THE WORLD CLIMATE AND SECURITY REPORT 2021

A Product of the Expert Group of the
INTERNATIONAL MILITARY COUNCIL ON CLIMATE AND SECURITY

JUNE 2021

The International Military Council on Climate and Security (IMCCS) is a group of senior military leaders, security experts, and security institutions across the globe dedicated to anticipating, analyzing, and addressing the security risks of a changing climate. The IMCCS is co-led by:

IMCCS Secretary General
The Honorable Sherri Goodman
Former Deputy Undersecretary of Defense (Environmental Security)
US Department of Defense
Senior Strategist, The Center for Climate and Security

IMCCS Chair
General Tom Middendorp (Ret)
Former Chief of Defence of the Netherlands
Senior Associate Fellow, Clingendael Institute

The IMCCS Expert Group consists of IMCCS leaders committed to driving analysis, policy and communications on climate and security, including through the development, publication and endorsement of the World Climate and Security Report, as well as other timely analysis driven by demand signals from the IMCCS. The IMCCS Expert Group currently consists of representatives from four institutions:

• The Center for Climate and Security (CCS), an institute of the Council on Strategic Risks (CSR)
• The Planetary Security Initiative at the Netherlands Institute of International Relations (Clingendael)
• *The Hague* Centre for Strategic Studies (HCSS)
• The French Institute for International and Strategic Affairs (IRIS)

CONTENTS

FOREWORD

The World Climate and Security Report (WCSR) 2021 from the Expert Group of the International Military Council on Climate and Security is a global assessment of the security dimensions of a changing climate and effective means to address them. It is intended to inform timely climate and security policy and action, and builds upon the analysis in the first WCSR, released in February 2020.

The world is at an inflection point for global climate action. Since the inaugural WCSR was released at the Munich Security Conference last year, we have witnessed a shift in awareness and growing acceptance of the security dimension of climate. It is now time to turn that awareness into action, driven by a sense of urgency amongst nations and other essential actors to address climate security risks. The key finding of the report is that a transition to more robust implementation of climate security practices is critical.

To that end, in addition to deep dive risk assessments of Europe and sub-Saharan Africa, the second edition of the WCSR provides concrete tools to help policymakers begin that transition, as they work to assess and address climate security risks and opportunities. Key among them is a first of its kind Climate Security Risk Matrix methodology, which evaluates comparative risk among countries. The report also includes a comprehensive assessment of existing climate security practices, and the findings from the second annual Climate Security Risk Perception Survey of top climate security experts. Both will assist policymakers in evaluating and prioritizing next steps needed to both prepare for and prevent climate security risks. Now more than ever, climate change is a critical aspect of national and global security, requiring collective global action to meet this unprecedented threat.

Signed,

The Honorable Sherri Goodman
Secretary General, The International Military Council on Climate and Security

General Tom Middendorp (Ret)
Chair, The International Military Council on Climate and Security

SPONSOR'S NOTE

More and more evidence has demonstrated the serious implications of a changing climate for peace and security. The most immediate effects of climate change occur in terms of internal conflicts, particularly in institutionally fragile contexts. The *World Climate Security Report 2021* you are about to read comprises a compilation of evidence of the security risks and threats induced and amplified by a changing climate. The report underlines that climate change has already had some effect on armed conflict within states and it is expected to rise sharply with rising global temperatures.

It is therefore imperative that risks arising from climate change are systematically integrated into our security assessments as well as into our development, diplomacy, security and defense policies. The best practices and policy recommendations proposed by the report could thereby be of great relevance.

Global security and defense are however not only affected by, but also contribute considerably to, global warming. Even though there have been some attempts to "green" certain aspects of military operations by increasing renewable electricity generation on bases or relying on e-vehicles for civilian duties, defense remains the single largest institutional consumer of hydrocarbons in the world. Moreover, given the long life cycle of military aircraft, warships and other vehicles, defense has locked itself into a hydrocarbon-based dependency for many years to come.

This is why it is imperative that we start now by investing massively into research and development of carbon neutral fuels and propulsion systems for military vehicles on land, sea, and air. Given the dual nature of such investments, they could also have some positive spillover effects to the civilian sector, in particular for the ailing civil aviation industry, looking for less energy intensive and more cost-effective business models after the COVID-19 pandemic.

