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Preparing NATO for climate-related security challenges

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Summary

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- Ukraine is inevitably NATO's critical focus – and will likely remain so for some time to come – but it is imperative that the war and consequent concerns over traditional security threats do not distract member states from addressing climate-related security challenges. The idea that focusing on climate security means drawing resources away from other security challenges is a false dichotomy. These policy areas are directly connected. For example, increased energy and food prices, as a result of the war in Ukraine, may fuel instability for NATO allies and partner countries. Instead, by future-proofing NATO infrastructure, equipment and operations through alternative energy resources, sustainable approaches to procurement and adopting climate change considerations in all its activities, NATO can help strengthen resilience, adapt to climate change and increase allied interoperability.
 - Climate change and extreme weather events will jeopardize capabilities across all of NATO's domains, as well as its personnel and infrastructure. Desertification and thawing permafrost will create new technical and geopolitical challenges. Climate impacts due to flooding and sea-level rise will potentially make NATO equipment and infrastructure inoperable, affecting NATO's defence posture. To meet these challenges, NATO must adapt by strengthening its political and institutional structures, its mechanisms for anticipating climate risks and its operational resilience. There would be significant negative ramifications for NATO's ability to defend and deter if the organization and allies were not to undertake climate change mitigation and adaptation action in the short term.
 - Building political consensus among NATO allies on this critical agenda is a crucial step in enabling the alliance to take mitigation and adaptation measures. The 2023 NATO Summit and the forthcoming annual Climate Change and Security Impact Assessment are important opportunities to reflect on current climate security policies and their efficacy. At the same time, NATO must carefully consider where it can play the most effective role in tackling climate security issues. It could do this by enhancing its work with partners, such as the European Commission, the UN and civil society organizations, which may be better placed to respond in specific policy areas or contexts, such as tackling climate-related migration.

- NATO has an obligation to address its own carbon footprint and work with allies to reduce and report on their military emissions. This would help the organization build legitimacy in the climate space among populations of allied countries and those most directly affected by climate change. NATO has set a target of cutting civilian and military emissions of its facilities and assets by 45 per cent by 2030 and to become carbon neutral by 2050. Decoupling military infrastructure and equipment from carbon-intensive and single fuel sources could ensure that NATO and its allies continue to move in this direction and incentivize investment and innovation in near-zero and zero-carbon solutions.
- For NATO and its allies, early investment in climate change adaptation can make a critical contribution to long-term resilience, reduce the fiscal impacts of climate-related events and increase military effectiveness. A failure to invest will only raise long-term operational costs, further impacting national budgets at a time when member states are still dealing with the effects of the COVID-19 pandemic and inflationary pressures. As the Defence Investment Pledge, which includes the 2 per cent of GDP guideline for military spending, is renegotiated ahead of its expiry in 2024, NATO could encourage including a climate adaptation and resilience target as a proportion of the future pledge.

01

Introduction

The 2023 NATO Summit presents a key opportunity for NATO to demonstrate the importance of climate change as a security priority and to lead the way in future-proofing allies against climate-driven shocks.

Climate change will impact the security of populations by altering access to resources, damaging livelihoods, increasing migration, weakening the ability of states to provide public services, and potentially triggering political instability.¹ As a cross-border threat, climate change is impressing upon international organizations their responsibility to anticipate risk, manage crises and coordinate the actions of others to strengthen awareness and resilience. The North Atlantic Treaty Organization (NATO) has also recognized the need to strengthen its abilities to cope with climate-driven shocks.

NATO is an alliance predicated on safeguarding its member states from security challenges that threaten a single ally or the alliance as a whole. Formed as a purely defensive organization in 1949, it was labelled ‘brain dead’ by French president Emmanuel Macron in 2019 due to a lack of strategic leadership from the US and poor coordination with Europe vis-à-vis the most pressing challenges facing the alliance.² Yet Russia’s invasion of Ukraine in 2022 has brought collective defence back to the fore and reignited the relevance of the alliance – even Sweden and Finland have abandoned a long history of neutrality to apply to join NATO. With new realities such as the rise of emerging and disruptive technologies, economic security issues and, critically, climate change presenting further security challenges, NATO’s ability to prepare for and respond to multiple threats is integral to its renewed sense of purpose. Ukraine is inevitably NATO’s main focus, but it is imperative that the war and consequent concerns over traditional security threats do not distract member states from efforts to address climate-related instability. In fact, climate change will significantly impact all facets of allied security – from the stability of communities and societies globally to the efficacy of military power.

¹ Lippert, T. H. (2019), *NATO, Climate Change, and International Security: A Risk Governance Approach*, Springer.

² Erlanger, S. (2019), ‘Macron Says NATO Is Experiencing ‘Brain Death’ Because of Trump’, *New York Times*, 7 November 2019, <https://www.nytimes.com/2019/11/07/world/europe/macron-nato-brain-death.html>.

NATO has shown that it wants to play a larger role in improving the resilience of its member states and that responding to the growing threats posed by climate change is fundamental to its three core tasks: collective defence, crisis management and cooperative security. It has taken significant steps to plan for and respond to climate-related events – most recently through the prioritization of climate change in the 2022 Strategic Concept, and the launch of the Climate Change and Security Action Plan at the 2021 NATO Summit. In addition, Canada created a new NATO-affiliated Climate Change and Security Centre of Excellence. These actions highlight the institutional momentum NATO has generated to tackle climate change for the benefit of global security and operational efficiency.³ Developing a clear plan for the integration and implementation of climate resilient approaches throughout all facets of the alliance is the next step.

NATO possesses distinct capabilities that could enable it to play a significant role in future-proofing its members' armed forces against growing climate impacts.

The 2023 NATO Summit will be an important milestone for NATO to demonstrate *how* it is preparing the alliance to operate within this changing security landscape. As this paper will illustrate, NATO possesses distinct capabilities that could enable it to play a significant role in future-proofing its members' armed forces against growing climate impacts. In this paper, 'future-proofing' and 'climate-proofing' mean reducing and mitigating the potential impact of climate change to the extent possible. NATO can show member states and the wider defence community that it is possible to balance between competing security threats and see climate change as a priority for international security and military effectiveness. It can lead the way in committing greater attention, funding and integration to climate concerns. This collaborative and forward-looking posture will be key to maintaining NATO's relevance and legitimacy as an organization committed to protecting the security of its members.

About this paper

The purpose of this paper is to provide practical guidance to NATO HQ⁴ and member states for implementing both adaptation and mitigation measures to strengthen resilience against climate change, with benefits reaching beyond NATO territory. The second chapter discusses the impact of climate change on the security and operating environment, how NATO will be affected in the immediate-, medium- and long-term, and the positioning of NATO's response

³ Government of Canada (2022), 'NATO Climate Change and Security Centre of Excellence', https://www.international.gc.ca/world-monde/international_relations-relations_internationales/nato-otan/centre-excellence.aspx?lang=eng.

⁴ In this paper, references to 'NATO' mean the whole organization, i.e. NATO HQ and the allies, whereas references to 'NATO HQ' refer to people or divisions within HQ.

as seen through the 2022 Strategic Concept. The third chapter outlines in detail three priority areas – institutional and political structures, measuring and monitoring systems, and operational resilience – in which NATO can begin to implement measures. The fourth chapter considers the political challenges that NATO must overcome and the partnerships it can utilize to maintain stability and cohesion and to ultimately deliver on its core tasks. The final chapter summarizes recommendations to NATO HQ and member states.

This analysis is drawn from 13 semi-structured interviews and a further 12 consultations with mid- and senior-level experts working in and on NATO across think-tanks, academia, non-governmental organizations, the defence industry and government, which took place between June and December 2022. Key findings and recommendations were tested in a hybrid expert workshop in October 2022.

02 NATO's response to climate-security risks

Climate change will threaten NATO's military effectiveness and its ability to preserve Euro-Atlantic stability. NATO should integrate climate considerations into its defence and deterrence posture or risk increasing operational costs and security threats.

The impacts of climate change are at once rapid and slow, widespread and isolated. They can weaken the resilience and abilities of states to respond to climate-related threats and trigger longer term instability and insecurity.⁵ Over the past 60 years, at least 40 per cent of internal armed conflicts were related to natural resources, and the most devastating armed conflicts between 1950 and 2000 occurred in biodiversity hotspots.⁶ According to the Notre Dame Global Adaptation (ND-GAIN) Country Index, 12 of the 20 countries most vulnerable to climate change are also sites of armed conflict.⁷

As an alliance charged with ensuring the security of its members, NATO must look beyond immediate challenges and consider how to prepare for a context in which climate impacts are becoming more frequent and severe. This chapter

⁵ Lamensch, M. and Moran, A. (2021), 'Reconceptualizing Risks and Security', in Kingham, R. (2021), *Sustainable Peace & Security in a Changing Climate: Recommendations for NATO 2030*, Environment & Development Resource Centre, https://link.springer.com/chapter/10.1007/978-3-540-75977-5_75.

⁶ International Committee of Red Cross (2020), 'Guidelines on the protection of the natural environment in armed conflict', ICRC Guidelines, <https://www.icrc.org/en/publication/4382-guidelines-protection-natural-environment-armed-conflict>.

⁷ Notre Dame Global Adaptation Initiative (undated), 'Country Index', University of Notre Dame, <https://gain.nd.edu/our-work/country-index> (accessed 21 Jun. 2023).

highlights how climate change will impact NATO's military effectiveness and its ability to deliver on its strategic and operational objectives to preserve Euro-Atlantic stability.

Climate change will affect all aspects of NATO's future operating environment

Climate change is both a 'threat multiplier' and the 'shaping threat' directly affecting NATO's military capabilities.⁸ Record high temperatures, drought, wildfires, flooding and more intense hurricane and tropical cyclone seasons will reduce or degrade the capacities of NATO personnel, equipment, weaponry, tactics and infrastructure – these risks are already being seen within NATO countries themselves and are not only limited to extreme environments. Climate hazards can also divert resources and attention and could leave the alliance more vulnerable to other threats, including conventional military attacks. NATO must therefore climate-proof itself to meet its core objectives of defence and deterrence.

NATO's operational capabilities and the health of its military personnel are at risk from climate change. On the current emissions trajectory, by 2030 more than 400 million people globally are likely to suffer temperatures surpassing the workability threshold each year.⁹ Member states are already seeing higher temperatures affect military operations: during a military exercise in Poland in 2019, temperatures exceeded 40°C inside armoured weapons carriers, preventing soldiers from being able to operate them for more than a few hours.¹⁰ Working in changing environmental conditions can also impact physical and mental health: in 2018, the US military suffered 2,792 cases of heat stroke or heat exhaustion among its service members, and figures have remained consistently high since 2012.¹¹ Higher temperatures can also lead to the transmission of infectious diseases while increased rainfall can expose personnel to waterborne diseases. Not only could this intensify the strain on personnel, but it could also increase the need for medical assistance, protective equipment or vaccinations.¹²

Climate change is also testing the resilience of military installations and infrastructure. The US Department of Defense (DoD) has revealed that two-thirds of US military bases, including Hampton Roads in Virginia, which holds strategic importance for NATO, are especially vulnerable to rising sea levels and extreme

⁸ Goodman, S. (2021), 'The Pentagon has to include climate risk in all of its plans and budgets', *Defence News*, 26 October 2021, <https://www.defensenews.com/opinion/commentary/2021/10/26/the-pentagon-has-to-include-climate-risk-in-all-of-its-plans-and-budgets>.

⁹ Quiggin, D., De Meyer, K., Hubble-Rose, L. and Froggatt, A. (2021), *Climate change risk assessment 2021*, Briefing Paper, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/2021/09/climate-change-risk-assessment-2021>; going beyond the workability threshold is when the monthly mean of daily maximum wet-bulb globe temperatures exceed 34°C.

¹⁰ Porter, V. and Vaklinova, G. (2021), 'Climate Change and Security: Emerging Challenges and the Role of NATO', in Milanov, P. (2021), *2021 CMDR COE Proceedings*, https://cmdrcoe.org/fls/pubs/2021_Proceedings-15-02-22.pdf.

¹¹ van Schaik, L. et al. (2020), *Ready for take-off? Military responses to climate change*, Clingendael, https://www.clingendael.org/sites/default/files/2020-03/Report_Military_Responses_to_Climate_Change_March_2020.pdf.

