Climate Security in Central Europe

Addressing the Challenges of Climate, Defence and Security Nexus

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NATO OTAN

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Executive Summary

The purpose of this report (funded by NATO's Public Diplomacy Division Programmes) is to raise awareness on the issue of climate security in general and within the Central European and Slovak contexts in particular. A special focus is on exploring the role of NATO in climate security. Ultimately, a main goal is to inform a more active approach to addressing climate change in Central Europe, with a focus on tangible results.

Climate change is a security problem, with both direct and indirect security impacts. Direct impacts include droughts, wildfires, floods, and extreme environmental events like heatwaves and cold snaps. Indirect impacts include migration, opportunistic crime, ethnic tensions, government instability, and social unrest. Climate change also poses operational and strategic challenges to armed forces around the world, degrading the operational capabilities of the world's militaries, all while increasing the demand for their use.

NATO recognizes climate change as a key challenge of the current era. In recent years, the Alliance has produced several declarations and documents to address climate security. NATO has both the capacity and the will to take on a leadership role in climate security; it is one of the crucial response organizations to climate-related disasters and regional destabilization due to climate change impacts. However, NATO is currently weaker in its existing implementation of climate adaption and mitigation measures, particularly in procurement terms. Sustaining a growing number of deployments in increasingly adverse conditions will tax member states' logistics capabilities to their limits. For the immediate future, the investment in early warning systems and assessment of the changing risks is crucial. It is also imperative for NATO to work with academia, industry, member states, and other partners. Sharing with Allies methodologies and data for assessing vulnerability would encourage NATO members to pay equal attention to climate security issues.

As a NATO member, Slovakia can benefit by being an active participant in climate security discussions both at home and within the Alliance. Climate change affects Slovakia in both direct and indirect ways, including extreme environmental events, prolonged droughts (and related energy security issues due to nuclear power development), floods, food insecurity, and migration. As a member of NATO, Slovakia

will likely also have to manage, in partnership with its partners, climate security crises beyond its borders – in form of peace operations and humanitarian relief work, for example. Slovakia's security is also affected by climate change impacts on its critical allies (like the USA). Climate change may weaken critical partner militaries and leave Slovakia more vulnerable as crucial NATO forces could be decreased or drawn down by disaster relief commitments at home. Changing threat profile will likely make some security and miliary planning obsolete and necessitate a more general and flexible approach to security than is currently used in Slovakia and within NATO.

The Slovak government has produced several policy documents and guidelines to both tackle environmental degradation and increase its preparedness for climate change. The Ministry of Defence in particular has several climate-related initiatives and produced strategic documents and action plans as well as best practices. Yet, there is currently no legislative requirement to reduce GHG emissions from the military vehicles and a more significant application of green initiatives on the Slovak Armed Forces is lacking. A key issue for the near future is the readiness of the armed forces to face the risks of climate change, both from an operational and strategic perspective.

One of the fundamental issues for climate security will be the greening of national militaries. The key general challenges of green transition are operational uncertainty and financing. Another challenge will be identifying viable green technologies with military applications. Overcoming this challenge will require development of 'green' defense equipment of performance that is superior to fossil fuel-powered alternatives. It is thus crucial to include in discussions experienced defence, scientific, and engineering experts.

There is some synthesis between green technology trends and military technology that may offer a path to greening of NATO militaries, including Slovakia's. Both private and public Slovak defence companies have engaged with green technologies and, where available, take advantage of incentives designed to increase efficiency and decrease energy consumption. Motivations are mixed, but undeniably increased energy costs serve as incentive to cost-cutting and increasing production efficiency.

Given the outlined challenges and opportunities, recommendations in this report are both general and pertain specifically to the greening of armed forces and defence industry. In general, due to the

complexity of climate change impacts, including cascading effects and compound disasters, there is a need for strategic foresight tailored to states' (and the region's) specific needs. Further potential solutions to the challenges of climate security in both Central Europe and Slovakia include a private-public cooperation, a better communication of the costs of climate change, increased state capability to respond to major disasters, and focus on common context and frameworks. For NATO and its members, it is crucial to invest in new technologies, allocate some defence spending to research & development, provide political incentives to large defence companies, and bring start-ups into climate security discussions.

Within the context of armed forces and defence industry, Slovakia should consider the potential changes in military logistics in current and future procurement projects. Rethinking the equipment lifecycle model offers emission reduction potential and synergizes with cost-saving and Slovak defence export plans. Keeping Slovak defence industries operational should be a government priority. There is also a need for effective signaling of greening intent on the subject of green defence procurement. This may, among other things, drive innovation in Slovak defence industries for green technologies, as there would be a clear signal of potential profits for businesses that do so.

NATO standardization on green technologies in defence would likely yield positive results in a relatively short timeframe. At the same time, NATO standards need to be accompanied by some degree of subsidization. Generally, lack of funding is the driving force behind slow modernization. NATO should therefore work towards subsidization or incentives for green standardization if it is serious about its members' militaries transitioning into being greener. If NATO subsidization is unfeasible, partnerships with members or institutions capable of offering subsidies for green military technology may be a viable alternative.

Slovakia will likely substantially benefit from being a NATO member due to the guaranteed response it will receive from capable partners if it suffers from severe climate change impacts. However, resilience building for the upcoming crises is crucial. Slovakia should be prepared for a highly insecure future, one not only shaped by overt Great Power competition, but also by acute and chronic crises that are in some way created, shaped, or aggravated by climate change.

1. Introduction

The international defence community has long recognized climate change as a major security concern. Aside from impacts on human societies, including food, water, and physical security, climate change poses operational and strategic challenges to armed forces around the world. In light of the worsening global climate trends and projections, NATO member states and their armed forces will need to adapt their tactics and inventories to better face the upcoming challenges of climate change.

NATO has made visible efforts in the area of climate security, including the 2021 Climate Change and Security Agenda, and Climate Change and Security Action Plan, among others. The topic of climate security has remained a priority for the Alliance, one that is only likely to grow in salience. The efforts that NATO has made – and potentially will make – in this area have implications for the member states, including Slovakia.

While climate change is of concern among the Slovak population,[1] its security dimensions are not well-known among the Slovak general public. Climate change remains viewed as a largely environmental issue, with less attention paid to its social, political, economic, and security dimensions.

The purpose of this report is to raise awareness on the issue of climate security in general and within the Central European and Slovak contexts in particular. A special focus is on exploring the role of NATO in climate security, including its current and future planned activities in this area. The report highlights some areas of preparedness, challenges, and opportunities for both Slovakia and NATO in addressing climate security, as well as possible ways of increasing climate considerations in Slovak defence procurement and long-term military planning, within the context of its membership in NATO. Ultimately, a main goal is to inform a more active approach to addressing climate change in Central Europe, with a focus on tangible results. Landlocked Central Europe has as much at stake from climate change as the more obviously affected coastal states of its NATO partners.

[1] A 2022 survey found that two thirds of Slovak population observe the impacts of climate change in their everyday life, while a third of the adult population worry about climate change. The research is available at https://institut2050.sk/vyskum-slovenska-klima-2022

This report, funded by NATO's Public Diplomacy Division Programmes, is the outcome of several months of research, interviews with experts, and a public workshop organized by the Institute for Central Europe (ICE). The report synthesizes the perspectives of officials from both NATO and the Slovak Ministry of Defence as well as scholars and representatives of the civil society, the Slovak defence industry, and the Slovak Armed Forces.

The report consists of four main parts. The first part discusses the concepts of environmental and climate security, including general direct and indirect impacts of climate change on both security and defence. The second part provides information on NATO's activities (and challenges) in climate security, while the third part examines climate security in Slovakia. This includes a discussion of likely impacts of climate change in the Slovak context and Slovakia's preparedness, challenges, and opportunities in climate security, including the greening of its armed forces and its defence industry. The last part provides conclusions and recommendations for relevant stakeholders.

