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WRITTEN BY
SIMON PERRIN DE BRICHAMBAUT

EDITED BY
THEODORA POȘTA

SUPERVISED BY
STEPHEN CROWLEY

Introduction

Europe's security, and the security of its population, is increasingly being compromised by the effects of climate change. Domestically, climate change is leading to more extreme weather conditions, which have led to an increase in weather-related risks and insecurity. Internationally, climate change is exacerbating conflicts and contributing to a climate of global insecurity that threatens Europe's vital interests. This paper contends that climate change constitutes both a security threat and an operational challenge for European land forces (Barry, 2022; NATO, 2024). Instead of understanding climate change as a threat multiplier, this paper will treat climate change as a threat in and of itself (Barry, 2022). Climate change's cumulative effects have – and will continue to – adversely impact populations and economies worldwide, as well as the stability of states and their institutions. The extreme weather conditions that climate change produces are threatening international peace and security, and are already driving conflicts and reshaping relations between states (European External Action Service, 2023).

Although Europe's land forces are increasingly accounting for the impacts of climate change in their policymaking and planning, those effects related to climate shifts continue to present these forces with complex tactical and operational challenges (Barry, 2022; NATO, 2024). These land forces are forced to cope with more extreme weather conditions in all of their operations, as well as being increasingly called upon to take part in humanitarian or disaster relief operations (Tavares da Costa et al., 2024).

For the purposes of this paper, climate change will be defined as the "shifts in the state of the climate system that give rise to substantial and enduring shifts of weather patterns", a trend that will persist and intensify as the global average temperature continues to rise (Tavares da Costa et al., 2024). This paper will examine the operational challenges brought about by climate change for the land forces of Europe. In its first part, this paper will assess how climate change constitutes a standalone security threat, both from a humanitarian and from a geopolitical standpoint. In its second part, this paper will examine the climate change-induced challenges and constraints faced by European land forces with regards to their personnel, equipment and infrastructure. Finally, a third section will offer some recommendations that could help these forces address, as well as mitigate, the challenges produced by climate change.

1. Climate Change as a Security Threat

The impact of climate change on the global security landscape is growing, thereby presenting European land forces with new threats. Europe is increasingly experiencing

climate change-related extreme weather events, such as floods and wildfires, that affect the human and economic security of its citizens (NATO, 2024). Such events are predicted to continue to worsen, with regions such as the Sahel or the Middle East being particularly impacted (Barry, 2022; NATO, 2024). Climate change threatens the populations of certain regions to such an extent as to cause migratory movements and displacements, as well as social unrest (European External Action Service, 2023). Such mass-migration movements can destabilise states and regions, thereby exacerbating competition or tensions between them. As is the case with all conflicts, women, children, as well as groups and minorities that are already vulnerable, stand to be particularly impacted by extreme weather events and their consequences (NATO, 2024). Similarly, economic inequality is further exacerbated by climate change, which in turn weakens social cohesion and trust in institutions. The global disorder that climate change is already enabling comes at a time where addressing this change is still a politicised issue, thereby further weakening Europe and the West's ability to address the security threats brought about by climate shifts.

As extreme weather events are predicted to continue to take place worldwide and increase in severity, they are impacting the political security of particularly vulnerable regions, as well as worsening existing conflicts (Barry, 2022). Through events such as droughts or resource scarcity, climate change disrupts the structures and institutions that underlie stability and human security (Scott & Khan, 2016). The resulting weakening of states and of their institutions stands to destabilise the already-fragile governments of the regions that are most vulnerable to climate change-induced insecurity. This means states will be less capable of meeting the needs of populations impacted by extreme weather events.

Climate change intensifies and exacerbates strategic competition, with implications for regional security and state resilience (NATO, 2024). States and populations, especially those most exposed to extreme weather events, are vulnerable to strategic predation from other actors, both state and non-state (Ashbridge, 2024). The instability and the resource scarcity brought about by climate change can be instrumentalised by armed groups and organised crime networks, thereby further weakening states and worsening the insecurity of populations (European External Action Service, 2023). Diverging narratives and inaction on the part of international institutions, with regards to climate change, are undermining their resolve and the effectiveness of their response (NATO, 2024). These shortcomings further erode the trust of people in the international order and undermine the values and interests of Europe.

However, it remains in Europe's interest to assist those populations and states that are most vulnerable to climate change. Extreme climate shifts can trigger or exacerbate inter and intra-state conflicts, as well as weaken the ability of states to provide for their people's

security (Barry, 2022). Therefore, the missions of European land forces will increasingly be defined by the entangled risks and consequences of climate change (Ashbridge, 2024).

Europe's significant contribution to the greenhouse gas emissions that cause climate change constitutes an ethical imperative for the continent to assist other states in countering the impacts of extreme weather events (Barry, 2022). Furthermore, security considerations require European states to assist those regions that are recovering from conflict in maintaining peace, with the latter being especially vulnerable to climate-related threats and risks (Barry, 2022). Mitigating the impact of climate change will require a multinational response, as well as an unified approach by the international community and its institutions (Ashbridge, 2024). This is both a moral obligation towards fellow human beings, and an imperative to address the security threats that Europe will be faced with if climate change-related insecurity remains unchecked.