¹² Cox, L. M. et al. (2022), *Countering Terrorism on Tomorrow's Battlefield: Critical Infrastructure Security and Resiliency*, NATO COE-DAT Handbook 2, <https://press.armywarcollege.edu/monographs/957>.

weather events.¹³ Major ports in Rotterdam, Antwerp and Hamburg, which are hubs for NATO's eastern flank, are also under threat.¹⁴ In Alaska, melting permafrost is leaving military facilities at risk of collapse.¹⁵ More recently, in July 2022, an unprecedented heatwave across the UK melted a runway at a Royal Air Force base and caused wildfires that disrupted military drills.¹⁶

Military hardware, in particular air and naval equipment, is weather-sensitive and must be made more resilient to climate stress. Higher frequency of strong winds, storms and increased salinity in the ocean can impact the performance of ship turbines and submarine operations.¹⁷ Humidity and cloud cover can affect intelligence gathering, satellite monitoring and surveillance, radio communications and strategic reconnaissance.¹⁸ In Afghanistan, dust storms and enduring high temperatures necessitated more frequent maintenance of helicopters and restricted the ability to move essential supplies.¹⁹ Even grounded equipment remains vulnerable to climate change: extreme heat can affect the storage of ammunition as was seen in 2011, when self-detonating munitions caused huge explosions at a Greek-Cypriot naval base and led to several casualties.²⁰ NATO's ability to defend and deter will weaken unless it adapts to these climatic conditions.

Member states are already experiencing the consequences of climate change on military capabilities and readiness, and it is clear that their operations will become more expensive, more time-intensive and more technically challenging unless they adapt. The US DoD's most recent budget shows this concern in its request for \$3.1 billion in climate-related investment, including funds to make equipment and infrastructure more resilient to extreme weather.²¹

For NATO HQ and member states, early investment in climate change adaptation will likely make a significant contribution to long-term resilience, reduce the fiscal impacts of climate-related events and increase military effectiveness. Economic inaction will only increase operational costs in the long term, impacting national budgets at a time when member states are still dealing with the effects of the COVID-19 pandemic and inflationary pressures. Importantly, the ability to sustain the political will for NATO funding – the 2 per cent of GDP guideline for military spending – post war in Ukraine may also become more difficult. Without proper preparation for future crises, NATO could suffer intangible losses, such as strained political cohesion between member states or the loss of public support.

¹³ Shea, J. (2022), 'NATO and Climate Change: Better Late Than Never', German Marshall Fund, <https://www.gmfus.org/news/nato-and-climate-change-better-late-never>.

¹⁴ Sikorsky, E. and Goodman, S. (2021), *A climate security plan for NATO: Collective defence for the 21st century*, Policy Exchange, <https://www.preventionweb.net/news/climate-security-plan-nato-collective-defence-21st-century>.

¹⁵ Klare, M. (2020), 'A military perspective on climate change could bridge the gap between believers and doubters', *The Conversation*, 18 February 2020, <https://theconversation.com/a-military-perspective-on-climate-change-could-bridge-the-gap-between-believers-and-doubters-128609>.

¹⁶ Sikorsky, E. (2022), 'The World's Militaries Aren't Ready for Climate Change', *Foreign Policy*, 22 September 2022, <https://foreignpolicy.com/2022/09/22/militaries-climate-change-security-threats-strategy-floods-fires>.

¹⁷ Shea (2022), 'NATO and Climate Change: Better Late Than Never'.

¹⁸ Cox et al. (2022), *Countering Terrorism on Tomorrow's Battlefield: Critical Infrastructure Security and Resiliency*.

¹⁹ Ibid.

²⁰ van Schaik et al. (2020), *Ready for take-off? Military responses to climate change*.

²¹ Sikorsky (2022), 'The World's Militaries Aren't Ready for Climate Change'.

Cascading and geopolitical impacts of climate change

Less obvious and more complicated is how the cascading and compounding impacts of climate change are shaping the future of geopolitics, making the possibility of social instability, state collapse and armed violence more likely in the near term, and creating intersecting challenges for NATO's security and defence posture. In addition to possible societal unrest due to the cascading impacts of climate change, actual warfighting and hand-to-hand combat are going to look different in a climate change-affected world. The types of equipment used, the way operations are planned and conducted, and when and where forces are deployed will be radically different in extreme climates.

The ripple effects of the Russian invasion of Ukraine and the COVID-19 pandemic demonstrate the interlinkages between conflict, environmental degradation and societal instability.

Climate change and extreme weather can disrupt critical ecosystems, resources, infrastructure and services, and cause water and food scarcity, health issues and severe loss of livelihoods.²² In societies with fragile institutions, these impacts can fuel inequality, trigger political instability and violence, and lead to displacement and migration.²³ NATO may not be able to predict a given disruption, but it must understand that such disruptions will become more likely and it should consider the types of disruptive situations that could emerge. In an interconnected world, the erosion of state stability and security in a distant region can have cascading impacts on wealth and power in the Euro-Atlantic sphere. NATO's ability to understand and respond to such compound risks requires a strategic focus on resilience-building to withstand or absorb shocks and to recover rapidly.²⁴ A resilient alliance will be crucial to managing multiple security threats that can increase over time as the level of disruption continues.

The ripple effects of the Russian invasion of Ukraine and the COVID-19 pandemic demonstrate the interlinkages between conflict, environmental degradation and societal instability, and how these can lead to greater security risks for NATO and have far-reaching implications on food and energy security.²⁵ Both events have compounded food and energy crises, hitting the most vulnerable countries hardest,

²² Remmits, F. and Rademaker, M. (2021), 'Acting Collectively: Why Climate Change Calls for Innovative Military Contributions and Collaboration', *Atlantisch Perspectief*, 45(5), pp. 37–42, <https://www.jstor.org/stable/48638268>.

²³ *Ibid.*

²⁴ See more on what resilience-building means in relation to different kinds of shocks (environment, economic, etc.) in Benton, T., Morisetti, N. and Brown, O. (forthcoming), 'Cascading and systemic risks from environmental change', in Meral, Z., Clack, T. and Selisny, L. (eds) (forthcoming), *Hot War: Climate Change & (In)Security*, London: Routledge Advances in Defence Studies.

²⁵ UK Parliament (2022), 'NATO's Climate Security Agenda', 24 June 2022, <https://committees.parliament.uk/writtenevidence/109556/pdf>.

including Egypt, Bangladesh, Iran, Lebanon, Tunisia, Yemen, Libya and Pakistan.²⁶ Many of these countries rely on lean supply chains and some may only have a few days' worth of food within their own borders. This high level of food and energy insecurity has the potential to generate widespread social revolts, migration, humanitarian crises and extremist activity in these regions.²⁷ Pakistan, for example, was still reeling from the pandemic when it was hit with devastating floods in 2022 and now faces a severe energy and economic crisis.²⁸ These countries will likely seek help from NATO member states, China or other actors, and the kind of support NATO member states decide to provide could become a political issue.²⁹

Russia's grip on European gas supplies came into stark view with the invasion of Ukraine. The fact that 30 per cent of the EU's gas was imported from Russia highlighted the importance of NATO seeking alternative and reliable sources of energy to uphold its collective defence priorities. This scenario presents NATO with greater incentives for the energy transition and the promotion of more renewable sources of energy across its armed forces. Yet the alliance must remain mindful of the economic risks a global transition might have for fossil fuel exporting countries, particularly those with fragile state authorities, and the potential for financial challenges and social instability.³⁰

At the same time, NATO must consider the resilience, diversification and sustainability of critical mineral supply chains to enable military innovation. The demand for critical minerals to build more sustainable equipment and infrastructure in the defence sector could lead to strategic challenges and competition over access to areas where these resources originate.³¹ China controls 60 per cent of lithium and 80 per cent of cobalt supply globally, minerals that are key for military functions including electric-powered tactical vehicles, autonomous systems and battery storage. Further down the value chain, China is refining rare earth elements at a rate five times greater than the global capacity to mine them, showing China's hold on critical minerals.³² The US Geological Survey's list of minerals vital to national security has grown from 35 in 2018 to 50 in 2020.³³ Many of these minerals – such as neodymium and samarium, which are used in magnets that can withstand high temperatures – are crucial to the military's ability to operate in extreme climate environments.³⁴ To respond to this, NATO should encourage member state collaboration across mining, production and supply-chain sectors to ensure that no further dependencies are created, and to prevent retaliatory responses or competition over resources.

²⁶ Benton, T. et al. (2022), *The Ukraine war and threats to food and energy security*, Research Paper, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/2022/04/ukraine-war-and-threats-food-and-energy-security>.

²⁷ Sikorsky (2022), 'The World's Militaries Aren't Ready for Climate Change'.

²⁸ Ali, M. (2023), 'Militarized Adaptation', *Phenomenal World*, 25 January 2023, <https://www.phenomenalworld.org/analysis/militarized-adaptation>.

²⁹ Gilli, A. et al. (2022), *Strategic Shifts and NATO's new Strategic Concept*, NATO Defense College, https://www.research-collection.ethz.ch/bitstream/handle/20.500.11850/560631/NDC_RP_24.pdf?sequence=1.

³⁰ Cox et al. (2022), *Countering Terrorism on Tomorrow's Battlefield: Critical Infrastructure Security and Resiliency*.

³¹ Ibid.

³² Dasilva, J. (2021), *Securing the Critical Mineral Supply Chain is Vital to the Future of the U.S Military*, American Security Project, <https://www.americansecurityproject.org/securing-the-critical-mineral-supply-chain-is-vital-to-the-future-of-the-us-military>.

³³ Bazilian, D., Holland, E. and Busby, J. (2023), 'America's Military Depends on Minerals That China Controls', *Foreign Policy*, 16 March 2023, <https://foreignpolicy.com/2023/03/16/us-military-china-minerals-supply-chain>.

³⁴ Dasilva (2021), *Securing the Critical Mineral Supply Chain is Vital to the Future of the U.S Military*.

Box 1. The Arctic as an emerging region of geostrategic competition

Melting ice in the Arctic has opened new sea routes for shipping and made new resources accessible, attracting the interest of several global powers and leading to increased military and commercial activity. The region holds rich mineral and energy resources, which has led to questions over who 'owns' the Arctic. The Northern Sea Route, the shortest sea lane from Europe to Asia, has become increasingly navigable. Russia and China have officially recognized the economic potential of the Arctic: Russia has signalled a bold approach for shipping in its 2035 Arctic Strategy, while China envisions a 'Polar Silk Road' connecting ports from Shanghai to Rotterdam to strengthen its already extensive international transportation network.³⁵ A shift in transit and resource access could enlarge Russian and Chinese influence and heighten current security concerns within the NATO alliance, leading to new geopolitical tensions or conflict.

The changing climate has given Russia and China greater interest in becoming pivotal powers in the Arctic, and NATO has responded by announcing its intention to create an Arctic Command.³⁶ This command structure could build political consensus on Arctic policy, ensure member states work collectively and maintain stability through diplomacy and, if needed, deterrence in the region.³⁷ Russia's invasion of Ukraine demonstrates its willingness to operate outside of international law and could contribute to further militarization of the region. The 'Arctic 7',³⁸ which are all NATO members or applying to be, have consequently suspended their participation in the Arctic Council – a cooperative forum that Russia chaired until May 2023 – impacting efforts to prevent conflict and limiting access to climate data in the Russian Arctic.³⁹ Greater awareness of the trajectory of climate change in the Arctic is key as competing powers seek dominance.

Climate change will test NATO's commitment to the protection of allies and other populations, and necessitate a greater role for militaries in humanitarian aid and disaster relief operations. Governments are facing increased pressure to respond to climate-driven events and often rely on the rapid-response capabilities of the armed forces. In 2022, more than 10 European countries mobilized their forces to combat forest fires, while unprecedented flooding in China, India, Iran, Pakistan, Uganda, the UAE and the US required military support to evacuate flood victims

³⁵ Goodman (2021), 'The Pentagon has to include climate risk in all of its plans and budgets'.

³⁶ NATO (2022), 'NATO is stepping up in the High North to keep our people safe', 24 August 2022, https://www.nato.int/cps/en/natohq/opinions_206894.htm.

³⁷ Mottola, L. (2023), 'NATO's Arctic Command: A Case for the Expansion of NATO's Mission in the High North', The Arctic Institute, <https://www.thearcticinstitute.org/nato-arctic-command-case-expansion-nato-mission-high-north>.

