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Global Security Challenges of Climate Change

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Introduction

2018 has been the year of meteorological records, and, at the time of writing this report, we're only halfway through the year. Drought, heatwaves, and wildfires have struck the northern hemisphere at rates and intensities well outside the range of normal weather, and the year is on track to become the hottest La Niña year ever recorded (WMO 2018). Although it is not possible to attribute these or any other specific weather events to anthropogenic climate change, they are consistent with the long-term trend of warming as a result of increased concentration of greenhouse gases in the atmosphere.

The 2018 extremes followed in the wake of another extreme 'event': the European migrant crisis. In 2015, more than 1 million migrants crossed the Mediterranean Sea in seek of refuge in Europe, and although the numbers have since dropped significantly, they remain well above historical levels. The dominant cause of the upsurge in asylum seekers was a combination of escalating levels of violence in key sending countries (notably Syria, Iraq, Afghanistan, and Nigeria) and increased opportunities for migration by means of human trafficking. Some have also linked the growth in forced displacement with climate change, either directly (Missirian and Schlenker 2017) or indirectly via climatic drivers of social unrest (Kelley et al. 2015).

A third recent series of events that have informed thinking about climate security is the 2011 wave of uprisings across the Middle East and North Africa, commonly referred to as the Arab Spring. The outbreak of protests in Tunisia and Egypt corresponded with a peak in international prices of core food commodities. For Egypt, the world's largest importer of wheat, the increasing cost of food imports eventually led the regime to cut the comprehensive consumer subsidy program, placing excessive burden on the urban poor (Johnstone and Mazo 2011). A contributing cause of the peaking food prices was major loss of harvest and resulting export bans among major grain producers, due to extreme droughts and heatwaves during the previous growing season (Sternberg 2012).

It is clear that climatic events can have immediate impacts on human security (health, livelihood, food security), but does climate change also constitute a direct threat to peace and societal stability? In this report, I discuss three aspects of relevance to the larger climate security debate: (i) the evident concentration of armed conflict in environmentally fragile regions; (ii) the scientific evidence base for a causal relationship between adverse climatic changes and armed conflict; and (iii) the role of climate-related security threats in a comparative perspective. I end by briefly reflecting on the reverse association, how armed conflict affects climate change vulnerability.

1. Climate Zones and Conflict Risk

Armed conflicts cluster in space. In the modern, post-Cold War period, large parts of the populated earth have been spared large-scale violent conflict. Other regions have been less privileged. Contemporary civil conflicts are disproportionately located in dry and tropical climates close to the Equator. Since 1950, the rate of civil conflicts has been ten times higher among countries in the dry climate zone than the continental zone (Buhaug et al. 2013).

The geographic clustering of contemporary conflicts is clearly discernible in Figure 1; central and southern parts of Africa as well as concentrated parts of Asia and Latin America have high to very high densities of conflict events. In contrast, North America, Oceania, and northern Eurasia have largely escaped organized, deadly political violence. In terms of lethality of conflict, some clusters are vastly more destructive than others. In 2017, the wars in Afghanistan, Iraq, and Syria accounted for more than three-quarters of all recorded civil conflict-related battle deaths, according to the Uppsala Conflict Data Program, UCDP (Pettersson and Eck 2018).