2. The Operational Challenge posed by Climate Change

Climate change will continue to define the mission and operational challenges of European land forces. European militaries have already operated in several theatres where climate change is aggravating insecurity, such as Afghanistan, Iraq and the Sahel (Barry, 2022). These theatres have shown the impact that extreme heat has on soldiers, military infrastructure, as well as on the broader conflict dynamics. European land forces will increasingly be required to adapt to hotter temperatures and more extreme, unpredictable operating environments (NATO, 2024).

As extreme weather events continue to grow in frequency and severity, it will become more common for these forces to be called upon to provide humanitarian assistance and disaster response, both in Europe and abroad (Barry, 2022; Tavares da Costa et al., 2024). These forces will increasingly be called upon when national civil protection capabilities and resources are overwhelmed (NATO, 2024; Tavares da Costa et al., 2024). Furthermore, it is both morally desirable and strategically necessary for European land forces to assist the states that are most impacted by climate change. Failing to do so will pave the way for humanitarian crises, conflicts and mass migration that will likely translate, later, into security challenges for Europe. Climate change-induced mass migration to Europe will increase the probability of European land forces having to support the continent's border security (Barry, 2022). All these developments will change the traditional role of armed forces (Scott & Khan, 2016). In an era of renewed 'great power' competition, this means European land forces may see their combat readiness, and the means available to them for war-fighting missions, decrease as a result of climate change-related missions and constraints.

Climate change, and the extreme weather events it produces, introduces new constraints and requirements for land forces and their equipment. With regards to equipment, extreme weather leads to higher maintenance and repair costs, decreases the availability and effectiveness of equipment and augments the risk of accidents caused by said equipment malfunctioning (NATO, 2024). For instance, according to the Canadian Ministry of Defence, armoured vehicle crews in Afghanistan that operated in excessively high temperatures struggled to remain effective after one to two hours (NATO, 2024). The solutions used to mitigate these effects, although necessary, require energy that places additional demands on the overall armoured vehicle power requirements (NATO, 2024).

Climate change-induced rises in the maintenance, repair and overhaul of equipment also divert the resources available to forces (Tavares da Costa et al., 2024). These factors, in turn, have an impact on the combat readiness and force projection capabilities of land forces. These forces mostly operate specialised equipment that has a long life-cycle, and developing new equipment adapted to current climate realities can take years, if not decades (European External Action Service, 2023). Future weapon systems will have to be developed with these weather-related requirements in mind. Until then, extreme weather will continue to strain soldiers, as their equipment remains largely unadapted to the climate that forces are increasingly exposed to.

Adapting to ever more extreme weather conditions requires land forces to turn towards energy-hungry solutions. For instance, air conditioning for United States soldiers deployed in Iraq and Afghanistan is estimated to have cost 20.2 billion USD in 2011 (NPR, 2011). These costs were the result of the logistical effort required to transport the necessary fuel for air conditioning across long distances in areas that had little to no suitable infrastructure (NPR, 2011). Transporting this fuel also puts soldiers at risk in certain operational environments, requiring additional protection that further strains the resources and overall capabilities available to land forces.

If these necessary changes are not made, then the impact of climate change on land forces' personnel and infrastructure will prove increasingly challenging. Military personnel at all levels of land forces may have their health, safety and overall wellbeing deteriorate as a result of climate change-induced extreme weather circumstances (Tavares da Costa, 2024). For instance, heat-related illnesses during deployment and training negatively impact both the health of military personnel and the readiness of a force (Tavares da Costa et al., 2024). When land forces are deployed, access to fresh water, as well as the provision of medical services, also stand to be impacted by extreme weather (NATO, 2024). As a result, these strains can prove detrimental to the mental health and morale of a force (NATO, 2024). Land forces are particularly impacted by extreme weather conditions, such as heat. A 2022

analysis from the South Korean armed forces found that 90.3% of heat injury cases occurred in the Army, when compared with other branches such as Air, Maritime, and Marine corps (NATO, 2024). This is also a result of the absence of larger platforms for the soldiers of land forces, such as aircrafts or ships, which can provide power for regulating exposure to extreme weather.

Similarly, the training of military personnel is directly affected by extreme weather, which can cause operational disruptions and compromise training and combat-readiness (NATO, 2024). Lastly, military infrastructure will increasingly be threatened by climate change (Barry, 2022; Scott & Khan, 2016). Extreme weather threatens military installations, such as bases, and complicates the logistics of keeping these installations operational (Barry, 2022). This stands to have grave implications for the operational readiness and effectiveness of a force, and increases costs for militaries, as the maintenance and replacement of assets becomes more regular and extensive (Tavares da Costa et al., 2024). As such, climate-related challenges will make it ever more difficult and costly for European land forces to maintain the necessary level of operational readiness. For the commanders of these forces, the impact of climate change on their soldiers and equipment, amongst others, calls for flexible and adaptive solutions.

