and defence strategy and policies: is climate change taken into account by your country's Department of Defense (and how)?

Climate change and the implications of climate change are a sensitive topic in US politics. The Pentagon publicly recognised climate change as a concern in 1990 in its report *Global Climate Change Implications for the United States*.[277] In 2010, the US Department of Defense (DoD) officially recognised climate change as a national security threat in the Quadrennial Defense Review, which was followed by recognising it as a threat multiplier internationally in 2014.[278] While the Obama administration supported the Pentagon's battle against the implications of climate change, President Trump removed climate change from his list of national security threats and he eliminated every reference to climate change in the White House's 2017 National Security Strategy report.[279]

Nevertheless, climate change is taken into account by the DoD in risk assessments and operational planning, thereby ignoring the Trump administration. In January 2017, a handbook was distributed to planners as an aid in climate impact assessments

274 Environment and Energy Study Institute, *The national security impacts of climate change*, Issue Brief, December 2017, p. 3-4.

275 Wilson Center Home – Polar Institute, *The Arctic and the US national security*, April 2019.

276 Office of the Under Secretary of Defense for Policy, *Arctic Strategy*, June 2019, p. 3.

277 Chris D'Angelo and Alexander C. Kaufman, *Pentagon confirms climate change is a national security threat, contradicting Trump*, *Huffpost*, January 2019.

278 Environment and Energy Study Institute, *The national security impacts of climate change*, Issue Brief, December 2017, p. 1.

279 US government, *National Security Strategy of the United States of America*, December 2017.

and for the evaluation of adaptation options for the then-already existing Installation Development Plan process.[280] In January 2019, the DoD also published a report on the effects of climate change on DoD and military facilities.[281] At the same time, formal structures put in place under the Obama administration to address climate-related risks for the armed forces, such as the US Navy Climate Change Task Force, have been or are now being dismantled under the Trump administration.[282]

The discrepancy between the Pentagon and the government also led to officials avoiding language related to climate change, using instead 'resilience', 'sea level rise' or 'increase in extreme weather events', when requesting funding to raise the level of docks.[283] For instance, the Naval Station Norfolk, Virginia, the largest naval station in the world, floods ten times a year.[284] Natural tides are exceptionally high due to rising sea levels. Currently, naval assets have to be moved to open seas to prevent damage each time the basis is flooded, a rather costly affair.

3. National (support) tasks: what are the consequences of climate change for the armed forces in responding to the effects on national territory (including overseas)?

Domestically, the armed forces provide pre- and post-disaster assistance at the request of the Federal Emergency Management Agency (FEMA). This is likely to increase as climate change-related natural disasters increase in frequency and severity.[285] The military assists with pre-emptive action, such as hazard mitigation and emergency preparation, evacuations, and providing food, water, shelter and medical assistance, but also rebuilding critical infrastructure and arranging emergency transport.[286] Since 2012, disaster relief funding, both regular and emergency, has totalled just under $195 billion and in the last two years, an extraordinary need for emergency disaster assistance has been observed.[287]

The US Military Department has reviewed a small subset of 79 installations and the possible impact climate change could have on those installations now and in the coming

280 *Report on Effects of a Changing Climate to the Department of Defense*, January 2019.

281 Ibid.

282 J.D. Simkins, Navy quietly ends climate change task force, reversing Obama initiative, *NavyTimes*, 26 Augustus 2019.

283 Chris D'Angelo and Alexander C. Kaufman, *Pentagon confirms climate change is a national security threat, contradicting Trump*, *Huffpost*, January 2019.

284 Laura Parker, Who's still fighting climate change? The U.S. Military, National Geographic, 7 February 2017.

285 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 9.

286 Rocio Cara Labrador, *US Disaster Relief at home and abroad*, Council on Foreign Relations, August 2018.

287 Gordon Gray, *Federal Disaster Relief and the Federal budget*, American Action Forum, October 2018.

20 years.[288] The climate-related events cover recurrent flooding, drought, desertification, wildfires and thawing permafrost. The installations are categorised as follows: air force, army, navy, Defence Logistics Agency (DLA), Defence Financing and Accounting Service (DFAS), National Geospatial-Intelligence Agency (NGA), and the Washington Headquarters Service (WHS).[289] The US Air Force is most prone to and affected by wildfires, followed by recurrent flooding and droughts. Both the army and the navy are affected by recurrent flooding and consider this a risk, while it is notable that the most significant vulnerability for the navy is drought.[290] Overall, recurrent flooding and droughts are the most significant risk factors for all military departments.

As climate change-related weather events will open the sea route for a longer period, costs will also rise for acquisition and supply chain requirements in this region.[291]

At the nexus of domestic and international threats, the Arctic region has become an area of interest as the Northern Sea Route slowly opens for maritime traffic. The sea route is currently open for one month a year, around September, and this period is likely to increase in the future. Therefore, specific search and rescue resources are necessary and military support to civil authorities to enable the peaceful opening of this sea route. The US Europe Command (USEUCOM) is responsible for stability in this area and emphasises that closer cooperation with international partners is necessary to conduct live training exercises together.[292] In addition to this, an indirect effect of the new Arctic commercial shipping route may be increased tensions and economic instability in Egypt and the MENA region due to less traffic through the Suez Canal.