³⁸ Canada, Denmark, Finland, Iceland, Norway, Sweden and the US.

³⁹ Boulègue, M. (2023), 'Exploring military security issues in the Arctic: Insights from the expert community', summary analysis, London: Royal Institute of International Affairs, <https://chathamhouse.soutron.net/Portal/Public/en-GB/DownloadImageFile.ashx?objectId=6665&ownerType=0&ownerId=202842>.

and repair transport and power infrastructure.⁴⁰ Climate disasters have also caused significant internal displacement in the European nations of Bosnia and Herzegovina, Spain, France and Germany, straining governance and, in some cases, requiring the deployment of the armed forces.⁴¹

As past crises have exemplified, NATO's ability and reach in delivering aid to member states and partner countries is an important signal of its reliability and soft power.

As extreme weather events continue to overwhelm the capacities of societies to cope, NATO coordination and assistance – in partnership with the UN Office for the Coordination of Humanitarian Affairs (UN OCHA) and aid organizations – will increasingly be sought and could become more important to maintaining peace and stability in affected countries. Responses could entail providing medical supplies to prevent outbreaks of disease (as seen during the COVID-19 pandemic), border security operations or managing tensions over natural resources.⁴² NATO has recently provided emergency equipment and critical medical care to support search and rescue operations in Türkiye and Syria following a devastating earthquake in February 2023.⁴³ The absence of NATO support (and of a strong state response) could lead to the increased influence of non-state armed groups: the Pakistani Taliban gained significant local support by providing aid in areas affected by flooding in 2010.⁴⁴ As past crises have exemplified, NATO's ability and reach in delivering aid to member states and partner countries is an important signal of its reliability and soft power.⁴⁵

These climate-induced shifts will compel a more strategic approach when operating in new environments and must be factored into NATO's deterrence and defence considerations. Reactive responses to heatwaves and flooding will strain resources and leave NATO less prepared to deal with conventional threats.⁴⁶ Box 2 shows how climate change impacts can become intertwined with security threats that seemingly take place independently of each other.

⁴⁰ Sikorsky (2022), 'The World's Militaries Aren't Ready for Climate Change'.

⁴¹ Sikorsky and Goodman (2021), *A climate security plan for NATO: Collective defence for the 21st century*.

⁴² King, W. (2014), *Climate Change: Implications for Defence*, University of Cambridge Institute for Sustainability Leadership, https://static.s123-cdn-static-d.com/uploads/2385729/normal_5d3c7f594d326.pdf.

⁴³ UK Government (2023), 'UK leading NATO's response to Turkey earthquakes', press release, 17 February 2023, <https://www.gov.uk/government/news/uk-leading-natos-response-to-turkey-earthquakes>.

⁴⁴ Sikorsky (2022), 'The World's Militaries Aren't Ready for Climate Change'.

⁴⁵ De Maio, G. (2020), 'NATO's Response to COVID-19: Lessons for Resilience and Readiness', *Brookings*, https://www.brookings.edu/wp-content/uploads/2020/10/FP_20201028_nato_covid_demaio-1.pdf.

⁴⁶ Ibid.

Box 2. Climate-related migration can destabilize security responses

As Russian forces were building up along the Ukrainian border, Belarussian president Alexander Lukashenko retaliated against sanctions by orchestrating a migrant crisis for neighbouring countries and members of the European Union.⁴⁷ Though he denied any involvement, migrants that arrived in Belarus soon after the invasion were transported to the Polish border and helped by border guards to break through the fence into Poland.⁴⁸ This alarmed Poland, as well as the neighbouring states of Lithuania and Latvia, which called upon NATO to help resolve the issue.⁴⁹ Many of the migrants involved in this scenario were Iraqi Kurds – an ethnic group from a country that has experienced record-breaking heatwaves and droughts,⁵⁰ and is considered the fifth most vulnerable country to climate breakdown.⁵¹ This example demonstrates the linkages between conflict escalation and climate adaptation and how such events can lead to greater security risks that overlap with NATO activities.

Through cascading climate impacts across sectors and geographies, NATO will face an altered security landscape. Whether the role of the alliance in maintaining peace and security remains relevant will depend on changing assumptions about the readiness and sustainability of armed forces, securing supply chains for food, energy and other vital goods, and a shift in the focus of national interests and policies to building resilience to climate change. Underpinning NATO's efforts must be the recognition that climate action does not need to be incompatible with its security and defence priorities, in fact, it can even advance them.

⁴⁷ Rosenberg, S. (2021), 'Belarus's Lukashenko tells BBC: We may have helped migrants into EU', BBC, 19 November 2021, <https://www.bbc.co.uk/news/world-europe-59343815>.

⁴⁸ Hugh, B. and Sikorsky, E. (2022), 'Moving towards security: preparing NATO for climate-related migration', NATO Review, <https://www.nato.int/docu/review/articles/2022/05/19/moving-towards-security-preparing-nato-for-climate-related-migration/index.html>.

⁴⁹ Plucinska, J. and Wlodarczak-semczuk, A. (2021), 'Polish PM calls for 'concrete steps' from NATO amid Belarus border crisis', Reuters, 14 November 2021, <https://www.reuters.com/world/europe/polish-police-say-group-50-migrants-broke-through-belarus-border-2021-11-14>.

⁵⁰ Hugh and Sikorsky (2022), 'Moving towards security: preparing NATO for climate-related migration'.

⁵¹ IOM Iraq (2022), *Migration, Environment, and Climate Change in Iraq*, <https://iraq.un.org/sites/default/files/remote-resources/079bd27fc79b4084e48157653d335c8f.pdf>.

Table 1. Overview of most prominent impacts of climate change on allied security

Time horizon	Climate change effect	Potential impact and vulnerabilities
Immediate: present–5 years	<ul style="list-style-type: none"> • Extreme heat • Permafrost melting • Risk of flooding • Risk of drought 	<ul style="list-style-type: none"> • Technical failure of infrastructure and equipment • Increased supply-chain vulnerabilities • Structural damage to critical infrastructure of military bases and training grounds • Increased demand on utilities to meet harsh operating environments, particularly energy and water • Threats to intelligence surveillance and reconnaissance
Medium-term: 5–20 years	<ul style="list-style-type: none"> • Frequent permafrost melting • Frequent flooding • Extreme heat • Extreme humidity • Sand and dust storms 	<ul style="list-style-type: none"> • Strategic competition and opening of new areas of conflict • Changes in mission profiles, particularly towards humanitarian assistance and disaster relief • Huge impact of storms on infrastructure, logistics, including power and solar • Budget pressures due to increased maintenance and repair regimes • Climate change-related political instability • Forced migration • Threats to intelligence surveillance and reconnaissance • Decreased societal resilience to manage and respond to crises
Long-term: 20+ years	<ul style="list-style-type: none"> • Extreme weather events, such as hurricanes, storms • Extreme heat • Extreme humidity • Frequent drought • Frequent flooding 	<ul style="list-style-type: none"> • Armed fighting in new areas of conflict • Limited societal resilience to manage and respond to crises • Permanently altered operating environment • Occupational health hazards • Fuel dependency leading to price increases and disruptions • Threats to intelligence surveillance and reconnaissance • Targeting of critical national infrastructure, including oil and gas storage facilities • Increase in biohazards • Humanitarian disasters, leading to mass forced migration • Inhabitable conditions in climate-affected regions

Source: Compiled by the authors based on Barry, B., Fetzek, S. and Emmett, C. (2022), *Green Defence: the defence and military implications of climate change for Europe*, Research Paper, London: The International Institute for Strategic Studies, <https://www.iiss.org/blogs/research-paper/2022/02/green-defence>.

2022 Strategic Concept

NATO Secretary-General Jens Stoltenberg incorporated climate change into NATO's 2022 Strategic Concept, which sets out the foremost challenges facing the alliance for the next 10 years.⁵² As a result, climate considerations are positioned within NATO's formal mandate in the strongest language to date. The leadership of the secretary-general has played a significant role in NATO's pioneering posture.

Taking a 360-degree approach to collective defence, NATO sets out an ambition to integrate climate change across its three core tasks of collective defence, crisis management and cooperative security:

NATO should become the leading international organisation when it comes to understanding and adapting to the impact of climate change on security. The Alliance will lead efforts to assess the impact of climate change on defence and security and address those challenges. We will contribute to combatting climate change by reducing greenhouse gas emissions, improving energy efficiency, investing in the transition to clean energy sources and leveraging green technologies, while ensuring military effectiveness and a credible deterrence and defence posture.⁵³

NATO now considers climate change a transnational crisis and both a cause and exacerbating factor of security threats on a tactical, operational and strategic level. Climate-related concerns and goals appear seven times across the Strategic Concept's 49 points. NATO's ambition is clear: it has committed to reduce emissions by 45 per cent by 2030 and become carbon neutral by 2050 – although this target only applies to NATO facilities and assets and not the emissions of member state militaries, which have a far higher carbon footprint.⁵⁴ NATO also released a Climate Change and Security Impact Assessment at the 2022 NATO Summit, which demonstrates an increasing awareness of how climate-related security challenges can have a cascading impact on conflict, fragility and geopolitical competition, and proposes a number of mitigation and adaptation measures for the alliance.⁵⁵

These announcements are important markers of political momentum and unity across NATO. European nations are also stepping up climate action as reflected in the EU's Strategic Compass, released in March 2022. A notable overlap in membership between both NATO and the EU – only Austria, Cyprus, Ireland and Malta are in the EU and not applying to be in NATO – reflects the importance of the EU as a partner and the need for a coordinated approach to climate change (this is expanded upon in Chapter 3).

While NATO's Strategic Concept and Climate Change and Security Impact Assessment are a welcome shift, both lack the certainty and framework of an assessment with a roadmap for delivery. A stronger vision and realistic time frame are needed to take the political will currently prevalent within NATO and translate it into a robust plan for implementation. Not meeting these commitments may lead to a loss in trust and credibility for the alliance.

⁵² NATO (2022), *NATO 2022 Strategic Concept*, 29 June 2022, https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/290622-strategic-concept.pdf.

⁵³ *Ibid.*

⁵⁴ NATO (2022), 'NATO releases its Climate Change and Security Impact Assessment', press release, 28 June 2022, https://www.nato.int/cps/en/natohq/news_197241.htm.

⁵⁵ NATO (2022), *Climate Change & Security Impact Assessment*, https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf.

It is also surprising, given the importance of climate change adaptation in the Strategic Concept, that resilience (strengthening the abilities of the alliance to respond to novel threats) is not made a core task. The Strategic Concept does, however, ‘emphasise the cross-cutting importance of ... integrating climate change ... across all our core tasks’.⁵⁶ NATO has previously acknowledged that the resilience of its member states’ militaries will have to be reconceptualized – going beyond traditional definitions of civilian preparedness and adapting to climate risks to maintain military operability and readiness. At the NATO Summit in 2021, member states made a strengthened commitment to resilience, extending their baseline requirements to include:⁵⁷

- Assured continuity of government and critical government services;
- Resilient energy supplies;
- The ability to deal effectively with the uncontrolled movement of people;
- Resilient food and water resources;
- The ability to deal with mass casualties and disruptive health crises;
- Resilient civil communications systems;
- Resilient transport systems;
- Secure and diverse supply chains;
- Resilient critical infrastructure and key industries; and
- The capacity to deal with the impact of natural hazards that are being exacerbated by climate change.

NATO has put lot of effort into building consensus on climate change and the resulting security impacts across the alliance. The organization must now work to translate this consensus into action.

⁵⁶ NATO (2022), *NATO 2022 Strategic Concept*.

⁵⁷ NATO (2021), *Brussels Summit Communiqué*, 14 June 2021, https://www.nato.int/cps/en/natohq/news_185000.htm.

03

Priorities for NATO

Three implementation areas – political and institutional structures, mechanisms for anticipating climate risk, and operational resilience – are critical for preparing the alliance for climate-related security challenges.

Strengthening political and institutional structures

Maintaining high-level political commitment for climate security

NATO has set clear and ambitious goals for decarbonization and the prioritization of the energy transition through a commitment to reduce its emissions by 45 per cent by 2030, and to become carbon neutral by 2050.⁵⁸ Pursuing this bold strategic vision is commendable. Through enduring commitment, high visibility and strong leadership, NATO has the influence and ability to become an important global actor on climate security, both by reducing its own carbon emissions and by helping to address the serious threats posed by climate change to peace and security.