2. Concepts: Background and Definitions

Security, in general, is about protecting human societies from danger. The traditional view of security focuses on protecting states, primarily in military terms.[2] Another, a more recent view of security focuses on human life and dignity as a referent object (i.e., that which must be protected from danger).[3] However, any part of human society can be politically elevated as needing protection from danger – that is, any part can be "securitized." With climate change posing an increasing global challenge, the environment and environmental risks have been brought to the forefront of public security discussions. This section introduces the basic tenets of environmental security and positions them in the debate on the security dimensions of climate change.

2.1 Environmental security

Environmental security is about "securitizing the environment," meaning assigning a level of political urgency to some environmental problems that are of particular concern. There are two general views of environmental security. First, the environment threatens human societies, including national or human security (e.g., due to various natural hazards). Second, human societies harm the environment, for example through industrial development or resource extraction.[4] Some complex environmental security issues, however, encompass both of these views.

In the 1990s, environmental security was mainly tied to concerns over resource scarcity and associated violent conflict in developing countries.[5] Environmental scarcity could mean depletion of fish stocks, water shortage, or degradation of soil, among other things. Environmental degradation as a potential security threat for the state influenced states' foreign policy at the time. At the core was the concern that changes in resource access would threaten international stability and even lead to military conflict in

[2] For example, Stephen M. Walt, "The Renaissance of Security Studies," *International Studies Quarterly* 35, no. 2 (1991): 211– 39.
[3] For example, Richard Ullman, "Redefining Security," *International Security* 8, No. 1 (Summer 1983): 129–53.
[4] For more details, see Peter Hough, *Environmental Security, 2nd ed*. (Routledge: 2021).
[5] For example, Homer-Dixon, "Environmental Scarcities and Violent Conflict," *International Security* 19, no. 1(1994): 5–40.

some parts of the world. The idea was that the least developed countries would have a difficult time adapting to changes in resource access because they could not easily adapt to environmental degradation. Environmental scarcity was viewed as a cause of social unrest that could potentially spill over to violent conflict.

The link between the resource scarcity and violence has, however, been disputed by many. For example, critics have called for focusing attention away from environmental scarcity and more towards improving democracy and economic development as well as cooperative responses to environmental problems.[6] Yet, overpopulation and resource depletion, pollution, and nature conservation concerns dominated early views of environmental security. Currently, the overwhelming focus is on climate change.

2.2 Climate security

The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) has concluded that "human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability."[7] The report further warns that climate change has caused some "irreversible impacts as natural and human systems are pushed beyond their ability to adapt."[8] Ecosystems and built environment have been affected by the growing severity of climate and weather extremes. Millions of people across the world have suffered from food insecurity, water shortages, and exposure to extreme environmental events. Climate change and security are therefore inextricably linked.

For a long time, however, climate change used to be considered a development not a security issue. The UN Security Council put climate change on the agenda for the first time in 2007, citing concerns about border disputes (due to changing landscape from the melting icesheets and rising sea levels), increased

[6] For example, Geoffrey D. Dabelko and David D. Dabelko, "Environmental Security: Issues of Conflict and Redefinition," ECSP Report 1 (1995): 3–13; Ken Conca and Geoffrey D. Dabelko, eds., *Environmental Peacemaking* (Washington, DC: Woodrow Wilson Center Press, 2002).
[7] IPCC, "Summary for Policymakers," in *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Cambridge University Press, 2022), 9.
[8] Ibid, p.9.

migration, and conflicts linked to scarcity, poverty, and extreme weather events.[9] Two years later, the UN General Assembly also acknowledged climate change impacts on security, emphasizing the importance of the Framework Convention on Climate Change. The focus was much more on the human security aspects of climate change than on the military (i.e., conflict) dimension.[10]

In the US security circles, too, some security dimensions of climate change became more apparent in the mid-2000s.[11] In 2007, the CNA Corporation (an American non-profit research and analysis organization) published a national security report warning of the multi-dimensional impacts of climate change.[12] The report was produced by a US military advisory group that consisted of more than a dozen retired three and four-star generals and admirals. The group was led by former Deputy Under Secretary of Defense, Sherri Goodman. These senior military officials were concerned about climate change impacts on the US security – specifically, the worsening of existing security risks as environmental conditions deteriorate. In other words, to them, climate change was a "threat multiplier."

The idea of climate change as a threat multiplier is now well established. Recently, in a return to the environmental security debates of the 1990s, climate change has been linked to concerns over the conflict potential of resource scarcity and environmental degradation in general. These concerns, too, have their critics,[13] and some analysts direct attention back to the issues of democracy and effective governance. For example, there is an interrelationship between climate mitigation and corruption. Corruption can lead to distortions in mitigation strategies, response, and recovery spending as resources (including

[9] United Nations Security Council, "Letter dated 5 April 2007 from the Permanent Representative of the United Kingdom of Great Britain and Northern Ireland to the United Nations addressed to the President of the Security Council, 5 April S/2007/186. Available at https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/CC%20S2007%20186.pdf

[10] General Assembly, "Climate Change and its Possible Security Implications Report of the Secretary General," General Assembly 64/350, 11 September. Available at https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/sg%20report%202009.pdf

[11] See Chad Briggs and Miriam Matejova, *Disaster Security: Using Intelligence and Military Planning for Energy and Environmental Risks* (Cambridge University Press, 2019).

[12] The CNA Corporation, *National Security and the Threat of Climate Change* (Alexandria, VA: The CAN Corporation, 2007).

[13] See Jan Selby, Omar S. Dahi, Christiane Frohlich, and Mike Hulme. "Climate Change and the Syrian Civil War Revisited," *Political Geography* 60 (2017): 232–244.

foreign aid) are siphoned off for personal gain.[14] Socio-political impacts of climate change, including also migration and greater refugee movements, tend to be indirect or induced. Other, more direct security concerns include increasingly unhabitable land due to droughts or inundation, disasters, and diseases.

2.2.1 Direct security impacts of climate change

The direct impacts of climate change differ across the globe. Coastal and low-lying island states are most at risk from the rising sea levels, and their citizens are becoming environmental refugees, having to leave their countries. Landlocked states in temperate zones may see the impacts of climate change as a more remote threat and with that, the urgency to act now is also smaller. Regardless, some direct impacts have been felt globally to a larger or smaller extent.[15]

More frequent and intense **droughts** is one consequence of global warming with implications mainly for food and water security. Droughts and reduced rainfall decrease crop yields and land productivity, and especially in parts of the world that already suffer from food shortages (i.e., tropical and warm climates). Some of these parts are also affected by desertification – irreversible degradation of land in the desert zones of Africa, Asia, North America, Australia, and South America. Security impacts include food scarcity (due to land degradation) and water shortages leading to malnutrition and use of polluted water sources, decline in biodiversity (with food security impacts as hunting becomes more difficult), and more exposure to natural hazards like landslides and dust storms. Degraded soil also contributes to deforestation and thus removal of carbon sinks, worsening climate change.

Draughts create favourable conditions for **wildfires**. An increased incidence of wildfires is a consequence of rising temperatures, which in turn increase the likelihood of fires in drier forested areas. Security impacts of wildfires include harm to human lives, health (e.g., poor air quality), property, and environment that people rely on. More frequent and more severe fires are increasingly occurring in previously more temperate environments. For example, the 2022 wildfires in Slovenia were linked to a

[14] For example, Jim Anderson, "To tackle Climate Change, Take on Corruption," World Bank Blogs, 22 November 2021, https://blogs.worldbank.org/climatechange/tackle-climate-change-take-corruption
[15] For an in-depth discussion of such impacts, see Peter Hough, *Environmental Security, 2nd ed.* (Routledge: 2021).

persistent draught and heatwaves that set temperature records across Europe.[16] Climate change also increases the length of the fire weather season.[17]

Other direct security impacts of climate change are linked to **flooding**, both coastal and inland. Sea level rise poses security problems for coastal communities – not simply due to the rising water but also because of the subsequent soil erosion, and deterioration in soil and freshwater quality due to saltwater intrusion. Climate change also changes and disrupts the natural water cycle. As the glaciers melt, rivers may flood more frequently and more intensely in inland regions. Collapsing buildings and trees jeopardize human life and property. Flooded areas are also prone to water-borne diseases, with impacts on human health.