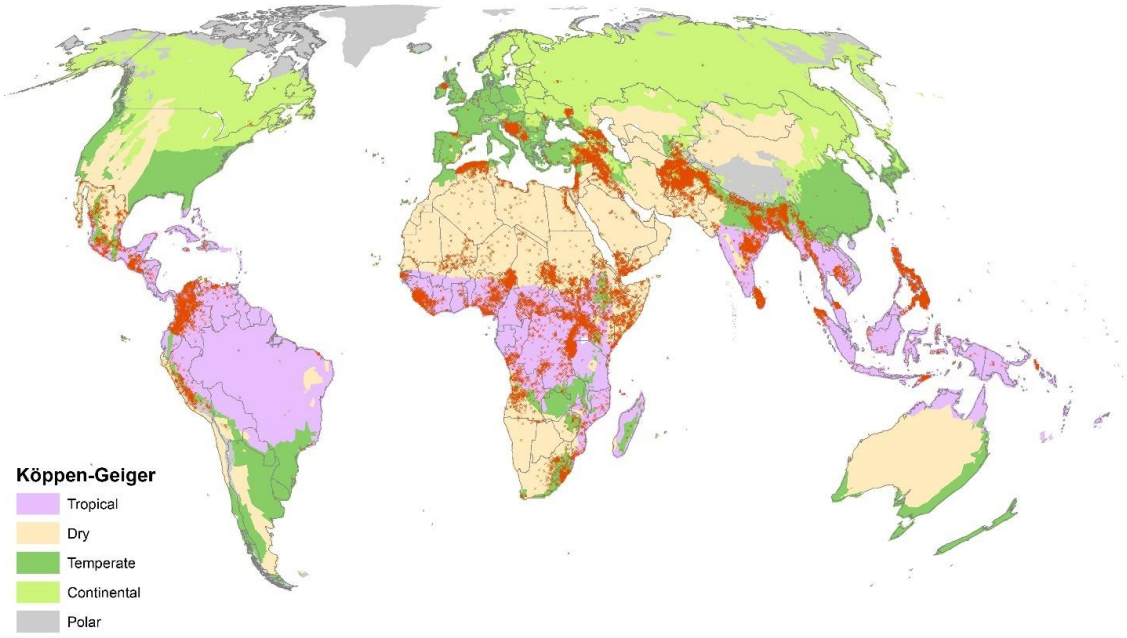

Figure 1. Location of deadly armed conflict events, 1989–2017[1]

[1] Data source: UCDP Georeferenced Event Dataset (Sundberg and Melander 2013). The map includes all deadly battle events in civil conflicts, non-state conflicts, and one-sided violence since 1989 (red dots; N=143,617 events), imposed on the Köppen-Geiger

One obvious explanation for the clustering of civil conflicts in certain climates is that it reflects – and is a product of – a similar spatial pattern of key risk factors (Buhaug and Gleditsch 2008). Country-specific factors that are robustly associated with increased conflict risk include low level of economic development, fragile and non-democratic governance, natural resource wealth, and a large population (Hegre and Sambanis 2006). Neither of these features is distributed completely by random. For example, virtually every country in the lower latitudes is classified as a 'developing economy' by the International Monetary Fund, and the poorest countries are also more populous and less politically stable on average than other states. Similarly, the 'bottom billion' controversially identified by Paul Collier a decade ago (Collier 2007; see also Carr-Hill 2013) – inhabitants of countries that are not only poor, but also stagnating or declining – are mostly located around the Equator and particularly in sub-Saharan Africa. Some also see the long-term variation in trajectories of growth and development across regions as a result of local climatic and environmental conditions (e.g., Acemoglu and Robinson 2012; Gallup, Sachs, and Mellinger 1999; Nordhaus 2006).

A complementary explanation for the distinct conflict clusters may be that they are results of spillovers from violence in nearby countries. Such a 'bad neighborhood' effect may materialize as a consequence of refugee flows (Salehyan 2008), transnational ethnic linkages (Cederman, Girardin, and Gleditsch 2009), external military intervention (Kathman 2010) or porous borders. We also know that conflict begets conflict through human and material destruction, essentially pushing some countries and regions into a 'conflict trap' (Collier et al. 2003; Gates et al. 2012).

But if conflicts cluster in certain climates, could climate itself be a cause of conflict? No study to date has investigated the relationship between climate, geography, and armed conflict in a rigorous and systematic manner. In fact, neither 'climate' nor 'temperature' features in the index of prominent modern surveys of the causes of war, such as Blainey (1988), Gat (2008) or Suganami (1996). However, the empirical relationship between geography and economic development has been subject to considerable scientific scrutiny. The widely-cited study by Gallup, Sachs, and Mellinger (1999) notes a pronounced geographical clustering of countries with low GDP per capita in the tropics. The disparity in overall economic productivity between non-tropical and tropical countries (3.3:1) is even greater for agricultural productivity (8.8:1). The geographical limitations of agriculture in the tropical zone apply equally to humid and arid tropics.

Without subscribing to environmental determinism, it seems fair to assume that armed conflicts cluster in regions with more challenging environmental conditions partly because these conditions have contributed to hindering long-term societal development and facilitated colonial exploitation, and partly because the combination of marginal environments and low socioeconomic development make local social systems more vulnerable to climatic extremes.