3. Recommendations for European Land Forces' Commanders

It is urgent for European land forces and their commanders to take into account the threat of climate change when it comes to their practices, training and strategic thinking. If the impact of climate change on these forces is to be adequately understood and addressed, it is also necessary to perceive this phenomenon as an immediate threat (Tavares da Costa et al., 2024). Although European land forces will increasingly be a part of the solution in responding to the effects of climate change, they also contribute to it, through their emissions of greenhouse gases, for example (Scott & Khan, 2016; Tavares da Costa et al., 2024). Therefore, there is an ethical imperative for these forces to reduce their impact on the environment where possible (Scott & Khan, 2016). Doing so will require raising awareness and changing the operational practices at all of a forces' levels.

The necessity of raising awareness about the immediate threat that is climate change extends to the strategic thinking that will be required of European land forces' commanders. Commanders should understand the impact of climate change on military operations, on the personnel under their command and on the operational effectiveness of their forces (Barry, 2022). Similarly, all military personnel should be aware of how climate change impacts their areas of operation and the local populations (Barry, 2022). Climate change will continue to alter land forces' operating conditions, such as the terrain or weather patterns, so, in turn,

developments must be adequately reflected in the training of a forces' personnel (Tavares da Costa et al., 2024). Finally, implementing these changes in practice and in the strategic culture will require informed leadership of the part of commanders. Indeed, it is these commanders that are ideally placed to upend the organisational barriers and tackle old practices, for the threat of climate change to be rapidly and completely addressed (Tavares da Costa et al., 2024).

The efforts of European militaries to adapt to, as well as combat, climate change, should be part of a broader European cooperative endeavour in defence matters (Ashbridge, 2024). Firstly, European land forces should strive to implement a common strategic culture and institutional framework that defines climate change as a present threat that must be dealt with and mitigated by Europe's militaries. International bodies such as the North Atlantic Treaty Organisation (NATO), or the European Union (EU), constitute existing frameworks for multinational cooperation that can be employed to find common solutions to climate change at a military level (NATO, 2024).

The climate change threat provides European land forces with a further incentive to harmonise their capabilities, requirements and strategies, thereby strengthening their cohesion and effectiveness. In addressing this challenge, it is desirable that a dialogue between European land forces be facilitated and encouraged. Commanders have a crucial part to play in implementing and strengthening these exchanges.

Furthermore, addressing climate change presents Europe's militaries with an opportunity to modernise their forces and further European cooperation in defence procurement (Tavares da Costa et al., 2024). As Europe strives for strategic sovereignty, cooperation at the operational and procurement levels could largely offset the costs incurred by European militaries because of climate change. For instance, by applying common requirements for energy efficiency, or by jointly developing and purchasing equipment that is adapted to more extreme weather conditions, European militaries can reinforce Europe's defence sector and strategic sovereignty (Tavares da Costa et al., 2024). By harmonising their requirements and strengthening interoperability, these militaries can both reduce their contribution to climate change and be better prepared to face its effects (European External Action Service, 2023). As such, existing multilateral frameworks should be utilised and expanded upon to enable the sorts of exchanges and cooperation necessary for European land forces to jointly rise to the challenge of climate change.

Conclusion

Climate change will continue to produce more extreme weather conditions that will shape

the mission of European land forces, as well as their operations in the field. As such, this change is increasingly becoming a threat in and of itself, not just a threat multiplier. In those regions most vulnerable to climate change, such as the Sahel, this phenomenon is producing human and political insecurity, which in turn has impacts such as mass migration. In Europe, climate change is leading to more extreme weather events that are requiring European land forces to take part in humanitarian operations and disaster relief. Both trends redefine the role and missions of these land forces and put stress on their combat-readiness. Climate change is continuing to strain the personnel, equipment and infrastructure of European land forces, thereby impacting their effectiveness and operational capabilities.

In the short to medium-term, the impacts of climate change will prove costly for European land forces, which will struggle to retain current levels of operational readiness, if left without contributing increasing means. As militaries and their operations contribute to climate change, it is also necessary for these land forces to address their contribution to the phenomenon of climate change.

Operational effectiveness need not be compromised in the name of efforts aimed at tackling climate change (Tavares da Costa et al., 2024). The commanders of European land forces should raise awareness about these issues and integrate the notion of climate change as a threat into their strategic thinking. These land forces can unite and cooperate to exchange best practices regarding operating in extreme weather conditions. They can also adopt the same requirements with regards to their equipment and weapons systems, so that these are adapted to the extreme weather land forces will continue to face. This is an opportunity for European defence to jointly develop and produce equipment that corresponds to new climate realities. Climate change impacts all states and, as such, responding to it needs to be a pan-European initiative.

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