Extreme events linked to changes in temperature and atmospheric pressure include cyclones, tornadoes, sandstorms, and extreme temperatures (cold snaps and heatwaves). **Cyclones** (hurricanes in North America or typhoons in East Asia) lead to coastal flooding as well as wind damage and loss of human lives. Climate change increases the frequency and intensity of windstorms, some of which will start affecting regions that were previously sheltered. For example, the 2020 Storm Ciara brought widespread damage to Western Europe and then moved inland, causing fatalities as far as Slovenia.[18] Similar unexpected impacts may be linked to tsunamis. While **tsunamis** (i.e., giant sea waves) are generally a consequence of seismic activity, in the future some tsunamis may be caused by climate change in areas where glacier melt causes massive landslides into the sea.[19] Impacts would include rapid coastal flooding and associated loss of human life and property damage.

Tornadoes originate inland rather than on the sea, and their security impacts include damage from high winds and property damage and human life loss due to moving of large objects and explosions. The 2021

[16] Marko Korosec, "Karst Region on Fire – The Largest, Historic Wildfire on Record in Slovenia Spreads Fast under the New Extreme Heat Dome Heatwave Event over Europe," *Extreme Weather Europe*, 24 July 2022, https://www.severe-weather.eu/global-weather/heatwave-heat-dome-slovenia-historic-wildfire-karst-summer-july-2022-mk/

[17] University of East Anglia, "Climate Change Increases the Risk of Wildfires Confirms New Review," *Science-Daily*, 14 January 2020, https://www.sciencedaily.com/releases/2020/01/200114074046.htm

[18] Maïthé Chini, "Storm Ciara: 8 People Died in Europe," *The Brussels Times*, 11 February 2020, https://www.brusselstimes.com/94457/storm-ciara-8-people-died-in-europe-czech-republic-germany-poland-sweden-slovenia-great-britain-air-traffic-public-transport-sint-niklaas

[19] Chad M. Briggs, Miriam Matejova, and Robert Weiss, "Disaster Intelligence: Developing Strategic Warning for National Security," *Intelligence & National Security* 37, no. 7 (2022): 985–1002.

tornado that ran through several villages in the South Moravia region of Czechia was one of the deadliest extreme weather events in Europe that year.[20]

Cold snaps harm human health through exposure (e.g., hypothermia) but also cause deaths due to hazardous conditions created by snow and ice (e.g., building collapse, infrastructure made unsafe). **Heatwaves** are problematic especially for the youngest and oldest members of human societies who are more vulnerable (children are less able to regulate their body temperatures and seniors often have pre-existing health conditions). The two deadliest heatwaves on record occurred in 2003 in Europe and 2010 in Russia – together they claimed about 50,000 lives.[21] The 2022 heatwave also affected European energy security as the Norwegian hydropower reservoirs dwindled and the French struggled to cool their nuclear reactors due to warmed rivers. The low level of Europe's largest rivers hindered transportation, including transport of coal.[22]

Lastly, climate change has direct impacts on human health due to **diseases** that spread from tropical regions to northern, traditionally more temperate zones as those begin to warm up. Insects like mosquitos that are disease vectors are able to breed in these newly warmer climates. For example, the West Nile virus has been reaching norther and norther zones in the USA since the late 1990s.[23]

Climate change does not affect all countries equally and within states some groups have been and will be hit harder than others. Aside from low-lying territories (threatened by the sea level rise) and the Arctic (threatened by the melting sea ice), those most affected are the young, the old, and the poor. Younger and older people suffer more health problems from heatwaves or from diseases. Poor people are more exposed to extreme weather due to the often inadequate and underdeveloped locations in which they live. These people are also most affected by scarcity and thus tend to suffer from food and water

[20] Marko Korosec, "The most powerful tornado on record hit the Czech Republic, leaving several fatalities and 200+ injured across the Hodonin district," Severe Weather Europe, 25 June 2021, https://www.severe-weather.eu/weather-report/europe-severe-weather-tornado-hodonin-czech-republic-mk/
[21] ABC News, "Russian heatwave killed 11,000 people," *ABC News*, 17 September 2010, http://www.abc.net.au/news/2010-09-18/russian-heatwave-killed-11000-people/2265184; see also UNEP report on the 2003 heatwave available at https://www.unisdr.org/files/1145_ewheatwave.en.pdf
[22] Jason Horowitz, "Europe's scorching summer puts unexpected strain on energy supply," *The New York Times*, 18 August 2022, https://www.nytimes.com/2022/08/18/world/europe/drought-heat-energy.html
[23] James J. Sejvar, "West Nile Virus: An Historical Overview," *The Ochsner Journal* 5, no. 3 (2003): 6–10.

insecurity. Many are forced to leave their homes, feeding into migration waves with potential new security impacts in countries that may be far away from climate hot zones.

2.2.2 Indirect security impacts of climate change

Many of the above-noted direct effects of climate change cascade throughout societies and create or exacerbate other problems. Migration has been perhaps the most frequently cited indirect impact of climate change. Desertification, for example, is an important driver of migration waves (e.g., Mexicans and Haitians migrating to the USA).[24] Migrants tend to settle in crowded locations, which contributes to urbanization and the growth of slums. This creates health hazards for these communities but also exacerbates more traditional security problems, including social tensions. Water scarcity in particular has been linked to migration and further opportunistic crime, ethnic tensions, and terrorism.[25] A growing frustration with governments that are unwilling or unable to address impacts of climate change may feed into the growth of extremist ideologies and mobilization of extremist movements.[26]

Food insecurity, too, may lead to social tensions especially when economic and political institutions fail to manage the distribution of scarce resources and disruptions to the food supply occur at a larger scale. Global food markets are shaped by the global demand and supply for food. Extreme weather changes or events may significantly disrupt and limit the global food supply, which then influences food prices. The result of food insecurity would be an almost inevitable aggravation of existing grievances, with potential social unrest. As referenced earlier, this would affect poorer states much more than wealthier ones as poorer states lack the resources to seek alternative food sources, may have contractual obligations to supply domestic agricultural products to the international market, and lack robust and capable institutions and organizations to manage the situation.

[24] See Hugh, *Environmental Security*.
[25] John Sullivan and Keeley Townsend, "Climate Migration: Adding Fuel to the Ethnocentric Fire," *Terrorism and Political Violence* 34, no. 5 (2022): 914–925.
[26] Graham Macklin, "The Extreme Right, Climate Change and Terrorism," *Terrorism and Political Violence* 34, no. 5 (2022): 979–996.

Climate change will also affect supply chains for a variety of goods and services in addition to food. Critical primary resources such as metals and minerals are often located in the areas affected by environmental degradation and climate change, including flooding and desertification. Reduced access to such resources may make climate mitigation efforts more difficult as rare earth minerals (like cobalt) are necessary for the latest generation of batteries.

2.3 Military and the environment

The environment has been part of regular warfare for centuries. As military technologies and weapons advanced, environmental degradation as a consequence of warfare worsened. Frequently, the environment has been used as a weapon in war. Examples include burning vegetation, chemical defoliation (such as during the war in Vietnam), degradation of soil (for example, with salt), and tampering with fresh water supplies. The scorched earth tactic, which destroys crops and livestock, has been used by armies since at least the Roman times. There is also indirect environmental damage from warfare – this is mostly a side effect of the use of weapons, targeting industrial infrastructure, battlefield destruction of land, or through pollution caused by military equipment.

At peacetime the global defence community has been much criticized for environmental pollution and damage. Among militaries' biggest sins towards the environment are nuclear weapons testing (caused for example landslides along with radioactive pollution), mass military exercises (caused excessive sewage, waste, general pollution), military base proliferation, as well as a large contribution to global greenhouse gas emissions.[27] World's militaries have been however also increasingly affected by environmental degradation and especially climate change.