Although climate change has been part of the security agendas of the EU and NATO for several years, in practice, it is still all too often only dealt with on the sidelines. We should therefore take advantage of the current reflection processes at both organizations to change this and ensure that the rising risks and threats related to climate change are fully reflected in NATO's updated Strategic Concept and the EU's Strategic Compass.

As the world looks to the UN Climate Change Conference (COP-26) this November, we should capitalize on the global momentum of this climate summit and lead strong climate security action in the months ahead. Such action includes significantly increasing investments into R&D for carbon neutral fuels and propulsion systems for military aircraft, ships and other vehicles as well as exploring the setting of voluntary targets to reduce the carbon emissions of militaries in the framework of a "Global Climate and Security Pledge" which could be officially announced at the COP-26.

We are the generation that still can induce meaningful change. Let us not waste this opportunity and let us use all the means at our disposal to leave a more secure and sustainable world to our children.

Let me, last but not least, commend and thank the Expert Group of the *International Military Council on Climate and Security* for the outstanding analysis, the development of a new risk evaluation methodology, the very relevant assessment of currently existing best practices and their interesting recommendations.

François Bausch, Deputy Prime Minister, Minister of Defence, Luxembourg

INTRODUCTION

The COVID-19 pandemic gripped the globe shortly after the release of the inaugural World Climate and Security Report at the Munich Security Conference in February 2020.[1] Despite the immediate and acute challenges of the pandemic, 2020 was an inflection point for global climate action. In the past twelve months the world has witnessed a sea change in the attitudes and urgency amongst many nations and other actors for addressing climate change risks. In the United States, the election of President Joe Biden has led to expanded opportunities to advance climate security internationally, in concert with partners, allies and others around the world.

This 2021 edition of the World Climate and Security Report builds on the regional risk analysis of the previous report to provide concrete climate risk assessment tools, and takes a deep dive into the climate security risks facing many regions of the world. Additionally, it draws lessons from existing climate security practices regarding addressing climate-related security risks, concluding that while a great deal of analysis and planning has been done on the importance and potential of integrating the climate security nexus into development, diplomacy and defense activities, the actual number of implemented measures is small. The transition from concepts of climate security to implementation is critical and urgently needed.

This report is meant to help provide policymakers the tools needed to make the transition, and begin conversations within security sectors as to which steps must be taken to both prepare for and prevent climate security risks in the future.

KEY RISKS AND OPPORTUNITIES

The key risks and opportunities identified in this section are drawn from the full report, and represent an overview of the document's main conclusions and recommendations. On the risk side, the report finds that the world is facing "significant or higher security risks under current circumstances" - importantly, across all regions of the world. On the opportunity side, the report's authors present a "path forward for security cooperation on climate change" that includes moving decisively from acknowledging climate security risks in concepts, plans and strategies to implementing measures to concretely address those risks.

KEY RISKS: Significant or Higher Risks to Security Under Current Circumstances

1   The convergence of climate change and other risks creates compound security threats for states and societies. As the COVID-19 pandemic has so starkly demonstrated, many countries are unprepared to manage multiple crises simultaneously. For example, the confluence of COVID-19 lockdowns, subsequent economic shocks, and climate change-related droughts and flooding increased food insecurity globally, risking greater instability and conflict in many parts of the world.

2   Climate security risks will continue to intensify across all regions, with new disasters hitting before societies can recover from or adapt to the impact of previous ones. Fragile regions of the world will continue to face the most severe and catastrophic security consequences of climate change, yet no region is immune, as demonstrated - for example - by the unprecedented wildfires in the United States and Australia in 2020.

3   Militaries will be increasingly overstretched as climate change intensifies. As the pace and intensity of extreme weather events increases, countries are increasing their reliance on military forces as first responders. While direct climate change effects regularly threaten military infrastructure and threaten to reduce readiness, the most pressing security threats will come from climate change-induced disruptions to social systems.

4   Proposed climate security adaptation and resilience solutions that do not account for local dynamics or integrate perspectives from local communities risk inadvertently contributing to other security risks.