In a political context of competing priorities, NATO must focus on the increasingly complex near- and long-term challenges of climate change, or risk being caught off-guard. NATO can demonstrate leadership and progress through regular public reporting on its own Climate Change and Security Action Plan, establishing benchmarks, timelines and clear measures for success. The secretary-general can provide detail on how the alliance can adapt its planning and capabilities to climate-security risks at NATO's annual high-level dialogue on climate and security.

⁵⁸ NATO (2022), 'NATO releases its Climate Change and Security Impact Assessment', press release, 28 June 2022, https://www.nato.int/cps/en/natohq/news_197241.htm.

This high-level dialogue can further member state consensus-building, strategic preparation and collaborative policymaking, due to its prevention- and resilience-based approach to climate change. Preserving unity across the alliance will be challenging given the varied effects of climate change on different countries. Climate impacts could create tension between NATO's three core objectives – deterrence and defence, crisis prevention and management, and cooperative security. For example, allies have imposed sanctions on Russia in response to the invasion of Ukraine to prioritize collective defence: these sanctions meet NATO's political and strategic aim of challenging Russian aggression and draining its military and economic capabilities. But from a crisis management and cooperative security angle, sanctions risk increasing energy and food prices and fuelling instability in NATO's periphery and partner countries.⁵⁹

To counter this, consultation, coordination and collaboration among member states and partner countries will become even more important. The secretary-general's office can use the annual dialogue to provide a more robust consultation process to maintain political cohesion. The dialogue can also contribute to a better understanding of, and coherence between, member states' strategies for dealing with climate-security risks.⁶⁰ This dialogue can be an important forum for knowledge-sharing, as well as bringing together siloed military, diplomatic, scientific and private sector stakeholders to build adaptive capacities against climate change.

Importantly, NATO must make a concerted effort to speak with a common voice and act in a coordinated manner on climate-related issues. Awareness of how climate change affects national security and military operations varies across the alliance – for example the US is a frontrunner in planning for climate change effects on the armed forces, while Germany acknowledges climate change as a challenge to security but has not integrated measures to tackle the impacts on decision-making and planning in its armed forces, and Türkiye does not yet consider climate change in security discussions at all.

Resolving these varying perspectives and dispelling the scepticism that climate action is a distraction from NATO's mission will require significant efforts from NATO's Emerging Security Challenges Division. Through political consultation and practical cooperation, NATO is well-positioned to make the case for the impact of climate change on NATO and member state capabilities, the operational benefits of transitioning to clean energy and the need to invest in climate adaptation. Appointing a special adviser to the secretary-general to champion work on climate change and security can raise the profile of this issue and generate momentum for pursuing climate-informed decision-making.⁶¹ Climate advocates, including the US, the UK, France and Sweden – once its membership bid has been finalized – can use their bilateral relationships to encourage NATO unity and cohesion behind these efforts. NATO can also support cooperative initiatives, such as the Climate Change and the Armed Forces Declaration launched by ministers of defence in 2021, which commits 26 signatory countries to review progress in their

⁵⁹ Gilli (2022), *Strategic Shifts and NATO's new Strategic Concept*.

⁶⁰ *Ibid.*

⁶¹ Shea (2022), 'NATO and Climate Change: Better Late Than Never'.

collective efforts.⁶² Other strategies include incentivizing volunteer pledges or ‘coalitions of the willing’, for example the COP26 First Movers Coalition, which brought together actors with supply chains across carbon-intensive sectors to scale up new solutions.⁶³

Investing in cultural change

Building resilience against climate impacts requires NATO to invest in cultural change across the alliance. Effective implementation of the Climate Change and Security Action Plan requires a substantial investment in resources and personnel within NATO HQ. NATO’s Emerging Security Challenges Division must take the lead in supporting member states to build a forward-looking organization able to deliver on collective security.

In particular, this includes funding for staff structures, such as the Emerging Security Challenges Division, that are responsible for devising NATO’s strategy to address climate-related security threats. Recruiting and educating staff across teams on climate and security can ensure that it is not seen as a compartmentalized area, but rather that it permeates how NATO conceptualizes its mandate and the security needs of the alliance.⁶⁴ The UN Development Programme (UNDP), for example, has hired staff with unusual skills – ‘horizon scanners’, ‘future thinkers’, ‘network specialists’ – in order to infuse new thinking into how it manages climate risk and challenge received wisdom.⁶⁵

NATO must also devote additional resources and funding to cooperation programmes such as the Science for Peace and Security Programme, which is responsible for providing grants to partner countries to explore climate challenges and innovative technologies. The activities funded by this programme have proven valuable in cementing practical cooperation between member states and partner countries, which has led to significant public diplomacy value for NATO. For example, a cross-border project between the Ben-Gurion University of the Negev (Israel), the University of Colorado (US) and the Hashemite University (Jordan) on desalinization technology strengthened NATO’s presence in the region and, for a short period of time, cooperation across Middle Eastern states.⁶⁶ Investing in these structures will enable NATO to translate its intentions into concrete action.

As part of the Defence Investment Pledge, NATO guidelines on the commitment to spend 2 per cent of gross domestic product (GDP) on defence are set to be reviewed in 2024.⁶⁷ Though there are existing political pressures on this commitment, it remains an important opportunity for NATO to encourage

⁶² Paris Peace Forum (2022), ‘Armed forces pledge to reduce their impact on the climate’, <https://parispeaceforum.org/en/initiatives/the-armed-forces-pledge-to-reduce-their-impact-on-the-climate>.

⁶³ World Economic Forum (2022), ‘Tackling the climate crisis with innovation’, <https://www.weforum.org/impact/first-movers-coalition-is-tackling-the-climate-crisis>.

⁶⁴ Kingham (2021), *Sustainable Peace & Security in a Changing Climate: Recommendations for NATO 2030*.

⁶⁵ Brown, O. and Dimsdale, T. (2021), *Climate risk management for international organizations*, Briefing Paper, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/2021/06/climate-risk-management-international-organizations/04-climate-risk-management-0>.

⁶⁶ Al-Marashi, I. and Causevic, A. (2020), ‘NATO and Collective Environmental Security in the MENA: From the Cold War to Covid-19’, *Journal of Strategic Security*, 13(4), pp. 28–44, <https://digitalcommons.usf.edu/jss/vol13/iss4/3>.

⁶⁷ UK Parliament (2022), ‘NATO’s Climate Security Agenda’.

funding for adaptation and resilience measures as part of the 2 per cent pledge. These funds are key to maintaining the alliance's military readiness but could also address vulnerable areas critical to NATO's security, for example investments in sustainable technologies to strengthen energy security and capacities to measure success by determining whether there has been a reduction in emissions. Setting a climate target focused on prevention and resilience as a proportion of this commitment is a far more effective and economical means to advance NATO's mission than focusing solely on strengthening capabilities to respond to crises after they occur. NATO HQ could commission the Climate Change and Security Centre of Excellence (CCASCOE), or an academic institution while the CCASCOE is set up, for a rapid research project to understand what this target should be to add value. The added security crisis of Russia's invasion of Ukraine in February 2022 has encouraged many member states to step up their investments in defence, which will likely be sustained at the 2023 NATO Summit in Vilnius, Lithuania.⁶⁸

Strategic coordination across NATO

NATO's political and military structures are complex, but preparing for and responding to climate risks and natural disasters can build cooperation and bolster capabilities across the alliance. Within NATO, the North Atlantic Council and the secretary-general set the direction for action on climate change, but continued communication between NATO HQ, the International Military Staff (IMS) advisory body and the Military Committee can facilitate more effective planning of operations and efficiency in implementation.

NATO HQ, in particular the Climate and Energy Security Section, must establish networks of communication and incentivize efforts by designating clear roles and responsibilities across NATO's internal machinery.

NATO HQ, in particular the Climate and Energy Security Section, must establish networks of communication and incentivize efforts by designating clear roles and responsibilities across NATO's internal machinery. This body should provide advice and assistance across NATO divisions to improve climate risk assessment and management, and it should empower staff to understand which risks threaten the success of their work.⁶⁹ Ensuring widespread participation is important to identify organizational 'blind spots' and maximize the perspectives informing mitigation and adaptation planning. This approach avoids the dangers of 'groupthink' and path dependency that can inhibit progress on climate action.⁷⁰ To coordinate

⁶⁸ Gould, J. and Sprenger, S. (2023), 'NATO summit defense spending pledges may exceed 2% target, Austin says', *Defense News*, 15 February 2023, <https://www.defensenews.com/pentagon/2023/02/15/nato-summit-defense-spending-pledges-may-exceed-2-target-austin-says>.

⁶⁹ Brown and Dimsdale (2021), *Climate risk management for international organizations*.

⁷⁰ Ibid.

with partner countries, NATO HQ can draw upon the specialized expertise of the Consultation, Command and Control Agency (NC3A), which supports communication between NATO's internal and external structures.⁷¹

Centres of excellence exist outside of formal NATO structures but are key mechanisms for building joint capabilities between NATO, member states, partner countries and international organizations. The recently initiated CCASCOE based in Canada can provide NATO with a central forum for knowledge-sharing and capacity strengthening on emerging climate risks. Climate change is a transnational threat and a collective discussion with military officials, strategic planners and policy staff, based on shared information, would help to build trust and create a learning-based cooperation network across the political landscape of NATO.⁷² Exchanging best practice on what has been tried and tested across militaries globally, from weapons systems to health, to training and infrastructure, can strengthen the individual security of member states and collective regional security through a reinforced NATO HQ.

The CCASCOE can establish a pathway of coordination with other centres of excellence to avoid duplication, enhance synergies and empower the alliance to prioritize the implementation of its climate mitigation and adaptation objectives. A continuous dialogue to integrate insights from, for example, the Energy Security Centre of Excellence on using microgrids to enhance the resilience of military bases, the Science and Technology Organization and the NATO Space Centre on using space-based observing systems to monitor emissions and optimize military operation routes to reduce reliance on fossil fuels,⁷³ and the Centre of Excellence for Military Medicine on ensuring the health of troops in extreme temperature environments, could provide a central repository to accelerate climate action within member states and support alignment across NATO's efforts to address climate change and security risks.⁷⁴

Importantly, NATO's role in responding to climate-induced humanitarian aid and disaster relief operations will be shaped by the preparedness of the Euro-Atlantic Disaster Response Coordination Centre (EADRCC), based in NATO HQ, and the effectiveness of the Centre of Excellence for Crisis Management and Disaster Response. The Civil-Military Cooperation Centre of Excellence (CIMIC) can also provide guidance on liaising with civilian actors, developing long-term preparation strategies, and addressing the gendered and disproportionate impact of crises on women and other marginalized groups.⁷⁵

⁷¹ Blahzevska, K. (2015), *Strategic communication in NATO: Need for a unified approach to security policy*, Security and Defence, <https://securityanddefence.pl/pdf-103290-36224?filename=Strategic%20communication.pdf>.

⁷² Kingham, R. (2021), *Sustainable Peace & Security in a Changing Climate: Recommendations for NATO 2030*.

⁷³ Lukacevic, J., Kertysova, K. and Heise, R. (2022), 'The climate-space nexus: new approaches for strengthening NATO's resilience', *NATO Review*, <https://www.nato.int/docu/review/articles/2022/08/18/the-climate-space-nexus-new-approaches-for-strengthening-natos-resilience>.

⁷⁴ Havstrup, E. and Ramnath, A. (2022), 'A new kid on the block: NATO climate change and security centre of excellence', *Planetary Security Initiative*, <https://www.planetarysecurityinitiative.org/news/new-kid-block-nato-climate-change-and-security-centre-excellence>.

⁷⁵ NATO Civil-Military Cooperation Centre of Excellence (2022), 'CCOE Seminar Series: Climate Change its Implications for Military Operations', CCOE minutes, https://www.cimic-coe.org/resources/online_seminars/20220629/minutes-seminar-series-climate-change-and-its-implications-for-military-operations-new.pdf.

The NATO Support and Procurement Agency (NSPA) will also be critical – the COVID-19 pandemic demonstrated the significance of its airlift capabilities in delivering rapid, cost-effective protective medical equipment. The NSPA and the EADRCC, for example, delivered field hospital tents to Luxembourg in less than 24 hours, an operation that usually takes five days.⁷⁶ The EADRCC was instrumental in facilitating ‘visa clearances, border crossings, and access to equipment and transportation routes’ during the pandemic, critical skills for both crisis and military mobility.⁷⁷ Strengthening coordination and coherence across these structures will be vital to fulfilling NATO’s crisis management responsibilities.