While the public and the media tend to focus on the conflict potential of climate change, for armed forces there are also other concerns that are both operational and strategic. Operationally, military adaptation to climate change is crucial since much of the current equipment (e.g., sonars, helicopters) does not function properly in warmer climates. Military bases around the world are vulnerable to the sea level

[27] Angelika Claußen, "War is a climate killer," IPS, 1 August 2022, https://www.ips-journal.eu/topics/economy-and-ecology/war-is-a-climate-killer-6094/

rise and desertification. Climate change will also open new theaters (e.g., in the extreme cold of the Arctic) and will make existing conditions in warmer climates even more challenging. In the end, climate change will degrade the operational capabilities of the world's militaries, all while increasing the demand for their use. There is thus a need for long-term planning in investment that incorporates climate considerations and a methodology for assessing the vulnerability of military bases, personnel, and operations.[28]

In terms of strategic risks for armed forces, the key missions of the armies are changing with the growing requests for post-disaster humanitarian assistance and emergency relief. Many national armies are lacking sufficient equipment and training for such missions. One short-term solution is more cooperation with the civil society, including organizations like the Red Cross.[29] Another strategic risk is the potential internal destabilization of countries due to effects of climate change, with cascading regional impacts. For example, regions that depend heavily on agriculture but suffer from environmental degradation are more susceptible to both internal and external migration, with potential clashes between the local groups and the newcomers. Potential tensions around land and food supply cannot be overlooked as these also provide opportunities for extremist recruitment and growth of extremist ideologies as the legitimacy of many states weakens. A remedy may be addressing the cause rather than mere symptoms of instability[30] – for example, addressing the root causes of land degradation and incorporating such objectives into defence and security doctrines, including those of the NATO member states.

[28] This was identified by participants of the public workshop organized by the Institute for Central Europe on November 25, 2022.
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3. NATO and Climate Security

NATO recognizes climate change as a key challenge of the current era; it sees climate change as "one of the defining challenges of our times" and as "a threat multiplier that impacts Allied security."[31] The security implications of climate change are evident both within the territories of NATO member states (e.g., the Arctic) and in the Alliance's neighborhood like the Sahel, Middle East, and North Africa. Both climate adaptation and mitigation efforts have been proposed or are underway since the fulfillment of NATO's core tasks and missions depends in part on the Alliance's responses to climate change.

Environmental security is not a new topic for NATO. At least in terms of science and technology, the Alliance has paid attention to environmental security issues since the 1960s. In mid-2000s the language of energy and environmental security began appearing in various summit declarations, most recently at the 2021 Brussels Summit and 2022 Madrid Summit.[32] Climate security is a priority even among other challenges for NATO such as the ongoing war in Ukraine.[33] Climate security also features on the NATO 2030 agenda[34] where NATO leaders expressed the ambition for the Alliance to become the leading international organization on climate security. Expressed commitments include reduction of GHG emissions from military activities and facilities as well as plans to increase awareness and data sharing. An important goal is to adapt to changing conditions like the rising sea levels and extreme environmental events, including extreme heat and cold.[35] According to a high-level NATO representative, it is imperative for NATO to work with academia, industry, member states, and other partners.[36]

[31] See NATO Climate Change and Security Action Plan at https://www.nato.int/cps/en/natohq/official_texts_185174.htm

[32] See https://www.nato-pa.int/document/2022-climate-change-mitigation-and-adaptation-role-technology-report-clement-024-stc#:~:text=NATO%20Heads%20of%20State%20and,tasks%20(NATO%2C%202022a)

[33] For an overview of NATO's recent activities in climate security, see Katarina Kertysova, "Towards a Greener Alliance: NATO's Energy Efficiency and Mitigation Efforts." In *Decarbonized Defence. The Need for Clean Military Power in the Age of Climate Change*, produced by IMCCS Expert Group (2022), https://imccs.org/wp-content/uploads/2022/06/Decarbonized-Defense-World-Climate-and-Security-Report-2022-Vol.-I.pdf

[34] Summary available at https://www.nato.int/nato_static_fl2014/assets/pdf/2021/6/pdf/2106-factsheet-nato2030-en.pdf

[35] For a detailed discussion of the challenges that climate change poses for NATO, see the Secretary General's report: NATO, *Climate Change and Security Impact Assessment* (2022), https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf

[36] Based on discussions during a public workshop organized by the Institute for Central Europe on November 25, 2022.

Translating the ambition to action, NATO has produced the 2021 NATO Climate Change and Security Action Plan to increase awareness, adapt, contribute to mitigation, and enhance outreach with partner countries and organizations.[37] For example, within the awareness 'pillar' NATO's Climate Change and Security Impact Assessment[38] examines impacts on assets, installations, missions, and operations. Within the adaptation pillar, NATO plans to tackle green procurement as well as training and exercises within the context of climate change. Important here is capability development and investment in science and technology. Within the mitigation pillar NATO aims at GHG emission reduction by the NATO enterprise (i.e., NATO managed and owned assets and installations) – by at least 45% by 2030.[39]

NATO is currently weaker in its existing implementation of climate adaption and mitigation measures, particularly in procurement terms. Of course, there are technological challenges to decarbonization of national militaries and even to measuring of the militaries' emissions.[40] Military vehicles, for example, have strict operational requirements (e.g., harsh conditions, rapid situational changes) and energy security requirements that are difficult to meet by technologies developed for the civilian use.[41] The Alliance also seems to be unable to agree on green technology standardization and emission reduction targets.[42] This is likely due to the reticence of some member states to consider this issue at the NATO level. While the Alliance cannot issue legally binding regulations, setting standards has been a powerful tool to guide common procurement practices across NATO.

[37] Available at https://www.nato.int/cps/en/natohq/official_texts_185174.htm. For a summary of best practices see a NATO factsheet available at https://www.nato.int/nato_static_fl2014/assets/pdf/2022/7/ pdf/0664-22_Climate_Change_Compendium_-_V3.pdf

[38] Available at https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf

[39] Sabine Siebold, "NATO aims to cut emissions by 45% by 2030, be carbon neutral by 2050," *Reuters*, 28 June 2022, https://www.reuters.com/world/europe/nato-cut-emissions-by-45-by-2030-be-carbon-neutral-by-2050-stoltenberg-2022-06-28/

[40] Pierre Laboué, "Military Emissions: Measuring is Knowing," in *Decarbonized Defence. The Need for Clean Military Power in the Age of Climate Change,* produced by IMCCS Expert Group (2022), https://imccs.org/wp-content/uploads/2022/06/Decarbonized-Defense-World-Climate-and-Security-Report-2022-Vol.-I.pdf

[41] Pierre Laboué, "Technological Innovation: Where the Hard Part Begins," in *Decarbonized Defence. The Need for Clean Military Power in the Age of Climate Change,* produced by IMCCS Expert Group (2022), https://imccs.org/wp-content/uploads/2022/06/Decarbonized-Defense-World-Climate-and-Security-Report-2022-Vol.-I.pdf

[42] David Keating, "Nato disappoints with tepid climate action," *Energy Monitor*, 18 July 2022, https://www.energymonitor.ai/policy/nato-disappoints-with-tepid-climate-action/

NATO has both the capacity and the will to take on a leadership role in climate security; it is one of the crucial response organizations to climate-related disasters and regional destabilization due to climate change impacts. This is something that the Alliance has recognized for some time in its public statements, and increasingly in its planning. To varying degrees, militaries across the Alliance are prepared to engage in humanitarian rescue and disaster relief. Sufficient and suitable equipment is however crucial. For example, there are different operating requirements of helicopters in warmer climates, which creates a need for engine improvements. Similar changes are needed with respect to operations in marine environments (since engines overheat faster in warmer ocean). Operational considerations are therefore at the centre of NATO's climate security concerns.

NATO is no stranger to operating in extreme environments. The twenty-year operation in Afghanistan gave most members substantial experience operating in hot, freezing, muddy, and especially dusty environments. Alliance members observed the toll this took on soldiers and equipment as soldiers frequently suffered heatstroke and took time to become acclimatized, reducing freshly deployed troops effectiveness.[43] Meanwhile, the lifespans of sophisticated and high-expense equipment like helicopters and armored vehicles were reduced as dust, heat, poor roads, and generally adverse conditions degraded their engines and subsystems.[44] With climate change predicated to change weather patterns and worsen desertification, flooding, forest fires, and generally alter operational conditions for militaries, NATO must be prepared to operate in environments more challenging and hazardous than Afghanistan. The subsequent degradation of equipment and personnel will increase military operation costs, decrease the lifespan/increase the maintenance needs of military equipment, and exhaust the soldiers.