5   The global governance system is ill-equipped to deal with the security risks posed by climate change. In some cases international law is modeled on outdated understandings of climate change impacts and therefore mismatched to future challenges, while in other cases, international law or norms to manage certain climate security risks do not yet exist.

KEY OPPORTUNITIES: A Path Forward for Security Cooperation on Climate Change

1   The world must take advantage of the return of the United States to the international stage on climate issues. The Biden Administration's stated commitment to climate change as a national security priority will present a range of opportunities for allies and partners to advance international cooperation on climate security issues, including at the UN Framework Convention on Climate Change COP26.

2   Increased EU and NATO leadership on climate security issues can set an example for defense and security forces around the world. Given Europe's bold decarbonization commitments, its security services are well placed to lead on climate security risks and resilience. The implementation of the EU Climate Change and Defense Road Map in 2021 is one opportunity for militaries in Europe to better integrate climate change into their planning, including the development of foresight tools and early warning systems.

3   Climate-proofing development for fragile or brittle states should be a priority for conflict prevention. Assistance should be aimed at climate resilience challenges such as water security, food security, and disaster preparedness, as well as 'green recovery' mechanisms that encourage investments in renewable energy and adaptive capacities.

4   The international community should embrace predictive modeling and climate risk assessment methodologies to better prepare for and prevent climate security risks. These types of assessments should be integrated into militaries' regional security plans and force readiness assessments.

5   Security institutions around the globe should act as leading voices urging significantly reduced greenhouse gas emissions, given recent warnings about the catastrophic security implications of climate change under plausible climate scenarios.

6   States and international actors must take urgent action to update and develop international law and mechanisms to include environmental and climate security impacts. In particular, multilateral negotiations to establish currently non-existent international mechanisms to govern climate intervention science, commonly referred to as "geoengineering," should be pursued urgently in multilateral fora.

EXECUTIVE SUMMARY

The World Climate and Security Report 2021 (WCSR 2021) is a globally-focused assessment of the security dimensions of a changing climate and opportunities for addressing them, conducted by the Expert Group of the International Military Council on Climate and Security (IMCCS). The inaugural World Climate Security Report in 2020[2] was anchored by a comprehensive and detailed analysis of climate security around the globe, to include risks and opportunities on a region-by-region basis. Building on that strong foundation, the focus of the WCSR 2021 is providing tools to policymakers tools for addressing those risks and opportunities. The report begins with the findings from the Climate Security Risk Perception Survey, featuring the views of top climate security experts about the most serious climate risks facing the globe at various timescales. This is paired with a first of its kind Climate Security Risk Matrix methodology, which evaluates comparative risk among countries. While these tools help the reader evaluate and compare risks, the subsequent section discusses what can be done: including an analysis of existing "best practices" in climate security policy and interventions. Next, the report presents more detailed regional climate security analysis: deep dives on Africa and the European Union, and shorter "year in review" snapshots of key developments in the United States, the Indo-Pacific, Central America, Brazil and Russia. The report concludes by identifying emerging opportunities in a set of recommendations for collective global action on climate security.

Report highlights include:

Climate Security Risk Perception Survey and Capabilities Game. The IMCCS Expert Group administered a survey in February-March 2021 to assess perceptions of climate security risk among a select group of 57 security and military experts and practitioners from across the globe, most of whom are familiar with climate security dynamics as either practitioners or analysts, and many of whom are IMCCS Participants, Observers or members of its Leadership. Specifically, this survey assessed perceptions on how these changes will affect global security over three time periods: this year (2021), 10 years from today (2031) and 20 years from today (2041).

The most important integrated findings from this survey are that experts anticipate all climate security phenomena presenting severe-to-catastrophic risks by as soon as 2031, with water, ecosystem, health, and national security climate threats posing the most consistent risks. In addition to the survey, the analytical Climate & Security Strategic Capabilities game was introduced in the inaugural WCSR in 2020 and digitized in 2021 for online play. The game's focus on how to build resilience and climate-proof security operations facilitated valuable data collection from climate and security practitioners, and is available for public access via *The Hague* Centre for Strategic Studies (HCSS).