In terms of specific mechanisms, standardization agreements are a valuable instrument for aligning approaches across the alliance. While challenging to develop, existing standardization agreements on climate and security have been useful as strategies to apply peer pressure, ensuring coherence and interoperability across allies, encouraging member states to decrease risk through energy transition, and sending a strong demand signal to relevant sectors.⁷⁸ They are a useful tool for including smaller member states, like Croatia and Portugal, that have more limited capabilities, R&D budget and infrastructure in place, and they can help improve interoperability, i.e. the ability for NATO and member states to operate without having to make adaptations so that their systems can function efficiently in adverse circumstances. NATO’s Environmental Protection Working Group (EPWG),⁷⁹ which sets standards for environmental protection in NATO military activities and provides expertise to alliance-wide innovation, can lead on efforts to expand and promote the application of standardization agreements in specific policy areas. This addresses a key challenge of a consensus-based organization, which typically experiences a stalemate on prioritizing needs and has led to ‘lowest common denominator’ policymaking.

Strengthening mechanisms for anticipating climate risks

Climate risk assessments

NATO possesses several instruments that collect intelligence and data on climate trends. Alliance navies, for example, hold advanced oceanographic and meteorological tracking sensors that can measure and monitor changes in Arctic polar ice. NATO is also investing in its space-based observation systems to track ocean warming and desertification.⁸⁰ Critically, this data should feed into NATO’s annual Climate Change and Security Impact Assessment, which analyses the climate vulnerabilities of NATO assets, but does not yet provide an overall risk assessment for each NATO installation.

⁷⁶ De Maio (2020), ‘NATO’s Response to COVID-19: Lessons for Resilience and Readiness’.

⁷⁷ Speranza, L. (2020), ‘Six reasons NATO’s Euro-Atlantic Disaster Response Coordination Centre is important for our future security’, *Atlantic Council*, <https://www.atlanticcouncil.org/blogs/new-atlanticist/six-reasons-natos-euro-atlantic-disaster-response-coordination-centre-is-important-for-our-future-security>.

⁷⁸ Research roundtable, London, 2022.

⁷⁹ Ibid.

⁸⁰ NATO (2023), ‘NATO’s approach to space’, 16 February 2023, *Newsroom*, https://www.nato.int/cps/en/natohq/topics_175419.htm.

Incorporating highly precise climate monitoring and modelling, societal data and geopolitical trends into the Climate Change and Security Impact Assessment and mission-specific risk assessments will strengthen NATO's ability to anticipate and prepare for potentially unstable scenarios and disruptions. While this data can be variable, it will help provide a more precise and comprehensive situational picture. The CCASCOE can support NATO with the coordination of an integrated and cross-sectoral approach: military actors can work together with scientific experts, data scientists, policymakers and local stakeholders to translate climate data into assessments of vulnerabilities, their significance and how best to respond. Key lessons can be learned from the US DoD's Climate Assessment Tool, which analyses historical data to forecast climate impacts on almost 1,400 of its locations globally. It can identify, for example, if seawalls need to be built to protect against sea-level rise and which skills military staff will require to implement climate adaptation measures.⁸¹

NATO can coordinate a multinational military effort to measure, monitor and assess climate variabilities on infrastructure, operations and overall security, which could contribute to a highly precise modelling and early warning system.

In fact, together with member states and partner countries, NATO can coordinate a multinational military effort to measure, monitor and assess climate variabilities on infrastructure, operations and overall security, which could contribute to a highly precise modelling and early warning system. This assessment can inform future planning and operational needs for NATO's Defence Planning Process and NATO's Defence Policy and Planning Committee, and longer-term military decision-making through the Framework for Future Alliance Operations (FFAO). It can also have significant tactical and strategic benefits for forecasting conflict hotspots and outcomes. For instance, changing climatic conditions such as rising temperatures and precipitation fluctuations can influence when and where actors engage in conflict. Most recently, an unusually mild winter in Ukraine delayed Russian land-based operations as a lack of ice and frozen ground created difficulties in the manoeuvrability of heavy vehicles and equipment.⁸² NATO can provide standard guidelines to promote the sharing of sensitive climate data between member states and strengthen the application of climate risk assessments.

⁸¹ Vergun, D. (2021), 'DOD using climate assessment tool to understand impacts of climate change', 22 April 2021, US Department of Defense news, <https://www.defense.gov/News/News-Stories/article/article/2576382/dod-using-climate-assessment-tool-to-understand-impacts-of-climate-change>.

⁸² Maternowski, C. (2023), 'Navigating a Global Crisis: Climate Change and NATO', *NATO Association of Canada*, <https://natoassociation.ca/wp-content/uploads/2023/02/NAOC-Climate-Change-publications-v2.pdf>.

Forecasting cascading risks

It is important to acknowledge that climate change is not a linear process and that ‘tipping points’, such as the accelerated melting of Arctic ice caps, can trigger cascading impacts over a short time frame. Climate risk assessments must consider the full range of threats – particularly those concerning critical gaps or uncertainties related to key systems such as energy, food and water – to inform further research and improve NATO’s understanding of the complex pathways of transnational and systemic risks.⁸³

Complex systems modelling has an important role in strategic foresight on climate issues, as operational dependencies on critical resources increase and new theatres of conflict emerge.⁸⁴ Mathematical modelling and multidisciplinary analysis – while imperfect – can be used to identify and analyse how cascading climate risks have a multi-domain impact. Such studies could enable NATO to prepare for new forms of hybrid and cross-domain warfare in a warming world, while anticipating potential vulnerabilities. NATO has been at the forefront of bringing together multiple datasets in an integrated way and several member states are already acting on this concern: in its 2022 National Defense Strategy, the US DoD identified the need for ‘integrated deterrence’ aimed at the multi-domain integration of maritime, land, air, space and cyber domains. Similarly, the UK Royal Air Force recognizes that multi-domain integration requires joining up operational and strategic approaches, not only to address climate risk but to also remain operationally effective. To do this, the UK has set a vision of a ‘networked integrated force’ as part of its approach to meet its net zero target by 2040.⁸⁵

NATO and member states’ abilities to strengthen and operationalize systems to measure and monitor the climate will necessitate investing in the development of scientific and data literacy. Risk assessments can only be developed and translated into action if strategic planners and risk officers have the knowledge to conceptualize climate risks and evaluate the emerging data in a manner that provides decision-makers with the ability to make informed judgments.⁸⁶ Moreover, understanding these risks from a broader security and political-economy perspective is key to ensuring that purely technical solutions are not advocated when the challenges are inherently political. This will require working with new partners, across academic and NGO communities, and fusing climate expertise with data on wider threats to provide a more accurate picture of the second and third order consequences of climate change. Only then will policy and decision-makers across member states better understand that climate-security risks are not necessarily niche or localized risks but should rather be a mainstream priority.

⁸³ Brown, O. and Dimsdale, T. (2021), ‘Climate risk management for international organizations’, *Research paper*, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/sites/default/files/2021-06/2021-06-24-climate-risk-international-brown-dimsdale.pdf>.

⁸⁴ For further information on complex systems modelling, please see: Unal, B. et al. (2022), ‘Uncertainty and complexity in nuclear decision-making’, *Report*, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/2022/03/uncertainty-and-complexity-nuclear-decision-making/01-introduction>.

⁸⁵ Laird, R. (2022), ‘Shaping a Way Ahead for the Networked Integrated Force: A Royal Air Force Perspective’, 19 April 2022, *Defense.info*, <https://defense.info/re-shaping-defense-security/2022/04/shaping-a-way-ahead-for-the-networked-integrated-force-a-royal-air-force-perspective>.

⁸⁶ *Ibid.*

Importantly, the CCASCOE could play an important role in centralizing training and forecasting efforts while also ensuring accessibility to, and accountability of, the wider climate community. Such efforts would foster knowledge-sharing, build mutual trust and strengthen collaboration across and beyond the alliance.

Reducing emissions

In the near term, NATO must focus on its commitments to reduce and report its carbon emissions. The secretary-general announced a common methodology to measure NATO emissions at the 2022 summit, and an emissions reduction target of 45 per cent by 2030. However, this target only applies to NATO's military HQ, NATO-run facilities and NATO-owned assets – i.e. a relatively small set of infrastructure – and there was no detail on how this would feed into NATO's Defence Planning Process.⁸⁷ The target also does not incorporate the emissions of member states themselves.

Yet this is an essential element to support NATO's credibility as an actor in this area.⁸⁸ An increasing understanding of climate justice has influenced the public to see NATO as an alliance of wealthy nations that have produced a significant share of historical global emissions that, in turn, have disproportionately harmed those in the Global South. The limited scope and transparency of the emissions methodology has disappointed activists and civil society organizations. It presents an accountability gap, with the public unable to scrutinize NATO's approach nor understand which member states have adopted the methodology.⁸⁹ To tackle this, the secretary-general's office could propose a method of independent and external verification of its emissions methodology – even if this is not made public due to sensitivity constraints. The secretary-general, through the North Atlantic Council, should also exert pressure on allies to set their own military emission targets and report to the UN Framework Convention on Climate Change annually.

Critical to this will be NATO HQ and member states' abilities to communicate the climate threat to their populations clearly and transparently. Public perception is of political significance. Citizens of NATO countries are already increasingly aware of the existential threat of climate change. According to Pew Research Center's 2020 Global Attitudes Survey, over 60 per cent of the public in every NATO member said they considered climate change to be a key threat to their country.⁹⁰ The increased use of the term 'eco-anxiety' further reflects the impacts of environmental crises on public mental health and well-being.⁹¹ In many of these countries, the size of the military's carbon footprint is already a source of controversy, and this is likely to increase with the frequency and intensity of climate disasters.

⁸⁷ Keating, D. (2022), 'Nato disappoints with tepid climate action', *Energy Monitor*, 18 July 2022, <https://www.energymonitor.ai/policy/nato-disappoints-with-tepid-climate-action>.

⁸⁸ In 2019, the carbon footprint of militaries in the European Union was 24.8 million tonnes, the emissions equivalent of 14 million cars. CE OBS (2021), 'The EU military sector's carbon footprint', Conflict and Environment Observatory, 23 February 2021, <https://ceobs.org/the-eu-military-sectors-carbon-footprint>.

⁸⁹ Shea (2022), 'NATO and Climate Change: Better Late Than Never'.

⁹⁰ Bloch, A. and Goldgeier, J. (2021), *Finding the Right Role for NATO in Addressing China and Climate Change*, Brookings, https://www.brookings.edu/wp-content/uploads/2021/10/FP_20211026_nato_china_climate_bloch_goldgeier.pdf.

⁹¹ Benton, T., Morisetti, N. and Brown, O. (forthcoming), 'Cascading and systemic risks from environmental change'.

Defence policymakers need to be alert to the possibility of a ‘tipping point’ event that could rapidly influence public perception to see climate change as the foremost challenge to society. Such an event would consequently focus attention on NATO’s lack of success in reducing emissions and tackling climate risks, and could lead to the rise of social movements that may themselves be destabilizing.⁹² Although it has no legislative power and cannot impose binding targets on the militaries of allies, NATO can take the lead in agenda-setting and building mutual trust among member countries, several of whom are already reporting on their military footprints.⁹³ NATO can lean into public concerns and bring to life climate risk assessments to show allies that there is a political, economic, moral and military imperative to reduce emissions and strengthen resilience against climate change.

Strengthening operational resilience

Strengthening military operational resilience to the anticipated demands of a climate-affected world will enable NATO to meet its core strategic tasks of deterrence and defence. NATO HQ and member states must prioritize the implementation of resilience and future-proofing strategies to improve military effectiveness, capabilities and readiness, and simultaneously meet climate targets. It is necessary for NATO to remain sensitive to the balance between easier and less time-intensive wins and longer-term structural transformation, both of which are critical but will require differing levels of incentivization across the alliance. NATO can begin to address this challenge by injecting fresh energy, resources and capacity into existing partnership platforms, increasing political dialogue and consultation at the cross-ministerial level, strengthening civil–military cooperation to unify siloed sectors, and advancing public–private partnerships.