Sustaining a growing number of deployments in increasingly adverse conditions will also tax member states' logistics capabilities to their limits. Good logistics are the lifeblood of any military deployment. This includes the provision of food, fuel, water, and general supplies for the military. The impact of climate change on logistics would manifest in several ways. First, logistics demands for certain operations will likely increase as water scarcity becomes common. This will increase financial costs,

[43] MSMR, "Update: Heat Illness, Active Component, U.S. Armed Forces, 2020," *MSMR* 28, no. 4 (2021): 10–15.
[44] Rene Heise, "NATO is responding to new challenges posed by climate change," *NATO Review,* 1 April 2021, https://www.nato.int/docu/review/articles/2021/04/01/nato-is-responding-to-new-challenges-posed-by-climate-change/index.html

operational environmental impact, emissions, and vulnerability of deployed forces as logistics routes are notoriously frequent targets (for example in Ukraine and Afghanistan, the latter of which required the bribing of Taliban fighters to curtail).[45]

Second, logistics will likely be challenged by the variety of progressively harsh operating environments. These impacts will again be somewhat similar to those experienced in Afghanistan (or in the Arctic) by NATO forces. The difference would be in the increased number of operations and the diversity of environments in which NATO may be operating simultaneously. Not only will this increase logistics demands, but it will also consume large quantities of logistics vehicles, necessitating the production of new vehicles and spare parts with associated emissions and environmental impacts.

From interviews, official documents, and the public workshop organized by the Institute for Central Europe, it is evident that NATO officials understand the future challenges of climate change; they believe that sharing with Allies methodologies and data for assessing vulnerability would encourage NATO members to pay equal attention to climate security issues. NATO's strengths in climate security are leading by example, setting standards, advising, and providing a forum for discussing best practices.[46] For the immediate future, the investment in early warning systems and assessment of the changing risks is crucial. It is also imperative for NATO to work with academia, industry, member states, and other partners, and to keep investing in both the military and climate to ensure regional and global security. As a NATO member, Slovakia can benefit by being an active participant in climate security discussions both at home and within the Alliance.

[45] Nick Schifrin, "Report: U.S. bribes to protect convoys are funding Taliban insurgents," *ABC News,* 22 June 2010, https://abcnews.go.com/WN/Afghanistan/united-states-military-funding-taliban-afghanistan/story?id=10980527

[46] For a discussion of NATO's "value-added" to climate security (including standardization and a platform for best practices), see Sherri Goodman and Katarina Kertysova, "NATO: An Unexpected Driver of Climate Action?" NATO Review, 1 February 2022, https://www.nato.int/docu/review/articles/ 2022/02/01/nato-an-unexpected-driver-of-climate-action/index.html

4. Climate Security in Slovakia

4.1 Security impacts of climate change

Slovakia is a landlocked country with a temperate climate. Due to its location in the mid-latitudes, Slovakia has thus far seen comparatively mild manifestations of climate change. Perhaps the most obvious general impacts are an increased frequency of extreme environmental events and specifically floods and droughts. As a result of climate change, the annual flooding in Slovakia has varied across regions, with mountain areas affected by floods the most.[47] Droughts affect both drinking water sources and agricultural productivity. Furthermore, more frequent and longer heatwaves threaten the health of the Slovak population, especially the aging groups. The summer of 2022 was the hottest on record in Slovakia and prolonged droughts are expected for the future.[48]

Droughts also have energy security implications for Slovakia. Even though the country makes relatively little use of hydroelectric power, its nuclear power facilities at Jaslovske Bohunice and Mochovce require significant volumes of water for cooling. The heatwave of summer 2022 led to many nuclear reactors across Europe facing challenging operational conditions as water levels in rivers dropped to their lowest points in decades.[49] As Slovakia is increasingly betting on nuclear power for its future energy needs and as economic opportunity (a new reactor opened at the end of 2022 in Mochovce), future prolonged droughts jeopardize economic, energy, and water security.

In Slovakia, some of the most pressing impacts of climate change are indirect and include issues of food security and migration. Prolonged droughts or more intense flooding has serious security implications linked to food security, the rising prices of food stuffs and potential social unrest (as well as socio-

[47] Gunter Bloschl et al., "Changing Climate Both Increases and Decreases European River Floods," *Nature* 573 (2019): 108–111.
[48] Otakar Horak, "Toto leto na Slovensku bolo najteplejsie od pociatku merani. Klimatolog: Perspektiva do buducnosti nie je dobra." *DennikN*, 13 September 2022, https://dennikn.sk/3008106/toto-leto-na-slovensku-bolo-najteplejsie-od-pociatku-merani-klimatolog-perspektiva-do-buducnosti-nie-je-dobra/
[49] Lars Paulsson and Todd Gillespie, "European heatwave risks curbing French nuclear power production," Bloomberg, 12 July 2022, https://www.bloomberg.com/news/articles/2022-07-12/french-nuclear-output-seen-curtailed-as-river-temperatures-rise

economic issues like unemployment). According to the 2022 Global Food Security Index, Slovakia is vulnerable to climate change-induced food insecurity, largely due to insufficient protection of fresh water sources and exposure to both droughts and floods.[50] The country trails behind most of the EU members in its overall food security score but performs worst in food availability, and sustainability and adaptation. The latter category is important with respect to climate change, since it reflects how well a country can respond to climate risks and disasters.

In terms of migration, while historically Slovakia has not been a target destination for migrants, the number of migrants settling in the country is slowly rising. Reasons behind legal migration to Slovakia are predominantly socio-economic and include family, work, and study.[51] Many migrants, however, transit through Slovakia as they travel to Western destinations. Migrants have different reasons for leaving their home countries. While the most frequent driver behind migration waves is violent conflict at home, many people are also increasingly moving for economic and environmental reasons.[52]

For Central European states, migration is a controversial political topic. Often underappreciated by non-Central and Eastern European (CEE) states is that the impacts of migration differ for CEE states due to their high ethnic homogeneity. Challenging such ethnic homogeneity would create political and social challenges that may be exploited by extremist movements to undermine political stability. Climate change could create a situation where Slovakia faces a choice of trying to integrate large numbers of climate refugees into a small and cohesive society or fortifying its borders. In light of these possible dilemmas for the region, Slovakia may be required to engage in increased foreign deployments with NATO as part of European-demanded initiatives to stabilize its periphery and reduce illegal migration into the European Union.

[50] The index is available at https://impact.economist.com/sustainability/project/food-security-index/
[51] Data available from the International Organization for Migration, at https://www.iom.sk/en/migration/migration-in-slovakia.html#:~:text=Today%20the%20foreigners%20make%20up,means%20an%20increase%20of%2011.7%25
[52] John Podesta, "The climate crisis, migration, and refugees," Brookings, 25 July 2019, https://www.brookings.edu/research/the-climate-crisis-migration-and-refugees/

4.1.1 Climate change impacts on armed forces

As a member of NATO, Slovakia will likely have to manage, in partnership with its Allies, climate security crises beyond its borders. Climate change will most dramatically affect areas that already face numerous other security challenges such as Africa and the Middle East. Climate security-related interventions across North Africa are perhaps only a matter of time as European states become increasingly concerned about mass migration originating in the region. Such inter ventions might take several forms, from an increased number of small- or large-scale peacekeeping/stability operations, like those attempted by France in North Africa, to disaster relief operations for both allies and partner states alike, and interventions designed to re-establish order in rapidly failing states such as those being considered for Haiti. Beyond peacekeeping and conflict intervention, there are likely to be a variety of humanitarian crises caused by extreme weather events worldwide that might necessitate Slovak soldiers deployed in a humanitarian role with NATO, the United Nations, or other international coalitions.