Climate Security Risk Matrix Methodology. The IMCCS Expert Group collaborated on a first of its kind Climate Security Risk Matrix, a data-driven methodology that helps to identify and evaluate climate-driven risk by assessing the probability and consequences of potential hazardous climate change-related events. The risk assessment methodology aims to inform decision-makers by identifying specific targets to prevent, mitigate, or avert the security impacts of climate-related extreme weather events. Moreover, progress in disaster risk reduction can be measured and the effectiveness of certain strategies assessed.

Assessing Best Practices: The Climate-Security-Triangle. There is a growing body of analysis on incorporating climate security measures into development, diplomacy and defense activities (the "3D" approach), but the actual number of implemented measures is still small. Assessing what actually works best is made difficult by this limited sample set of ongoing practices and the inherently context-dependent nature of security. To tackle this challenge, the WCSR 2021 includes a new model, the Climate-Security-Triangle, to map activities impacting climate security outcomes by characterizing to what extent they are driven by climate change, traditional security dynamics or both. This guide to climate security best practices seeks to help policy-makers assess and pursue effective climate security action.

Regional Climate Security Risk Assessments. Since the publication of the WCSR 2020, the IMCCS Expert Group has completed a series of regional reports exploring climate security risks in certain regions in more depth. The WCSR 2021 continues this effort, with deep dives on Sub-Saharan Africa and Europe. It also provides "Year in Review" highlights from select countries and regions that experienced particularly significant climate security related events in 2020.

Recommendations for Enabling Collective Global Action. The final section of the report identifies two paths forward for collective global action. First, new global governance tools need to be developed to cope with the emerging climate security implications for a range of issues in the international domain to include human rights, international maritime law, and geoengineering. Second, the tremendous potential of existing institutions such as the UN Security Council and the Green Climate Fund need to be fully engaged and utilized.

2021 CLIMATE SECURITY RISK PERCEPTION SURVEY

Survey and Analysis by:

Kate Guy
Deputy Director
International Military Council on Climate and Security
Senior Research Fellow
The Center for Climate and Security, an institute of the Council on Strategic Risks

Leah Emanuel
Research Intern
The Center for Climate and Security, an institute of the Council on Strategic Risks
Undergraduate Student
Princeton University

INTRODUCTION

Across the *World Climate Security Report 2021*, we see examples of urgent climate risks that are impacting our world in profound ways. Climate change is no longer a "future" risk that will strike decades from now, but one that is already actively shaping the security environments and interests of all countries. These risks are now on track to increase significantly in response to the Earth's continued warming trajectory. Forecasting surveys offer one tool for security actors to plan for this changing – and increasingly dangerous – future.

For the second year in a row, the IMCCS Expert Group surveyed top climate security experts for their predictions on how and when climate security risks are likely to progress.[3] Their responses offer insightful opinions about which risks this expert community deems the most likely to disrupt security in the years ahead, as well as how these security threats may interact with each other.

The 2021 Climate Security Risk Perception Survey was administered from February-March 2021 with responses from 57 global climate security experts in the fields of defense and intelligence, climate and ecosystem change, and national security. Respondents were asked for their judgement on the severity (low, moderate, high, and catastrophic) of climate-related national security risks in three time periods: today, ten years from now, and twenty years from now. Respondents were then asked to consider the compound impacts of climate security risks by selecting five pairs of climate security categories that, together, will pose the highest risks to security.

For the purposes of this survey, and consistent with the 2020 Climate Security Risk Perception Survey, "climate security" phenomena were defined as "climate change-exacerbated events that affect global security, including the security environment, security institutions or security infrastructure." For full descriptions of each phenomenon, see Appendix 1.

The conclusions in this chapter complement the findings of the climate security risks methodology in the subsequent chapter. Survey results should be used as helpful data points to inform strategy, but not as a blueprint of the future. Most of all, these findings should be read alongside the specific regional analyses in the remainder of this report, which detail the very real and present dangers of our changing climate, and the severe damages these changes are already causing globally.

SURVEY CONCLUSIONS

The survey data below offers a variety of important lessons for security actors and decision-makers looking to build resilience to the climate change phenomena posing significant threats to the safety and stability of populations worldwide.