Energy

Energy independence and consumption

For NATO and its allies, decoupling from carbon-intensive and single fuel sources is essential to build resilience. Transitioning to energy independence at military bases will benefit military readiness and capabilities. In the case of extreme weather events or malicious activity, which can disrupt critical national infrastructure such as grid services, power can be generated ‘off-the-grid’ using a microgrid with on-site storage. For navy bases and installations, reliance on electricity that is sourced from an interconnected grid can also become a vulnerability. If one part fails, the whole system can fail. As dependencies between power plants, transmission lines and

⁹² Sawislak, J. et al. (2022), ‘Climate-forward defense’, Deloitte Insights, <https://www2.deloitte.com/us/en/insights/industry/public-sector/climate-forward-defense.html>.

⁹³ ‘Out of the 30 NATO members, the United States and Canada provided two of the most exhaustive carbon footprints for their respective defense departments, with open-access data sheets. Luxembourg, Norway and Denmark have also conducted a complete assessment of their Defense carbon footprint, with shorter historic data’. See Laboue, P. (2022), *Decarbonized Defense: The need for clean military power in the age of climate change*, p. 13, International Military Council on Climate and Security, <https://imccs.org/decarbonized-defense-the-need-for-clean-military-power-in-the-age-of-climate-change>.

distribution grids increase and become more dependent on cyber and ‘smart’, or interconnected systems, the risk of physical and cyber sabotage, fuel shortages and extreme weather also increase.⁹⁴

Several tried and tested strategies, such as generating on-site renewable energy through smart microgrids, can accelerate energy independence and combat dependencies on local infrastructure. These energy resources are small-scale methods of independent power generation that are connected to a larger distribution grid, but they operate locally and are able to run even if the main grid power is lost. As waste disposal is a critical issue during military operations, waste-to-energy solutions should also be explored. The deployable waste-to-energy convertor project developed in cooperation with the US Army for example, involves drawing on landfills that produce methane to convert waste into organic power.⁹⁵ This approach uses less fossil fuel, has a smaller logistical footprint, eliminates common chemical and biological hazards, and is self-powering. Regenerating military-owned land to improve carbon sequestration and biodiversity is another strategy that can help to redress the adverse environmental impacts created by military operations. The removal of vegetation for military activities in Iraq for example, has drastically worsened sand and dust storms. This has contributed to growing desertification and migration from rural areas.⁹⁶

NATO can leverage the progress made by allies’ national strategies in these areas. In the Middle East, the US has approximately 18 bases with installations largely running on power provided by the grids of host nations, making these facilities dependent on local energy supplies, susceptible to outages and a potential strain on grid capacity. In response, the 2022 US National Defense Strategy has pledged to increase US efforts to improve the resilience of its military installations. By 2035, it aims to install a microgrid on every installation and, by 2040, generate enough renewable energy and battery storage capacity to make all army installations self-sustaining. The US Army has started to roll out microgrid demonstrations using solar photovoltaics in Camp Arifjan and Camp Buehring in Kuwait.

Unintended vulnerabilities must be anticipated and mitigated when applying these solutions. For instance, renewable energy infrastructure is often a target of attack. The Ukrainian government estimates that 90 per cent of wind power and 50 per cent of solar energy capacity has been decommissioned as a result of the war.⁹⁷ Moreover, cleaner solutions tend to be ‘smarter’ and therefore rely on cyber capabilities, such as smart microgrids that are susceptible to cyberattacks and adversaries. Standardized risk assessments and measures that strengthen operational resilience in case of attack and mitigate cyber-related vulnerabilities must be embedded from the outset. The use of microgrids and other innovations

⁹⁴ Maurer, E. (2022), ‘Advancing military microgrids: challenges and recommendations based on insights from a two-day workshop to support naval facilities engineering command Southwest’s microgrid efforts’, Rocky Mountain Institute, <https://rmi.org/wp-content/uploads/2017/04/NavyReport.pdf>.

⁹⁵ US Department of Defence SERDP ESTCP (2023), ‘Deployable waste to energy convertor (DWECCX) for expeditionary contingency bases with thermal energy to electrical power system (TEEPS)’, <https://www.serdp-estcp.org/projects/details/c9d43f12-4cf9-4e83-b9df-5c6ac6b3401f/wp18-5149-project-overview>.

⁹⁶ International Committee of the Red Cross (2021), ‘Iraq’s perfect storm – a climate and environmental crisis amid the scars of war’, <https://www.icrc.org/en/document/iraqs-perfect-storm-climate-and-environmental-crisis-amid-scars-war>.

⁹⁷ Fakty (2022), ‘Because of the war, 90% of the wind energy capacities have been decommissioned’, 23 October 2022, <https://fakty.com.ua/en/ukraine/ekonomika/20221023-cherez-vijnu-90-potuzhnostej-vitrovoyi-energetyky-vyvedeni-z-eksploataciyi-galushhenko>.

may be privy to individual allies. However, NATO can incentivize these endeavours by facilitating cooperation between allies and making use of its platform to share knowledge.

Box 3. Stress-testing and 'islanding' energy resources

Stress-testing of military bases through 'black start exercises' and 'islanding' – i.e. using sources of energy generation independent from an external main energy supply grid – are proven strategies to address vulnerabilities of military operations and reduce dependencies on external sources of energy. The US regularly holds black start exercises, which involve decoupling from the energy supply in a critical military installation and operating for two-weeks with on-site power.⁹⁸ Integrating similar exercises into NATO missions could support its transition to energy independence and reduced energy intensity. In addition, the IMS can incentivize islanding more broadly to enable NATO to operate under attack. To anticipate climatic events or malicious activity episodes, NATO can collate guidance on best practice and champion pioneering efforts by allies to enhance knowledge-sharing.

NATO must recognize that despite reducing energy consumption, the military can still provide a competitive advantage on the battlefield. Indeed, less resource-intensive operations can help sustain military effectiveness. For example, improved fuel efficiency and a reduction of the heat and noise signature of equipment can shorten inefficient and polluting military supply lines. Not only could this innovation help protect military personnel – in 2007 in Afghanistan and Iraq, there was on average one casualty for every 24 fuel resupply convoys – it could also reduce air and soil pollution and other harmful impacts on local communities. The IMS can propose that all military bases undertake a comparative study using time-historical data on the impacts of climate change to measure and identify changes in the energy-use profiles of bases. Collecting data on energy consumption can become standard practice to identify processes that are energy intensive. NATO's Energy Security Centre of Excellence is developing a handbook for member states that can be an instructive resource to help institutionalize change on best practice energy management and energy efficiency strategies.⁹⁹

NATO can learn from partners to move forward at pace and avoid duplicating efforts. For example, the UN's Greening the Blue Initiative is supporting the UN system to achieve greater environmental sustainability across its facilities. As a result, the UN peacekeeping operation in Haiti worked with the government, local communities and UNDP to recycle shredded paper and cardboard boxes to make charcoal briquettes, both as a source of fuel and a means of reducing

⁹⁸ Douglas, A., Pina, A. and Pringle, M. (2022), 'Exercise Roadmap for Resilience: Requirements, Results and Resourcing', report, Naval Postgraduate School, <https://nps.edu/documents/110773463/135759179/Exercise+Roadmap+for+Resilience-+Requirements%2C+Results%2C+and+Resourcing.pdf/085dab03-053a-9464-c41d-94c392b12228?t=1652135881385>; US Army (2022), 'RIA readies itself for 'Black Start' power outage exercise', May 16, 2022, press release, https://www.army.mil/article/256626/ria_readies_itself_for_black_start_power_outage_exercise_may_16.

⁹⁹ NATO (2022), 'NATO Climate Change and Security Action Plan', July 2022, *Factsheet*, https://www.nato.int/nato_static_fl2014/assets/pdf/2022/7/pdf/0664-22_Climate_Change_Compendum_-_V3.pdf.

waste.¹⁰⁰ NATO could also draw on the European External Action Service (EEAS) proposed standards for the EU Military Committee – *EU Concept for Environmental Protection and Energy Optimisation for EU-led Military Operations and Missions*.¹⁰¹ These could help identify principles for a common approach across allies for the development of standard operating procedures in relation to the climate and environment as well as the creation of common standards and baselines for the environmental performance of missions.¹⁰²

Fuel policy

The use of fuel in operations accounts for approximately two-thirds of military emissions. This primarily comes from the air domain, specifically aircraft equipment and aviation.¹⁰³ NATO can encourage the exploration of alternative landing modes that are less fuel-intensive and help to rethink civil-military airspace.¹⁰⁴ It can champion key players, such as the UK Royal Air Force leading on sustainable fuels and new methods of descent to reduce fuel use.

In the long term, adding flexibility to NATO's Single Fuel Concept¹⁰⁵ with opt-outs for allies pursuing alternative fuel types, such as hydrogen, will be key to the energy transition. Each member state is moving away from carbon-based fuels at varying speeds of progress – cascading impacts from the Ukraine crisis will only speed up this process – and as member states diversify their fuel type and supply, it may become more challenging and less relevant to maintain a single fuel policy. Instead, NATO can incentivize R&D into the development of alternative fuel sources, such as sustainable aviation fuels, biological fuels and synthetic fuels. Eventually, NATO could perhaps envisage developing standardization agreements on sustainable aviation fuels like biofuels – recognizing the political sensitivities this may bring.¹⁰⁶ The Netherlands is already innovating with mixing biofuels into current fuel systems and has held successful trials of drop-in biofuels.¹⁰⁷ Mitigating the adverse impacts of sourcing biofuels, which can include displacement of communities,¹⁰⁸ is critical and will necessitate appropriate risk assessments.

¹⁰⁰ United Nations Environment Programme (2012), 'Greening the Blue Helmets: Environment, Natural Resources and UN Peacekeeping Operations', https://wedocs.unep.org/bitstream/handle/20.500.11822/8840/UNEP_greening_blue_helmets.pdf?sequence=3&%3BisAllowed=.

¹⁰¹ European External Action Service (2021), *EU Concept for Environmental Protection and Energy Optimisation for EU-led Military Operations and Missions*, Council of the European Union, <https://data.consilium.europa.eu/doc/document/ST-9263-2021-INIT/en/pdf>.

¹⁰² Council of the European Union (2021), '9263/21 EUMC 118 CSDP/PSDC 286', 28 May 2021, Cover Note, <https://data.consilium.europa.eu/doc/document/ST-9263-2021-INIT/en/pdf>.

¹⁰³ Research interview with Sherri Goodman, vice chair of the US Secretary of State's International Security Advisory Board, online, 2022.

¹⁰⁴ Research interview with Sophy Antrobus, research fellow at the Freeman Air and Space Institute, King's College London, online, 2022.

¹⁰⁵ 'The aim of the concept is to maximize equipment interoperability through the use of a single fuel, namely F-34, on the battlefield for land based military aircraft, vehicles and equipment', NATO (1997), 'NATO Logistics Handbook', <https://www.nato.int/docu/logi-en/1997/lo-1511.htm>.

¹⁰⁶ *Ibid.*

¹⁰⁷ McKinsey & Company (2022), 'The link between climate and national security', 28 November 2022, Interview, <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/the-link-between-climate-and-national-security>.

¹⁰⁸ Rulli, M. C. (2023), 'Roadmap to 2050: The land-water-energy nexus of biofuels', report, Sustainable Development Solutions Network, <https://roadmap2050.report/biofuels/water-land-biofuels>.

Infrastructure, supply chains and procurement practices

Infrastructure is the cornerstone of all NATO missions and operations. In this context, infrastructure is defined as NATO-owned or NATO-used installations that are necessary for the deployment and operation of armed forces, which includes but is not limited to ‘airfields, signals and telecommunications installations, military headquarters, fuel pipelines and storage, radar warning and navigational aid installations’.¹⁰⁹ Although military infrastructure is a national responsibility, NATO can incentivize and make pooled funding available for infrastructure programmes while setting standard practices, requirements and baselines that incorporate resilience measures in its role of funding infrastructure through the Joint Support and Enabling Command and the NATO Office of Resources.

Supply chains are a huge cost driver of military missions and a risk factor given the rise in deliberate attacks by adversaries on critical international and national infrastructure.