Similar challenges are likely to arise closer to home. Slovakia's new Blackhawk helicopters had their international deployment debut not in combat but in disaster response. During the height of the 2022 Czech forest fires, Slovakia lent the support of helicopters for firefighting.[53] In the future, military equipment is likely to be much more needed (to be modified) for disaster response than military intervention – in the Slovak domestic context, for emergency relief during floods, for example. For most states, militaries are the only organizations that have the manpower and equipment to adequately respond to large-scale disasters both nationally and internationally. As much as NGOs and other civil organizations have some role in disaster response, national militaries have control over the largest number of physically fit young men, helicopters, logistics equipment, and long-term supplies.

Slovakia's security is also affected by climate impacts on its critical Allies, many of whom are more immediately threatened by climate change due to the location of military bases in coastal areas. For example, the USA's inventory of 5th generation air superiority aircraft, the F-22 Raptor, were put at

[53] RTVS, "Slovakia sending firefighters and helicopter to help fight Czech fire," *RTVS*, 27 July 2022, https://enrsi.rtvs.sk/articles/news/298708/slovakia-sending-firefighters-and-helicopter-to-help-fight-czech-fire

substantial risk by Hurricane Michael in 2018.[54] The total number of aircraft in at risk locations during this weather event was larger than Slovakia's entire aircraft inventory. Climate change may thus weaken critical partner militaries and leave Slovakia more vulnerable as crucial NATO forces could be decreased or drawn down by disaster relief commitments at home. This may necessitate Slovakia to invest in a larger military, expending a greater share of GDP on its security to maintain territorial integrity, assert sovereignty, and deter aggression. The 2022 invasion of Ukraine by Russia has now re-emphasized the critical necessity of competent armed forces for deterring aggression and resisting land grabs by neighbours that do not respect the international order and the UN Charter. Slovakia must thus plan for an increasingly uncertain future with existential threats simultaneously posed by hostile neighbours and an increasingly hostile climate.

Climate change will distort the current threat profile and predicted threat horizon for Slovakia and its partners. How the threat profile will change is somewhat difficult to predict, beyond a general understanding that new theaters of operation, extreme weather hazards, and environmental conditions will emerge. This level of uncertainty will likely make some security and miliary planning obsolete and necessitate a more general and flexible approach to security than is currently used in Slovakia and within NATO. This could allow NATO members to be more prepared for a variety of climate change-induced and non-climate change hazards such as pandemics.[55] Already the value of such an approach would have been demonstrated, had it been adopted earlier, in the managing of the COVID-19 pandemic.

4.2 Current preparedness

The Slovak government has produced a series of policy documents and guidelines to both tackle environmental degradation (and thus ensure environmental protection) and increase its preparedness for climate change impacts. At the national level, Slovakia has conformed to the EU requirements, developing strategies and documents to set goals and set up regular reporting. These include, for

[54] Ankit Panda, "Nearly 10 percent of the US F-22 inventory was damaged or destroyed in Hurricane Michael," *The Diplomat*, 15 October 2018, https://thediplomat.com/2018/10/nearly-10-percent-of-the-us-f-22-inventory-was-damaged-or-destroyed-in-hurricane-michael/

[55] See Miriam Matejova and Chad Briggs, "Embracing the Darkness: Methods for Tackling Uncertainty and Complexity in Environmental Disaster Risks," *Global Environmental Politics* 21, no. 1 (2021): 76–88; Briggs et al., "Disaster Intelligence."

example, the National Energy and Climate Plan,[56] Envirostrategy 2030, [57] and the Strategy of the Environmental Policy of the Slovak Republic until 2030,[58] among others. Climate change is also explicitly discussed in key Slovak security strategic documents, including the Security Strategy of the Slovak Republic.[59]

The Ministry of Defence (MOD) in particular has several climate-related initiatives and produced strategic documents and action plans as well as best practices. MOD is aware that climate change is a security – and not simply ecological – problem. In 2020, for example, the Ministry adopted a strategic document that envisions a cleaner and more ecological defence department. Among other things, the Ministry aims to initiate interdepartmental discussions to contribute to reductions of ecological impact that the departmental activities have on the environment – this includes both the Ministry and the Slovak Armed Forces.[60] Target areas include energy consumption, energy efficiency, and green procurement, among other things. Interviews conducted by the Institute for Central Europe revealed that MOD representatives also actively participate in working groups, conferences, and seminars at the EU and NATO level to discuss climate security issues.

Most activities aimed at climate mitigation or adaptation are at the civilian part of the Ministry. There are efforts to engage relevant stakeholders in dialogue on green defence, including the impacts of climate change on defence and vice versa. There are also other objectives, including greener working environment, ecological defence, and green procurement (e.g., energy saving computers, low emission vehicles, low energy buildings). MOD seeks inspiration from other countries such as the USA and Scandinavian states. The Department designs and works with various toolboxes such as a toolbox for green defence[61] that puts emphasis on mobility (e.g., electric, hybrid vehicles), logistics (e.g., 3-D printing, supply by drones), and infrastructure (e.g., low-energy buildings, local energy production,

[56] Available at https://www.climate-laws.org/geographies/slovakia/policies/slovakia-s-integrated-national-energy-and-climate-plan-for-2021-to-2030
[57] Available at https://www.minzp.sk/iep/strategicke-materialy/envirostrategia-2030.html
[58] Available at https://www.minzp.sk/files/iep/greener_slovakia-strategy_of_the_environmental_policy_of_the_slovak_republic_until_2030.pdf
[59] Available at https://www.mzv.sk/documents/30297/4638226/security-strategy-of-the-slovak-republic.pdf
[60] This is based on the discussions with participants in the public workshop organized by the Institute for Central Europe on November 25, 2022.
[61] Available at https://www.mosr.sk/data/files/4857_2022-b-06-zasobnik-opatreni-pre-zelenu-obranu.pdf

virtual training). MOD also supports several research & development projects related to green technologies.

MOD's action plan on green mobility envisions a reduction in GHG emissions produced by the civilian motor vehicle fleet by 55% by 2030 compared to 2021.[62] There is currently no legislative requirement to reduce GHG emissions from the military vehicles and a more significant application of green initiatives on the Slovak Armed Forces is lacking. Reasons include lack of awareness of the problem or of suitable solutions;[63] although, the Ministry plans to work on addressing these issues through the use of various toolkits and awareness programs. A key issue for the near future is the readiness of the armed forces to face the risks of climate change, both from an operational and strategic perspective.[64]

4.3 Challenges and opportunities

In the international context, climate change may yield some circumstances that, if properly managed through international cooperation (e.g., NATO), might yield opportunities for Slovakia. New Arctic shipping routes, for example, may allow Slovak goods to reach destinations in Asia more swiftly, with a corresponding flow of goods and resources in the opposite direction. However, such opportunities will also create new security challenges, including possibly Slovak military commitments in the Arctic as part of NATO missions.

In the domestic context, according to interviewed experts, among the Slovak government agencies cooperation on climate security issues is much needed and can at times be challenging. Concurrently, effective communication with the public is also a challenge – what is needed is awareness raising, active communication, and active listening both within the Slovak public service, and between government agencies and the public. There is also lack of modelling for the Slovak context specifically and no

[62] This is based on the discussions with participants in the public workshop organized by the Institute for Central Europe on November 25, 2022.
[63] Based on interviews conducted by the Institute for Central Europe in the fall of 2022.
[64] Based on the discussions with participants in the public workshop organized by the Institute for Central Europe on November 25, 2022.

conceptual framework that would account for specific climate security and defence challenges for Slovakia.