The next section briefly reviews the main proposed causal pathways between climatic changes and conflict risk.

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climate zone classification. Due to the overwhelming nature of the ongoing Syrian civil war, the geocoding of that conflict is not complete and thus excluded from the map.

2. Climatic Changes and Conflict Risk

The spatial association between climate zones and conflict prevalence displayed in Figure 1 is remarkable, but the aggregate temporal trends in global average temperature and armed conflict are less obviously connected. During the last three decades, when the warming trajectory has become particularly notable, the global number of battle-related deaths from armed conflict has stabilized at the lowest level observed since World War II (Figure 2). If anything, it would seem that warming is associated with an overall decline in conflict casualties. Of course, such a plot cannot be used to establish causal relationships (or lack thereof), and attempts to make conflict projections based on simple extrapolation of such trends should be treated with much care, but if anything the figure implies that conflict-affected countries have become better at curbing the level of violence. Could climate change reverse this trend?

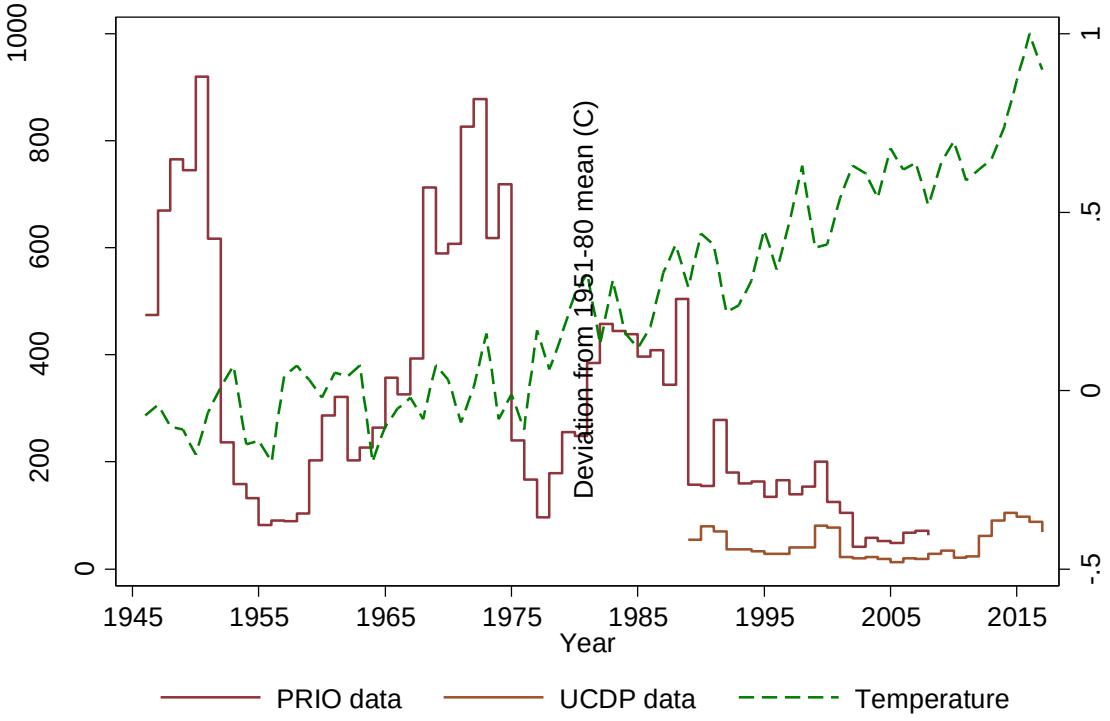

Figure 2. Trends in global warming and armed conflict severity, 1946–2017[2]

In 2007, three related events jointly provided a strong impetus for increased investments in scientific research on the climate-security nexus. The first was the release of the UN Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4), which provided the most comprehensive assessment of the state of the art to date on anthropogenic climate change and its likely consequences. The Working Group II contribution to AR4, on Impacts, Adaptation, and Vulnerability, did not explicitly and rigorously consider armed conflict risk (in line with previous reports but unlike the most recent AR5, see Adger et al. 2014). Instead it contained scattered statements about possible negative