Drawing from best practice, NATO can set mandatory requirements for member states in the design and development of climate-proofed infrastructure. Such requirements should include a baseline that can meet all member state capabilities. For example, NATO could set a commonly agreed percentage of renewable energy usage across military bases. Similarly, given the threat of rising sea levels, a new Finnish navy project, Squadron 2020, stipulates that all new infrastructure should be built at least 3 metres above current sea levels and naval ships should be able to sail in storm and ice conditions.¹¹⁰

Beyond infrastructure, allies must consider supply chains and procurement as well. Supply chains are a huge cost driver of military missions and a risk factor given the rise in deliberate attacks by adversaries on critical international and national infrastructure. Protecting these supply chains requires significant investment. It is therefore in member states’ best interests to consider how their practices can become more resilient and less carbon intensive. NATO’s Life Cycle Management Group can help to optimize defence capabilities by considering performance, cost and integrated logistics over the life cycle of activities.¹¹¹ It can explore the full cycle of infrastructure (which would include how NATO can deal with end-of-life recycling, repurposing, disposal, etc.), procurement and supply chains to measure carbon emissions and identify areas of high energy intensity. This could inform the development of procurement provisions within the climate and environment standard operating procedures mentioned earlier, to more effectively mainstream environmental procurement practices and enhance the interoperability of defence procurement.

¹⁰⁹ NATO (2014), ‘Infrastructure and Logistics’, https://archives.nato.int/uploads/r/null/1/3/137761/0196_Aspects_of_NATO-Infrastructure_and_Logistics_ENG.pdf.

¹¹⁰ Finnish Ministry of Defence (2023), ‘Squadron 2020 replaces the vessels the Navy will decommission’, <https://puolustusvoimat.fi/en/squadron-2020>.

¹¹¹ See NATO Defence Investment Portal (2023), ‘About Life Cycle Management Group’, Defence Investment Portal, <https://diweb.hq.nato.int/lcmg/Pages/About.aspx>.

Yet procurement, like infrastructure, is an individual member state responsibility, and crises often prompt a response that could provide immediate gains, but also come with long-term consequences. For example, Russia's invasion of Ukraine spurred the procurement of sizable amounts of carbon-intensive equipment. Instead, NATO can play a role in encouraging militaries to act collectively to balance competing immediate and long-term priorities by institutionalizing baseline commitments on certain long-term priorities as standard practice for membership. Moreover, member states should avoid committing to procurement decisions that lock in emission-intensive processes and prevent opportunities to improve sustainability down the line. NATO can support member states by devising incentive structures, such as funding for less carbon-intensive equipment. It can help partner countries identify opportunities for cooperation, for instance on 'High Visibility Projects' such as the Multi Role Tanker Transport project developed to optimize existing assets and establish a shared fleet.¹¹² The Emerging Security Challenges Division can support existing initiatives, such as the Global Air Forces Climate Change Collaboration initiative, now signed by 50 states as the first multinational platform coordinating efforts by national air forces to mitigate and adapt to climate change.

Public-private partnerships are a crucial, yet underutilized, tool for NATO. The recently announced Defence Innovation Accelerator for the North Atlantic (DIANA) aims to provide funding for deep tech, dual-use innovations within the alliance. Its emerging and disrupting technologies strand will fund energy resilience, secure information-sharing, and sense and surveillance technologies.¹¹³ DIANA is a crucial vehicle given its deliberate dual-use remit to develop technologies with civil impact and tactical military usability, and it can strengthen civil-military cooperation across siloed sectors. Other platforms can also be utilized, such as the NATO-Industry Forum, the NATO Industrial Advisory Group, the National Innovation Fund, and the Defence Investment Division Portal, which serves as a single point of entry to facilitate communication and collaboration in the development of military capabilities in NATO common-funded assets.¹¹⁴

NATO and member states' commitment to new and cleaner energy sources and equipment will send a strong demand signal to suppliers and manufacturers. This can help stimulate industry to produce the necessary materials and processes by introducing the required elements into their product pipelines, as seen in processing for biofuels. To enhance the market competitiveness and uptake of innovative technologies, NATO and allies can set procurement standards for buying materials and using transport systems from suppliers that use less carbon intensive or zero-carbon processes. Collective efforts can have a multiplying effect: if 75 per cent of member states commit their forward purchasing to near-zero carbon technologies, it could have a ripple effect on other NATO countries.¹¹⁵ NATO can further incentivize member states to work closely with

¹¹² See NATO Defence Investment Portal (2022), 'High Visibility Projects (HPVs)', Defence Investment Portal, <https://diweb.hq.nato.int/kme/Pages/default.aspx>.

¹¹³ NATO (2022), 'NATO approves 2023 strategic direction for new innovation accelerator', 12 December 2022, press release, https://www.nato.int/cps/en/natohq/news_210393.htm.

¹¹⁴ See NATO Defence Investment Portal (2022), 'High Visibility Projects (HPVs)'.

¹¹⁵ World Economic Forum (2022), 'Tackling the climate crisis with innovation', <https://www.weforum.org/impact/first-movers-coalition-is-tackling-the-climate-crisis>.

the private sector to develop their capabilities as suppliers, for instance distributing microgrids to military bases. Incentivizing members and further supporting a culture of de-risking investment in resilient technological innovation will signal to the defence industry that there is a demand for innovative technologies.

Box 4. Military innovations can also transform the commercial industry

Recognition of the need to make military operations more climate resilient can lead to economic growth. Investing in solutions to address the effects of extreme weather and sea-level rise on concrete degradation across military infrastructure, for example, can have spillover benefits for the broader economy. The global annual cost of metal and concrete corrosion is estimated at \$2.5 trillion, more than 3 per cent of international GDP.¹¹⁶ A breakthrough solution could have enormous commercial impact, as has been seen previously with innovations such as global positioning satellite technology (GPS), the internet, radar, lidar, integrated circuits and touchscreens, all of which were invented to address a military need. In fact, GPS is thought to have contributed \$1.4 trillion to the US economy since its release to the public in 1993.¹¹⁷ Given the scope and scale of climate change, NATO's support in developing new technologies to tackle these issues could bring huge benefits to both military performance and commercial success.

Learning, training and exercises

NATO can build on its existing learning, training and exercise platforms to further mainstream and embed climate literacy across its HQ staff, IMS and member state officers. NATO's professional military education reach includes the NATO Defense College, the NATO School Oberammergau, and the Military Engineering Centre of Excellence. A dedicated and compulsory curriculum for all military officials, strategic planners and policy staff can help to strengthen climate literacy and build a shared understanding of climate change impacts on national and regional security. This knowledge can empower member states and partner countries to prepare for worst-case scenarios and inform policy and planning decisions. It could also provide an important opportunity to build trust and cooperation on climate concerns across the alliance's divisive political landscape.

NATO can expand its crisis management, wargaming and scenario exercises to anticipate climate-induced vulnerabilities and inform planning.¹¹⁸ Engaging in scenario exercises can help member states identify risks, liabilities, logistical and communication challenges, and recognize priority response areas and opportunities for delivering emergency assistance. These exercises can mainstream climate considerations into the 'situational awareness' of mission profiles and be integrated into military operational planning. The US Center of Excellence in Disaster Management and Humanitarian Assistance hosted a four-day wargame

¹¹⁶ Sawislak et al. (2022), 'Climate-forward defense'.

¹¹⁷ Ibid.

¹¹⁸ Paschal, A. (2023), 'CFE-DM Co-hosts Climate Change Wargame', US Army, 17 January 2023, https://www.army.mil/article/263325/cfe_dm_co_hosts_climate_change_wargame.

in January 2023, designed by the Center for Naval Analyses, which explored scenarios across five-, 10- and 15-year horizons to prepare the US Indo-Pacific Command for climate-related security impacts.¹¹⁹ This is an example of expertise among allies that NATO could draw on and learn from. NATO can also leverage its defence engagement activities to support officer exchange programmes with a specific focus on climate adaptation and mitigation strategies.

Virtual reality simulations for training staff are also effective. The UK Defence, Equipment & Support agency agreed a £7.2 million contract with Bohemia Interactive Simulations to deliver DVS2, a simulator capable of creating military environments and operations across the globe, including training for Arctic warfare and alongside NATO allies.¹²⁰ The UK Royal Air Force is also experimenting with advances in virtual reality to develop training simulations such as parachuting and piloting jets. These innovations are not only cost effective and able to deliver training in a zero disruption and secure environment, but they also reduce overall military fuel consumption.¹²¹ Training for new skills will become increasingly important as missions are required to operate in the extreme heat and extreme cold, and for humanitarian aid and disaster relief activities that necessitate medical and first aid training, search and rescue, and evacuation skills.

Bringing together typically siloed technical, military, political and scientific communities is key to ensuring complementarity and coherence. A good example of military and industry collaboration is between the US Army and Microsoft, who are using climate modelling to determine where and how to build military installations.¹²² The US is testing how its coastal storm-modelling system, CSTORM-M, operates in Microsoft's Azure cloud environment to increase scalability and run new, never-before-deployed simulations of coastal sea-level rise.

Moreover, NATO can ensure that training centres in partner countries outside of NATO member state territory, such as in Jordan, Kuwait and Mauritania, remain well-resourced and staffed to build the resilience of its partners in reacting to crisis situations. Through Eco Camp 2025, which aims to develop energy and water security in the MENA region, the French military has been the most advanced in improving the resilience of its overseas military camps.¹²³ Re-energizing its existing network of 34 Partnerships Training and Education Centres (PTECs) is another vehicle for building resilience, while NATO liaison offices can host shared foresight and scenario exercises on climate risks. PTECs have previously offered their expertise for missions of other international organizations, such as the UN, including the UN Stabilization Mission in Mali, or the African Union. The next chapter discusses some of the challenges of these partnerships.

¹¹⁹ Ibid.

¹²⁰ See Ministry of Defence (2022), 'UK military enhancing training through virtual-reality', 10 June 2022, press release, <https://des.mod.uk/uk-military-virtual-reality>.

¹²¹ Royal Air Force (2020), 'RAF Regiment assists in developing virtual reality training platform', 13 August 2020, News, <https://www.raf.mod.uk/our-organisation/force-protection/news/raf-regiment-assists-in-developing-virtual-reality-training-platform>.

¹²² See Microsoft (2023), 'Azure for US Department of Defense', <https://azure.microsoft.com/en-us/explore/global-infrastructure/government/dod/#use-cases>.

¹²³ van Schaik et al. (2020), *Ready for take-off? Military responses to climate change*.

04

Political trade-offs and opportunities

There remain competing views and priorities across the alliance that may hinder efforts to tackle climate-security concerns. Yet climate change adaptation and mitigation is an enabler for the alliance to gain military advantage over adversaries.

NATO now encompasses 31 countries (potentially soon to be 32) in the Euro-Atlantic area, with significant but not full overlap with the EU. As discussed above, the 2022 NATO Strategic Concept is clear in identifying climate change as a challenge – not just as a global challenge, but as one for NATO specifically to address. The fact that this is a consensus document that all allies have signed up to is encouraging. While the leadership of the secretary-general has also played a key role in driving NATO’s current posture towards climate change, this is not sufficient in isolation – particularly as a new secretary-general may be selected in autumn 2023, if Jens Stoltenberg’s term is not extended a second time.¹²⁴

However, there remain competing views within NATO on how to tackle the range of threats that NATO countries face, including climate change, and which to prioritize. As a consensus-based organization, it is a challenge to get all its members to consider climate change with the same urgency. Yet by preparing NATO for climate-related security challenges, NATO allies also have an opportunity to improve their operational effectiveness by increasing interoperability and making their capabilities more resilient. Climate change mitigation and adaptation should be seen as a way to provide a competitive advantage for NATO allies over adversaries, rather than a distraction from crisis management. It is, in fact, an enabler.

¹²⁴ Research interview with NATO representative, NATO Emerging Security Challenges Division, online, 2022.

Climate change adaptation during an era of geopolitical competition

In the context of the war in Ukraine, NATO allies cannot afford to compartmentalize security issues that have an impact on European and transatlantic security. Russia, China, climate-related security threats and other challenges all threaten transatlantic stability and security in the short- and long-term. Inevitably, this means NATO allies will always need to balance priorities between immediate threats and longer-term challenges. Part of the difficulty is the perception that climate impacts are not ‘hard’ security concerns, and climate may fall off the agenda as other security risks arise. As this paper has argued, this is a false dichotomy. To be an effective organization NATO, using the mechanisms and ideas outlined in this paper, must keep climate as a high priority on the political agenda.