Public-private cooperation in facing the challenges of climate security presents itself as an important prospect. There are opportunities for some Slovak companies to contribute to energy security – for example, through exploring geothermal energy possibilities like advanced plasma-based technology by a Slovak start-up.[65]

One of the fundamental issues for climate security will be the greening of national militaries. The key general challenges of green transition are operational uncertainty and financing. Within the NATO context, green transition, however, is only feasible once the new technologies are sufficiently tested, standardized, and approved by other NATO member states to ensure interoperability as well as combat and logistical capabilities. This requires long-term planning, investment, and active discussions within the Alliance. Green defence technologies are costly, and their modification and adaptation to the needs and requirements of the armed forces increases the total investment costs even more (including the maintenance costs). With respect to the Slovak army, and CEE militaries generally, investments in green technology are a tertiary concern behind more immediately relevant funding requirements that can increase military performance such as new armored vehicles, air defence systems, and combat aircraft. Abandoning, delaying, or even modifying acquisitions to release funds for green investment is likely perceived as an unreasonable prospect for the Slovak Armed Forces, and possibly the Slovak populace at the time that a neighboring state is enduring an invasion.

Another challenge will be identifying viable green technologies with military applications. To avoid accusations of greenwashing (i.e., advocating for technologies of dubious viability and application for either emission reduction or defense) it is crucial to include in discussions experienced defence, scientific, and engineering experts. For example, there are ongoing discussions about the efficiency and applicability of some alternative fuel sources. Biofuels and synthetic fuels, however, are inefficient to produce (the latter due to high energy demands). Biofuels in particular are problematic as their production requires a lot of arable land and water, which potentially creates further environmental crises.

[65] A brief discussion available at https://www.euractiv.com/section/energy/opinion/slovakian-ga-drilling-has-been-awarded-the-solar-impulse-efficient-solution-label/

Biofuel production also increases deforestation and displaces production of other commodities (like food) to a new converted land. However, some types of biofuel, like switchgrass ethanol, have shown a promising potential for significantly lowering GHG emissions in transportation.[66] Relevant expert opinions on this topic are therefore crucial to inform any future policies on adoption of biofuels in military greening.

In fact, general discussions on military greening would benefit from inputs from engineers and other relevant experts. Decades of research and refinement have made hydrocarbon-powered engines generally safe for military purposes. However, there is no such guarantee with alternate fuels and electric engines. Both civil and defense companies are keen to demonstrate the viability of their alternatively powered vehicles and aircraft. However, few ask if there would be an increase in vulnerability or a decrease in performance as a result.

While there has been effort to highlight prototypes that are hybrid or electrically powered, many militaries – including Slovakia's – continue to rely on fossil fuel-powered alternatives and have chosen them over hybrid powered alternatives in recent procurement projects. An example is Slovakia's likely upcoming acquisition of the 4x4 Joint Light Tactical Vehicle (JLTV), which is not the hybrid or electrical version. In choosing this version of the vehicle, Slovakia would be following the example of all other JLTV operators, including the USA, none of whom have expressed interest in the hybrid or electrical engine version.[67] Overcoming this challenge will require development of 'green' defense equipment of performance that is superior to fossil fuel-powered alternatives. For the JLTV specifically, the manufacturer is attempting to now highlight operational advantages of the design, stating that the electrical engine version is silent, thus being suitable for more covert usage.[68] However, until green defence equipment can prove itself superior to fossil fuel powered alternatives, it will likely remain confined to an exhibition of novelties.

[66] Wei-Ru Chang et al. "Environmental Impact and Sustainability Study on Biofuels for Transportation Applications," *Renewable and Sustainable Energy Reviews* 67 (2017): 277–288.
[67] Andrew Eversden, "Oshkosh Defense announces first hybrid electric JLTV," *Breaking Defense*, 25 January 2022, https://breakingdefense.com/2022/01/oshkosh-defense-announces-first-hybrid-electric-jltv/
[68] Eversden, "Oshkosh Defence."

Fortunately, there is some synthesis between green technology trends and military technology that may offer a path to greening of NATO militaries, including Slovakia's. Perhaps the most important of these is an increasing demand in military vehicles for large on-board electrical generation or storage capacity to operate increasingly sophisticated suites of sensors, software, and processing power. Likely future trends like the deployment of direct energy weapons, electromagnetically powered weapons, and edge computing will only increase this demand. To maximize efficiency and so increase the operational capability, militaries will likely become convinced of the merits of electrically powered vehicles.

4.4 The greening of the defence industry

While Slovakia may have thus far experienced limited greening of its Armed Forces, the domestic defence industry presents a more optimistic picture. Both private and public Slovak defence companies have engaged with green technologies and, where available, take advantage of incentives designed to increase efficiency and decrease energy consumption. Motivations are mixed, but undeniably increased energy costs serve as incentive to cost-cutting and increasing production efficiency as much as possible.

Interviews with representatives of the Slovak defence industry have revealed that across Slovak private and public defence producers, old energy-inefficient equipment is being replaced, energy saving measures are being put in place, and on-site energy generation is being utilized to reduce costs. This is hardly surprising given that energy costs for production for some Slovak defence companies have risen ten times between 2021 and 2022, while heating bills increased by over five times.[69] The interviewed Slovak defence industry representatives believe that this is an unsustainable trend, with one interviewee noting that companies will either be forced to go green or go bankrupt.

Subsidies and various incentives are mostly offered by the European Union, and not by NATO or the Slovak government. These EU incentives appear to be successful. One senior public defence company representative has noted that EU funding had allowed for the installation of photovoltaic panels that are now supplying 100% of the electricity used in company offices and 20% of the electricity utilized at their production site.

[69] Based on interviews with Slovak defence industry representatives in fall 2022.

The increasing concerns over climate change and emissions from the side of potential international customers and suppliers have also driven some Slovak defence companies to pursue a policy that puts a greater emphasis on emission reduction and mitigation strategies. This has reportedly extended to deep supply chain analysis of carbon emissions of suppliers and a desire to work with companies whose values similarly align. Representatives from industries that have engaged in these practices stated that they believe that shaping company values to put greater emphasis on climate change helped align the company with the values of the youngest generation of its employees. This is to help with retention of young talent, increase buy-in from new employees, and foster a more inclusive working environment.

While Slovak defence companies are taking the initiative to reduce energy consumption, leading private sector defence industry representatives believe that the government must offer incentives or risk that production moves from Slovakia (and Europe in general) to other parts of the world where labour and production costs are cheaper, and environmental and emission standards are weaker. It is thus in Slovakia's interest from an economic and climate security perspective to offer financial and practical incentives for the adoption of cost-saving, green technologies for Slovak defence companies (and likely Slovak industry in general).

5. Conclusion and Recommendations

Scholars and experts invited to participate in the interviews and public workshop organized by the Institute for Central Europe within this NATO-funded project have raised concerns about preparedness and future needs in climate security of Central Europe. Among the main regional security concerns are the weaponization of narratives that use migration and nationalism, and the general ability of adversaries to strategically use climate change to undermine democratic institutions. For Central Europe, climate change is not a distant phenomenon; it will affect energy security and infrastructure, among many other things. This concluding chapter outlines some general recommendations that have come out of this project, and then focuses attention on the specific recommendations pertaining to armed forces and defense industry.

5.1 General conclusions and recommendations

Climate change is not a single variable – it is not simply about rising temperatures but affects all environmental systems with impacts cascading through these systems in at times unpredictable ways. In the future, disaster response, for example, may thus become far more complicated, expensive, and generally difficult to implement. Due to the complexity of climate change impacts, including cascading effects and compound disasters, it is imperative that *adaptation and resilience building depart from doing things solely as they were done in the past.* In other words, *there is a need for strategic foresight* tailored to states' (and the region's) specific needs.

As discussed by experts participating in this project, potential solutions to the challenges of climate security in both Central Europe and Slovakia include a *private-public cooperation* and *a better communication of the costs of climate change, both human and financial*. It is also crucial to *increase state capability to respond to major disasters and its ability to house (and provide services to) migrants*. Since national lens may be unfeasible in the Central European context with sharp divergences in energy and other policies, *focusing on common context, common frameworks, and common ways of looking at the problem and solutions* may be more productive. Both for NATO and its members, it is crucial to *invest in new technologies*, allocate some defence *spending to research & development*, provide *political*

incentives to large defence companies, and *bring start-ups into climate security discussions*. Other, more specific recommendations, pertain to the greening of armed forces, as discussed below.