2.[2] The figure shows 'best estimate' of global yearly number of battle-related deaths from armed conflict (1946–2008) from PRIO (Lacina and Gleditsch 2005) (dark brown solid line); global yearly 'best estimate' number of battle-related deaths from armed conflict (1989–2017) from UCDP (Pettersson and Eck 2018) (light brown solid line); and global yearly average combined land-surface air and sea-surface water temperature anomalies, compared to the global 1951–80 mean, from NASA (green dashed line). The PRIO and UCDP battle deaths datasets use similar definitions of armed conflict, but UCDP adopts a more stringent methodology for classifying information as credible, resulting in more conservative estimates.

impacts on societal stability and peace, substantiated primarily by grey literature (Gleditsch and Nordås 2014), effectively revealing a glaring need for more peer-reviewed evidence on the subject.

Second, in April 2007, the UN Security Council held its first ever debate on climate change as a security threat on the initiative of the UK. In her introductory remarks to the debate, then UK Foreign Secretary Margaret Beckett made the connection between climate change and conflict crystal clear: "What makes wars start? Fights over water. Changing patterns of rainfall. Fights over food production, land use" (Lederer 2007). The scientific foundation for this observation remained unclear, however.

The third important event during 2007 was the Norwegian Nobel Committee's decision to give the Nobel Peace Prize to the IPCC and former US Vice-President Al Gore for their work to raise awareness about man-made climate change. As stated in the Nobel Committee's press release announcing the award, "[e]xtensive climate changes may alter and threaten the living conditions of much of mankind. They may induce large-scale migration and lead to greater competition for the earth's resources. Such changes will place particularly heavy burdens on the world's most vulnerable countries. There may be increased danger of violent conflicts and wars, within and between states." The Nobel Peace Prize was a final reminder of the urgency of the issue and served as a manifestation that the climate security nexus had moved high on the international political agenda and that the debate had run ahead of the scientific evidence base.

Is there a direct relationship?

In the decade that has passed since 2007, the collection of academic peer-reviewed studies on climate change and violent conflict has expanded rapidly. In addition to individual studies published in top general science journals that have generated considerable media attention (e.g.,

(Buhaug 2010; Burke et al. 2009; Hsiang and Burke 2013; O'Loughlin et al. 2014), the research community has produced special issues dedicated to climate and security in leading disciplinary journals, such as the Journal of Peace Research (2012), Political Geography (2014), Geopolitics (2014), and Current Climate Change Report (2017). Overall, this body of research has provided limited evidence that violent conflict is related to climatic changes in a direct and general manner (see Adger et al. 2014 for a comprehensive assessment).

Acknowledging that climatic changes and events are unlikely to influence peace and stability directly and in a sweeping manner, researchers have increasingly shifted their attention toward more plausible indirect pathways and sought to identify conditions under which a climate effect on conflict can be observed. Unsurprisingly, much of this research has focused on Africa, or limited areas within the continent, because of an anticipation that developing countries are especially vulnerable to the impacts of extreme weather events and environmental degradation. Three broad pathways are generally seen as particularly plausible:

Indirect pathway I: Producer shocks

The first links climatic changes with political instability and conflict via macro-economic contraction. In most developing countries, agriculture remains the dominant economic sector for employment and income. Where water availability is scarce or irrigation systems are limited, loss of rainfall can have dramatic impacts on the local economy. Heat-induced stress and destruction of crops due to flooding and saltwater intrusion are other common ways in which extreme weather exerts a negative impact on productivity. Early investigations into this pathway suggested that rainfall patterns indeed are strongly linked with civil conflict risk (Miguel, Satyanath, and Sergenti 2004) although more recent research provide a more mixed impression

(Buhaug et al. 2015; Ciccone 2011; Koubi et al. 2012; von Uexkull et al. 2016). However, much of this research is too aggregated to reveal how climatic changes affect household- and community-level economic security, and more research is needed to better understand the observed variation in environmental sensitivity among agricultural economies.

Indirect pathway II: Consumer shocks

A second commonly proposed causal pathway views conflict as a possible outcome of weather-induced food price shocks. So-called 'food riots' are not a new phenomenon, but they received increased scholarly attention after the Arab Spring uprisings of 2011, which broke out in the wake of rapidly increasing food prices. For Egypt, the world's largest importer of wheat, the doubling of the international price of wheat meant that the government could no longer sustain its expansive domestic price subsidies, resulting in a tripling of the price of bread in local markets that stirred widespread protest (Sternberg 2012). A number of studies have since uncovered statistically significant correlations between increasing food prices and unrest risk (see Rudolfsen 2018 for a review). The effect appears strongest for low-intensive social events such as demonstrations and riots, most of which never escalate to the level of armed conflict.