NATO can use its partnerships to help tackle these geopolitical, long-term challenges. Direct action should be supplemented through a complementary strategy for strengthening its partnerships through political consultations, knowledge exchange and diplomacy. The recent addition of Finland to NATO and the application of Sweden are critical not only because of these countries’ political actions in the UN on climate and security, their large foreign aid budgets, and their strong connections across the alliance, but also because of their regional and geographical knowledge and enhanced military capabilities in the Arctic, which can potentially counter Russian and Chinese aggression.

The Indo-Pacific is a region of the world particularly at risk from climate change, and a likely theatre for military operations over the coming decades. Cooperation with NATO’s four existing Indo-Pacific partners – Australia, Japan, the Republic of Korea and New Zealand – can strengthen political ties with countries playing an essential role in containing China in the Indo-Pacific, while also deepening partnerships with countries on the forefront of tackling climate change. NATO can boost these climate partner relationships by establishing a learning-based cooperation network to fast-track knowledge-sharing, co-design regional assessments and projections, and facilitate political consultations. NATO contact point embassies and liaison offices should utilize their in-depth country-level expertise to enable channels for knowledge exchange on climate vulnerabilities. This should be fed upwards to NATO HQ while being used to assist the host nation.

In the foreseeable future, NATO will face increasingly difficult trade-offs in pursuit of its mission. The implementation of NATO’s strategic priorities will create new inequalities, which may impact alliance cohesion. For example, some allies or partner countries will be more vulnerable to climate impacts than others and look to NATO to allocate more resources towards humanitarian assistance and disaster relief. Similarly, NATO could provide incentives to accelerate the energy transition, but inflationary pressures and supply-chain disruptions could leave some allies in a better position than others to adopt new technologies. This could feed a perception of winners and losers, further complicating consensus-building on any common strategy.

Establishing credibility in the international climate architecture

The environmental and local impact of military action and conflict itself is an important consideration. Military facilities are estimated to cover 1–6 per cent of the global land surface and much of this land is ecologically vital.¹²⁵ Military bases can displace local communities and strain already limited water, food and energy resources in climate-vulnerable regions.¹²⁶ Military operations can alter the natural environment, including terrestrial and marine habitats, and create air, chemical and noise pollution from the use of weapons, aircraft and vehicles. NATO HQ and allies must ensure that they are minimizing negative impacts on the environment and local communities during military activities. This will help build NATO's credibility internationally in this space.

Equally, if NATO is serious about its commitments to adapt to climate change, and adopt effective mitigation measures, it also needs to work on building credibility in some of the worst climate change-affected states. Where helpful and desired by a partner, NATO can support climate-vulnerable countries in the Middle East and sub-Saharan Africa to build resilience to limit the cascading impacts of climate-security threats (trade, migration, conflict etc.).

In turn, taking concrete action to support a reduction in NATO HQ and member state emissions, and doing so in a transparent and inclusive manner, can build NATO's credibility as a serious climate actor in the military space as well as give NATO a foothold within the broader international climate community.

The EU: A key partner for NATO

The EU is a key partner for NATO and both institutions have a long track record of cooperation. The 2023 Joint Declaration on EU-NATO Cooperation presents a novel opportunity to build climate change into this partnership.¹²⁷ Although the declaration is primarily symbolic, it reinforces the perception that neither NATO nor the EU alone can respond to and address multifaceted and cross-border climate risks, and it encourages deeper collaboration. There are 21 EU member states that are also NATO allies. This overlap means that issues prioritized at the EU's Political and Security Committee will also likely make it onto the agenda of NATO's North Atlantic Council. In particular, the transatlantic element of NATO (the role of the US) is a formidable strength in enabling both organizations to play complementary and mutually reinforcing roles to bolster climate cooperation.

Despite policy convergence on climate change, cooperation between the EU and NATO is hindered by political obstacles. Cyprus, an EU state not recognized by Türkiye, a NATO member, is the only EU country not a member of NATO's

¹²⁵ Zentelis, R. and Lindenmayer, D. (2014), 'Bombing for Biodiversity – Enhancing Conservation Values of Military Training Areas', *Conservation Letter*, 8(4), pp. 299–305, <https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/conl.12155>.

¹²⁶ van Schaik et al. (2020), *Ready for take-off? Military responses to climate change*.

¹²⁷ NATO (2023), 'Joint Declaration on EU-NATO Cooperation', https://www.nato.int/cps/en/natohq/official_texts_210549.htm.

Partnership for Peace programme. For the EU, inclusiveness is a key principle in decision-making procedures, meaning it does not accept formal meetings between the EU and NATO where Cyprus is excluded. This could impact future scenarios for NATO–EU sharing of military capabilities in the context of climate security interventions, or support to humanitarian operations.

Given the level of coordination, but the absence of close cooperation between the EU and NATO, and the overlap in membership, it may be helpful to institutionalize a division of labour. For example, this may include an agreement on EU responsibilities for crisis responses to floods and forest fires in the EU, and NATO taking charge of capabilities and equipment and training standards. Such an approach may enable a faster response and avoid duplication.

Going forward, climate diplomacy will be essential to mitigate conflict and reduce tensions. As a result, it is vital that NATO and the EU raise the level of their frequent informal exchanges to formal discussions on climate security. Liaison committees and working groups including key stakeholders from the European External Action Service (EEAS) and NATO’s Emerging Security Challenges Division can play an integral role in influencing and shaping each other’s policies, procedures and projects on the front line of climate impacts across regions of interest including the Middle East, sub-Saharan Africa and the Indo-Pacific. As part of the EU–NATO Structured Dialogue on Resilience, the EU and NATO recently established a taskforce on resilience of critical infrastructure. This covers energy and space and will look at how to improve resilience in those sectors.¹²⁸ A forthcoming joint communication on climate change, environmental degradation, security and defence will reinforce this partnership and aim to more closely align EU initiatives and financing with NATO activities. A technical partnership between the EU Military Staff, which is the source of military expertise within the EEAS, and NATO’s Climate Change and Security Centre of Excellence could establish a similar coordination pathway to avoid duplication while enhancing synergies to meet NATO’s adaptation and mitigation objectives.

¹²⁸ European Commission (2023), ‘Launch of the EU-NATO Task Force: Strengthening our resilience and protection of critical infrastructure’, statement, 16 March 2023, https://ec.europa.eu/commission/presscorner/detail/en/statement_23_1705.

05 Conclusion

A vital starting point for this critical agenda is building political consensus among NATO allies. Despite challenges raised by the invasion of Ukraine, ensuring that allies agree on the importance of this challenge will enable further necessary climate security mitigation and adaptation work.

Climate change is already having an impact on NATO. The organization has historically undergone institutional change in the face of existential events: most recently, prompted by Russia's invasion of Ukraine.¹²⁹ The invasion has laid bare the interconnected nature of conflict, geopolitics, climate change and the environment. If NATO wants to remain an effective organization able to deliver on its three core tasks, it will need to adapt. The organization is in a position to make a range of structural and operational changes to tackle the systemic risks of climate change, including on security and defence.

Through its convening power, NATO has a unique window of opportunity to prepare for climate security challenges. Notwithstanding the challenges and capacity constraints brought on by Russia's invasion of Ukraine, the 2023 NATO Summit and the forthcoming annual Climate Change and Security Impact Assessment are important opportunities to reflect on current climate-security policies and their efficacy. There would be significant negative ramifications in NATO's ability to defend and deter if the organization and allies were not to use this chance to undertake climate change adaptation and mitigation actions now.

The most pressing challenge for the alliance is building a political consensus among all allies. Agreement among all 31 – potentially soon to be 32 – countries on the importance of climate security, and how the alliance can tackle it, will enable further necessary action on this issue. This point is critical as strengthening political and institutional structures, creating mechanisms for forecasting and boosting operational resilience all require buy-in from NATO allies.

¹²⁹ Research interview with Jamie Shea, former NATO official and current professor of strategy and security at the University of Exeter, online, 2022; Lippert (2022), *NATO, Climate Change, and International Security: A Risk Governance Approach*.

Recommendations

	Quick and easy wins	Medium-term success	Difficult but high impact
Political and institutional structures	<ul style="list-style-type: none"> • Demonstrate leadership and progress through regular public reporting by the secretary-general's office on NATO's Climate and Security Action Plan, establish benchmarks, timelines and clear measures for success. • Establish networks of communication and designate clear roles and responsibilities across NATO's internal machinery for addressing climate security, led by the secretary-general's office. • Appoint a special adviser to champion work on climate change and security to raise its profile and generate momentum for pursuing climate-informed decision-making. • CCASCOE should regularly convene military officials, strategic planners and policy staff to help build trust and create a learning-based cooperation network across the political landscape of NATO. 	<ul style="list-style-type: none"> • Devote more funding to staff structures such as the Emerging Security Challenges Division and cooperation programmes, including the Science for Peace and Security Programme. • Climate advocates, such as the US, the UK and France, can use their bilateral relationships to champion NATO unity and cohesion behind climate security efforts. 	<ul style="list-style-type: none"> • NATO allies should agree on a climate target as part of the 2 per cent of GDP spend on defence pledge renegotiation that includes resilience and adaptation measures.
Measuring and monitoring systems	<ul style="list-style-type: none"> • Propose a method of independent and external verification and audit of NATO's emissions methodology. The secretary-general through the North Atlantic Council should exert pressure on allies to set their own carbon military emission targets, and report on those annually. • The NATO Resilience Committee should apply comprehensive risk assessments to the planning process of all climate adaptation and mitigation measures to identify any inadvertent risks, specifically to local populations. 	<ul style="list-style-type: none"> • Use complex modelling to build contingency in identifying cross-domain, hybrid and cascading climate threats. 	<ul style="list-style-type: none"> • Coordinate a multinational military effort to monitor, assess and collate information on climate variabilities on infrastructure, operations and equipment. This information should be centralized through the CCASCOE to develop highly precise modelling and early warning systems. NATO should invest in developing staff capabilities in scientific and data literacy. • Use climate risk assessments to facilitate scenario planning for humanitarian aid and disaster relief operations, enabling military and civilian staff to understand who has the capabilities to respond in an initial response, how to transition responsibilities to civilian agencies and NGOs, and help improve existing international assistance programmes.

	Quick and easy wins	Medium-term success	Difficult but high impact
Operational resilience	<ul style="list-style-type: none"> • Carry out a full audit of military bases and operations to identify emission profiles and select where to prioritize reductions. NATO's Operations Policy Committee could lead on this. • Incentivize member states to take a staged approach to decarbonization efforts, starting with peacetime equipment, followed by operational capabilities, such as lighter vehicles and base camps. • Support existing multinational and domain-specific climate change initiatives, such as the Global Air Forces Climate Change Collaboration Initiative, to signal political support and further incentivize military leadership and uptake. 	<ul style="list-style-type: none"> • Set conditions on military purchasing through standard operating procedures, for instance a maximum carbon emission baseline for all equipment purchased. • Standardize 'climate literacy' across all military education. This should include a dedicated and compulsory curriculum that includes training on environmental protection. • Training and exercising in regions where NATO expects to operate in a climate warming world, such as the Indo-Pacific and the Arctic. Identify skills required, ranging from medical and first aid training, to search, rescue and evacuation expertise. • Develop guidance on the integration of two-week black start exercises at all NATO bases to support the transition to energy independence. • DIANA and the NATO Innovation Fund should earmark funding for R&D in near-zero and zero-carbon solutions, focusing on carbon-intensive technologies, such as heavy equipment. • Support officer exchange programmes with partner and non-partner countries focusing on climate adaptation and mitigation strategies. 	<ul style="list-style-type: none"> • Develop standardization agreements on embedding resilience baselines into all future infrastructure that meet specific water, energy and waste targets. • Add opt-outs to the single fuel policy for allies pursuing alternative fuel types, such as hydrogen, to help accelerate and facilitate the energy transition. • Provide guidance on regenerating military-owned land that is no longer operable or in use to improve soil stability, carbon sequestration and biodiversity. NATO can cooperate with local and national organizations, climate protection agencies and UNEP on land remediation and ecosystem regeneration projects. • Enhance defence investment in the materials, transport systems and supply-chain infrastructures needed to adopt new technologies at scale. Encourage the pooling of funds and investment in green bonds. • Incentivize member states to take a staged approach to their military decarbonization efforts, including heavy capabilities, such as tanks, naval vessels and fighter jets, which are the most energy intensive and challenging to adapt.

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Cover image: Military communications unit personnel wave to a passing Slovenian Bell-412 helicopter helping with firefighting efforts as a large wildfire burns in the Karst region of Slovenia in July 2022.

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