5.2 Recommendations pertaining to armed forces and defence industry

Climate change will dramatically affect military logistics. It is likely that not only will military logistic demands increase, but they will also change. To maintain and even increase the levels of logistics efficiency, *Slovakia should consider these potential changes in military logistics in current and future procurement projects.* This is especially true for any vehicle purchases which, even if presently ordered with engines designed for hydrocarbons, should be capable of being upgraded with new electrically powered engines. This is important within the context of NATO and Slovakia's partners. At some point, the USA will likely transition to operating vehicles with electric or alternatively powered engines. Having a vehicle fleet capable of similar upgrades would simplify the logistics of Slovak operations with US forces and increase the potential capabilities of the USA on Slovak territory, due to established logistic chains for electricity/alternative fuels. This recommendation however recognizes that it is impractical, cost-prohibitive, and perhaps overly idealistic to advocate for Slovakia to transition to an alternatively/electrically powered vehicle fleet until critical NATO partners do. Slovakia almost certainly cannot afford to conduct a military green transition alone in financial or technological terms.

Yet, in Slovakia, rethinking and redefining the procurement process and the lifecycle of military equipment would likely yield immediate tangible results on emission production and lifecycle carbon production for military hardware. Presently, NATO militaries generally do not emphasize recycling and reuse of equipment; instead, they focus on disposal. For example, the UK uses the CADMID cycle, which is a typical equipment lifecycle model for a NATO military.[70] CADMID stands for concept, assessment, demonstration, manufacture, in service, and disposal; it describes the lifecycle of a given piece of military hardware. This model has been effective at determining equipment lifecycles in the

[70] Some information on CADMID is available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/422475/Section4v22final.pdf

UK, but it does not account for greener alternatives to disposal. Disposal includes many options like re-selling (as surplus) and scrapping. Putting further emphasis on re-using, recycling, and refurbishing could avoid emissions from producing new pieces of equipment. For example, rather than scrapped, equipment could be refurbished and updated, and subsequently reused or sold. This would also increase procurement efficiency as some production costs would be offset. For Slovakia, refurbishment is practically relevant as the country seeks to replace Czechoslovak legacy equipment with modern NATO standard pieces. Old equipment may be recycled for materials or sold to third party states. Slovak industries are already adept at updating and overhauling legacy hardware, so this concept offers financial incentives, too. Thus, *rethinking the equipment lifecycle model not only offers emission reduction potential but also synergizes with cost-saving and Slovak defence export plans*.

As noted in section 4.4 of this report, Slovakia needs to pay more attention to military green procurement. *Keeping Slovak defence industries operational should be a government priority* from a variety of standpoints. From a climate security perspective, it is better to protect and support local industries that are increasingly leading the way in efficient and low-emission production. Such local industries do not necessitate imports of equipment from outside Slovakia to meet defence equipment needs. Additionally, Slovak defence industries allow Slovakia to operate a larger military with reduced maintenance costs and increased repair capabilities. This is imperative from a security and emission reduction standpoint since increasing the lifespan of military equipment is one of the key mitigation strategies to reduce militaries' carbon emissions.

With the exception of the European Union, there is currently lack of *effective signaling of greening intent* from either the Slovak government or NATO *on the subject of green defence procurement*. Effective signaling can have a major impact. For example, earlier in 2022 the UK government mandated Procurement Policy Note 06/21 (PPN 06/21),[71] which is a requirement for any company looking to engage with UK tenders to have a carbon emission reduction plan, with a clear outline of how it might achieve a net zero emissions in the next ten years. Therefore, the UK government not only demanded that potential business partners meet certain standards, but also signaled that it takes emission reductions seriously and will continue to do so in the future. With PPN 06/21 disqualifying suppliers that do not

[71] Available at https://www.gov.uk/government/publications/procurement-policy-note-0621-taking-account-of-carbon-reduction-plans-in-the-procurement-of-major-government-contracts

have emission reduction plans, there is a clear short-term incentive for industrial greening, as well as the long-term implication that climate change-related policies will likely go further. This has reportedly pushed firms wishing to do business with the UK to proactively engage in green initiatives that go beyond PPN 06/21 as they anticipated future UK government demands and expect that they will receive a competitive edge by having greener credentials than competitors.[72] Setting similar standards and requirements in Slovakia may generate similar positive effects. Furthermore, Slovakia would be *contributing to making carbon emission reduction plans an international best practice for government procurement*. A trickle-down effect may also be observable in driving innovation in Slovak defence industries for green technologies, as there would be a clear signal of potential profits for businesses that do so.

While, as discussed earlier, NATO has developed environmental and emission-related best practices, its standards related to procurement and logistics to advance climate security have been lagging behind. Fuel, ammunition, and many other defence assets are standardized across NATO due to member-directed standardization. For example, 5.56x45mm ammunition is the standard intermediate rifle caliber ammunition, because NATO members agreed upon it in 1980.[73] For the most part these standards contribute substantially to guiding members to pursue suitable procurement strategies as NATO effectiveness is greatly improved by the resulting interoperability. From a defence industry perspective, NATO standards also present very strong signaling that specific technologies will be in high demand. This is because NATO militaries are a primary customer for most European and North American defence companies. NATO standards also typically become international standards as the world's militaries seek the highest quality equipment and align their procurement with likely defence partners. *Standardization on green technologies in defence would likely yield positive results in a relatively short timeframe*.

At the same time, NATO standards need to be accompanied by some degree of subsidization as standards alone are not always capable of facilitating a rapid change in militaries, including those of NATO members. For example, despite being a member of NATO since 2004, Slovakia has yet to adopt (though it is in the process of doing so) a main service rifle chambered in a NATO standard cartridge and has only just signed documentation on the supply of new armored fighting vehicles that meet NATO

[72] Discussion available at https://rusi.org/podcasts/greening-defence/episode-2-sustainable-defence
[73] STANAG 4172, available at https://nso.nato.int/nso/home/main/home

standards.[74] Generally, lack of funding is the driving force behind slow modernization, and interviews with experts revealed that this is also the case in Slovakia. NATO should therefore work towards *subsidization or incentives for green standardization* if it is serious about its members' militaries transitioning into being greener.

Alternatively, if NATO subsidization is, for whatever reasons, unfeasible, *partnerships with members or institutions capable of offering subsidies for green military technology* may be a viable alternative. This would help make any potential standardization more effective and ensure quicker transition, especially for Central and Eastern European members with lower military budgets and a more urgent need to retire Warsaw pact legacy military equipment.

Militaries across NATO and the world must recognize that their roles in defending their home states and allies will increasingly become multifaceted, combining elements of traditional miliary operations, anti-insurgency warfare, peacekeeping, and disaster relief. Recognizing this now will allow the military institutions to begin new best practices, training, and acknowledge their changing role. Such changes are necessary not only at a practical level but also at a cultural one. If militaries can recognize their changing roles and identities, then equipment and plans can be adapted much faster. This may manifest in several ways, such as an increased interest in procuring a larger helicopter fleet, a greater number of engineering vehicles, and redesigned training facilities capable of being used to simulate disaster relief as well as military operations. Broadly speaking, Slovak and NATO militaries will need to become adept at a generalized approach to threat management.

Within the context of climate security, Slovakia will likely substantially benefit from being a NATO member due to the guaranteed response it will receive from capable partners if it suffers from severe climate change impacts. However, resilience building for the upcoming crises is crucial. Slovakia should be prepared for a highly insecure future, one not only shaped by overt great power competition, but also by acute and chronic crises that are in some way created, shaped, or aggravated by climate change.

[74] Ola Thorén, "Slovakia signs $1.37 billion deal for 152 CV90s under government-to-government agreement," BAE Systems, 12 December 2022, https://www.baesystems.com/en/article/slovakia-signs-deal-for-152-cv90s-under-government-to-government-agreement

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Institute for Central Europe (ICE) is a nonpartisan think tank based in Bratislava, Slovakia. We are committed to examining, promoting, and addressing issues that we feel require greater attention both nationally and internationally. We carry out this mission to support Slovakia and its partners in Europe, NATO, and other international organizations. ICE's dedicated and diverse international team includes former politicians, ministers, academics, and a variety of subject matter experts.