While the link between food prices and social unrest is important in its own right, the role of weather and, in the longer term, climate change, in influencing food-related conflict remains less well understood. Historically, climate variability has a modest influence on fluctuations in the international price of food commodities, which instead are driven largely by increasing transportation (oil) and fertilizer costs, global financial downturns, excessive hoarding and market speculation, and more recently, demand for biofuel production (Tadesse et al. 2014). For food markets that rely mostly on local products, the effect of weather shocks will be more pronounced. However, even if conflict may break out during peaking food prices, the protesters are likely to be motivated by other political and economic issues (Sneyd, Legwegoh, and Fraser 2013), implying that stabilizing food prices are unlikely to solve underlying grievances in society.

Indirect pathway III: Forced migration

A third possible pathway between climatic changes and armed conflict involves forced migration. Extreme weather events and degrading environmental conditions may force people on the margins to relocate and compete for natural resources, public goods and employment opportunities with host populations, thus escalating latent social conflict and intercommunal animosity. This pathway has been proposed as a contributing cause of the Syrian civil war (Kelley et al. 2015), although the role of climate change in this case is disputed (e.g., Selby et al. 2017).

Due to challenges with ascribing human mobility to specific drivers (see Black et al. 2011 for an insightful discussion) and, consequently, limited data on 'environmental migration', this mechanism has not been subject to the same level of replicable, generalizable research as the other pathways (though see Reuveny 2007). In a recent review of the literature, Brzoska and Fröhlich (2016) conclude that there is "limited evidence both for the proposition that climate change will lead to major population movements as well as that modern migration movements generally trigger violent conflict."

Research that focuses specifically on refugee flows – for which there is good data – suggests an increased risk of conflict diffusion (Fisk 2014; Salehyan and Gleditsch 2006), although it is not obvious that individuals seeking new economic opportunities as a consequence of climate-induced livelihood loss will have the same destabilizing effect as the arrival of traumatized refugees, some of whom may be armed and some of whom may have an aspiration to mobilize new warriors and continue the struggle. Gaining better insight into how environmental and climatic factors interact with other drivers in shaping human mobility (how, when, where) and its knock-on security impacts is a key priority for future research.

It should be mentioned that almost all relevant empirical studies of the three pathways discussed here focus on climate variability, or short-term climatic changes, typically ranging from specific extreme weather events to yearly deviations from long-term mean conditions. Owing to the difficulty of disentangling unique effects of long-term processes and complex systems, social responses to gradual but permanent environmental changes remain poorly understood.

Overall, the more nuanced approach adopted by recent scholarship, investigating the possibility of indirect and conditional climate effects on conflict risk, have not succeeded in uncovering a powerful and 'statistically significant' effect on conflict risk. Results seem to be stronger and more robust for less severe forms of conflict (communal violence, urban riots) than for large-scale civil war, and there is also more consistent evidence that weather fluctuations affect conflict dynamics (severity, duration) than outbreak of conflict in previously stable societies. However, this academic field is still in its infancy, and many research questions remain to be studied or should be revisited using more appropriate analytical tools, and emerging consensus around specific links (e.g., between rising food prices and urban riots) needs to be validated through in-depth case analysis (see Theisen (2017) for an up-to-date review of the scientific literature).

3. Climatic Drivers in Comparative Perspective

The limited weight of evidence for a causal effect of climatic changes on contemporary violent conflicts should not be used as justification for dismissing the relevance of climate change for societal security altogether. First of all, available research is generally unable to shed light on more complex, long-term relationships between nature and society, which cannot be detected using conventional statistical methods. Second, climatic changes may exhibit a non-linear influence on social systems, permitting coping and adaptation only up to a certain point, beyond which a transition in behavior may occur – analogous to the final straw that broke the camel's back. As the atmosphere heats up, it will increasingly generate weather phenomena beyond the range of experienced conditions, potentially resulting in cascading and self-reinforcing impacts on ecosystems and societies (see Steffen et al. 2018).