4. International military operations: what consequences does climate change have for international operations (types, geographical orientation, etc)?

Internationally, military operations of the Combatant Commands of the Ministry of Defense (CCMD) could be affected by climate change as extreme weather events become more severe and frequent in the future. In international operations, instability issues will rise and climate change will act as a threat multiplier. The United States Africa Command (USAFRICOM) already takes drought and desertification into account as a threat multiplier, and the Indo-Pacific Command (INDOPACOM) consider

288 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 4.

289 Ibid.

290 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019.

291 Ibid., p. 4.

292 Ibid., p. 8.

flooding and earthquake-induced tsunamis as factors for instability. To ensure mission resiliency, the DoD works closely with partner nations to analyse climate change-related effects that could impact missions. Through the Defense Environmental International Cooperation (DEIC) programme, several projects have already been initiated. Prominent examples include: the USAFRICOM water security management in the Chad Basin and Tanzania; the United States Europe Command water workshop in the Czech Republic; and the United States Northern Command (USNORTHCOM) Arctic mission analyses in cooperation with Norway, Sweden and Finland.[293]

The melting of the Arctic will also have economic implications; natural resources will come within reach for extraction; and commercial shipping traffic will increase through the region. Increasing economic interests in the Arctic will push for an increase in US military expenditure for the Arctic region, to protect new US interests. A greater need for search and rescue operations will arise when maritime traffic increases in the area.[294] In 2019 the US considered a Freedom of Navigation Operation (FONOP) to sail through the Northern Route and provoke Russia, but realised it currently lacks ice-capable ships[295] and the operation would be at risk with regard to search and rescue capacity that can only be assured by Russia for the time being.

Logistics and mission support issues will also be affected, especially in the Mediterranean Sea region. Weather conditions affect intelligence, surveillance and reconnaissance (ISR), and an increase in no-flight days will impact personnel recovery/ casualty evacuation and logistic flights from Europe to African countries.[296] In Guam (Pacific), flooding limits the capacity of Navy Expeditionary Forces Command Pacific operations, submarine squadrons activities and telecommunication.[297] At Andersen Air Force Base (Guam), mobility response, communications, combat and security forces squadrons are affected by recurrent flooding, as are contingency response groups.[298]

Lastly, the US government seeks to reduce the vulnerability of its development aid and investments through the systematic identification of climate risks and the funding of adaptation programmes to reduce vulnerability.[299] The effects of climate

293 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 15.

294 Michael Paul, Polar Power USA: Full Steam Ahead into the Arctic, SWP, no. 42, November 2019.

295 *Now is not the time for a FONOP in the Arctic*, War on the Rocks, 2019, https://warontherocks.com/2019/10/now-is-not-the-time-for-a-fonop-in-the-arctic/ (accessed November 2019).

296 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 8.

297 Kate Cimini, *How climate change is threatening the navy's footprint in the pacific*, June 2018.

298 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 8.

299 Climate effects on US international interests, https://nca2018.globalchange.gov/chapter/16/.

change can 'slow or reverse' economic and social progress in developing countries, potentially increasing the need for US aid, humanitarian assistance and disaster relief.[300] This is normally conducted by the Geographic Combatant Commands and, while the Department of Defense does not design a force structure for this, it offers regular assistance to the US Agency for International Development (USAID).[301]

5. Personnel and equipment: what is the impact of climate change on personnel (education and training, clothing, etc) and equipment?

Climate effects will affect the domestic training locations of the armed forces. These locations are designed to replicate the mission's environment, but as climate change effects will change this, the number of suspended/delayed and cancelled outdoor training exercises will rise in the future. Extreme heat in the south-east and south-west of the US has led to loss of military training and testing time.[302] Wildfires and hurricanes affect military operations and infrastructure, and lead to delays in training, testing and space launches. In Alaska, permafrost thawing has an impact on cold weather testing activities.

6. Greenification: what contributions are the armed forces making (or planning to make) to reduce climate change (such as GHG emission reduction targets, green infrastructure, sustainable fuel, etc)?

The US military's carbon footprint is quite large, and most of the emissions are driven by fuel use, and those are dominated by wide-body aircraft. Relying on not only wide-body aircraft but also container ships and trucks, the US military consumes more liquid fuels and emits more gases than most medium-sized countries and it consumes 77% of the entire federal government's energy consumption, which is not surprising as it is the biggest entity in the federal government.[303] In the Kyoto Protocol negotiations, the US demanded an exemption for reporting military emissions, a regulation again active due to the US retreat from the Paris Agreement. This decision was made to prevent operational decisions being made based on emissions instead of operational considerations. In government policies, no specific greenhouse gas reduction targets are presented.

300 Ibid.

301 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019, p. 9.

302 Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on effects of a changing climate to the Department of Defense*, January 2019.

303 Heather L. Greenley, *Department of Defense Energy Management: background and issues for Congress*, Congressional Research Service, July 2019. https://fas.org/sgp/crs/natsec/R45832.pdf.

Nevertheless, the armed forces are making an effort to reduce their carbon footprint. They are introducing new supply chains with green initiatives and using more renewable energy at installations and bases. This is beneficial not only for its carbon print but also for the safety of convoys delivering diesel fuel for generators at US bases. These convoys are easy to attack and mobile solar-power units are silent, allowing soldiers to move unnoticed through enemy territory.