On the other hand, social systems are remarkably inert, and just like today's weather usually constitutes a good prediction of what to expect tomorrow, major sites of armed conflict and their causes are unlikely to change dramatically over time. The best available scientific evidence suggests that climatic impacts on conflict risk to date has been modest, compared to factors such as intergroup inequalities and discrimination, political corruption, weak rule of law, a stagnating economy, a large population, conflictual history, and violent neighborhood. Using the past half century as a guide, this suggests that political factors are likely to remain dominant causes of armed conflicts also in the foreseeable future.

Not everybody would agree with this assessment, however. Indeed, there is a tendency among think-tanks and NGO communities to shy away from discussing climate-driven security threats in relative terms. Often, this occurs tacitly, where reports describe how climatic changes may amplify extant risks and outline ways in which climate-driven stressors could translate into various security threats without discussing the role of non-climatic drivers, let alone considering the relative significance of different risk factors. Others are more explicit in their rejection of a comparative approach. Indeed, one of the pioneers in environmental security research admits that he tries to "avoid entangling [himself] in the metaphysical debate about the relative importance of causes", due to the intractable task of separating between causal factors (Homer-Dixon 1999, p. 7). Likewise, Werrell and Femia (2015) argue that "we need to move away from [..] 'ranking' threats to national security" because of "the complex way in which climate change affects the broader security landscape." I disagree.

The complexity of nature-society interactions, playing out across various temporal and spatial scales and involving feedback loops, requires careful analytical treatment and demands sober conclusions, but it should not prevent us from seeking to gauge the relative importance of contributing factors. As scientists, we have an obligation to offer the best and most rigorous evidence-based insights possible in order to inform the best possible policy. Avoiding efforts to estimate the relative importance of various conflict drivers is not compatible with that ambition, and failing to identify the main causes of social discontent and violent conflict across contexts will hamper the formation of effective peacebuilding policies. Focusing only on climate-related security threats and formulating policy advice that ignores non-climatic security threats not only risks diverting funds and attention away from where they are most effective, it could potentially lead to counter-productive policies (e.g., Hasegawa et al. 2018).

3. Concluding Remarks

Extreme weather events pose real threats to human security and wellbeing, and climate change is likely to make things worse, especially among societies with people presently living on the margins and lacking necessary skills and resources to cope on their own. So far, however, there is little evidence that climatic changes are an important direct cause of armed conflict, and this policy brief has argued that the dominant causes of violent conflict in the years to come are likely to remain political in nature, related to issues such as equality and representation, rule of law, minority protection, and economic wellbeing. Climate change may affect some of these drivers, notably those tied to agricultural production and livelihood security, and hamper development more generally, but heatwaves, crop failures, and weather-induced material destruction are unlikely to result in violent conflict in the absence of other prevailing conflict-promoting conditions. Ongoing armed conflicts, from Afghanistan to Yemen, are fundamentally political contests that require political solutions.

While science is unclear with regard to the true impact of climatic changes on armed conflict, the reverse association, from conflict to climate impacts probably cannot be overstated. Armed conflict is development in reverse (Collier et al. 2003; Gates et al. 2012) and "the biggest threat to human development" (The Millennium Development Goals Report 2015, p. 8). Accordingly, the single most important strategy to improve local climate resilience and adaptive capacity in conflict-affected societies is to secure a lasting end to fighting, which is necessary in order to attract long-term planning and investments.

Over the past decades, the world has experienced remarkable progress on central human development indicators, for example: a reduction by more than half in the number of people living in extreme poverty since 1990; a reduction by almost half in the number of undernourished people; a reduction by more than half in the under-five mortality rate; a reduction by more than half in the mortality rate of malaria; and considerable improvement in youth literacy rate. As evidenced in Figure 2 above, the world is also becoming less violent, despite recent and horrible setbacks in Syria, Yemen, Northern Nigeria and elsewhere.

These positive developments should not be an excuse for inaction, but it is important not to ignore success stories. While climate change may be the greatest challenge yet to face mankind, we are also better placed than ever before to overcome this challenge. The international community, spearheaded by dominant actors such as the United Nations and the European Union, should increase its investments in finding lasting solutions to ongoing conflicts and avoiding new ones from breaking out. The best way to minimize the security threat imposed by future climate change is to address, and resolve, the dominant causes of contemporary wars.

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