When compared to the first Climate Security Risk Perception Survey, administered in 2019 and published in the 2020 World Climate and Security Report, respondents continue to highly rate the risks posed by climate change to issues of water security, ecosystem security, and dynamics like natural disasters and human migration. A few categories received higher rankings in 2021 due to current developments and new research, including health security risks and precipitation and oceanic changes. The 2021 Survey also introduced new risk category groupings to better allow for comparisons across types of risk, as captured below.

In summary, the survey responses are clear: within the next twenty years, security risks stemming from climate phenomena will present severe and catastrophic levels of risk. The increase in severity that our expert respondents anticipate over the next two decades is stark. Whether because humanity's continued warming means that climate change impacts will only increase in severity and frequency over time, or due to a pessimism about society's ability to handle the compound effects of these impacts at once, these responses suggest that climate security risks will become more dangerous in the years to come.

Though climate security threats are perceived as generally low-moderate now (2021), respondents see those risks quickly growing in severity over the next decade. Particularly concerning in the short-term will be direct environmental impacts, including precipitation changes, sea-level rise, and more severe natural disasters, as well as the subsequent effects that those impacts will pose to agricultural, economic, and healthcare systems worldwide. This suggests that nations should prioritize investment in disaster-relief and insurance systems, while focusing on significantly bolstering critical infrastructure against increasing vulnerabilities.

Next, this surveyed group of defense and security experts were even more worried about the risks climate change poses to society as a whole than the concerning risks posed to military installations, missions, and institutions. By 2041, human security risks, such as food, water, economics and infrastructure were ranked as even more severe than risks to the "military security" category of threats, including military over-reliance, mission failures, and the degradation of key alliances. This suggests that, while the world's militaries will undoubtedly face growing climate risks, the most pressing threats to security come from the disruption of social systems, rather than the disruption to military assets and missions. This consideration should be understood alongside the finding that "instability within nations" was ranked consistently more severe, across all time periods, than "instability between nations." These findings suggest that to prepare our security establishment to confront climate security risks effectively, traditional training and planning operations will need to shift to account for a broader understanding of threats to society, rather than simply threats to defense assets or threats from other state actors.

Importantly, survey responses also suggest that currently under-studied and novel risks to security stemming from climate change require more attention. Respondents saw the severity of threats, such as the unilateral deployment of geoengineering technologies and the potential for cascading climate-induced disasters, increasing sharply over the next two decades. This poses problems, since the level of understanding and preparation for such threats is exceedingly low within security services, and suggests that nations may not be in a place to confront such novel threats when they arise. To build resilience to such threats, policymakers and defense leaders must collaborate closely with natural and social

scientists to forecast how new risks might evolve, and work to build capacity within their institutions to address them. Finally, these results also offer a new understanding about the intersection of a wide range of risks and the inevitability of their impact on each other. The COVID-19 pandemic has demonstrated the swiftness with which one risk can infiltrate all other aspects of society, impacting the stability of a multitude of societal components. The data gathered here predicts that climate threats will manifest in a similar, compounding manner.

Taken together, the forecasts identified by this survey group of more than fifty climate security experts represent a critical input to planning efforts needed to address climate security threats into the future. While the most severe near-term risks do not always mirror those that will be most severe in the coming years, all will become increasingly pressing security concerns for world leaders to address. They will require deliberate and informed efforts to pivot planning toward increasing the ability to withstand these growing threats, while also confronting the climate challenge head-on to minimize warming to levels safe for humanity.

SURVEY DATA

I. Respondents found **a variety of different climate security phenomena to pose risks**, depending on the time period in question. A few risks are consistently deemed more severe than others, specifically Increased Natural Disasters, Infectious Diseases, Forced Displacement, Precipitation Change, and Population Center Disruptions.

For today (2021), respondents found the top five most pressing climate security phenomenon to be:

1. Increased Natural Disasters;
2. Increased Inequality;
3. Biodiversity Loss;
4. Infectious Diseases;
5. Forced Displacement.

Ten years from now (2031), respondents found the top five most pressing climate security phenomenon to be:

1. Increased Natural Disasters;
2. Precipitation Change;
3. Forced Displacement;
4. Population Center Disruptions;
5. Infectious Diseases.

Twenty years from now (2041), respondents found the top five most pressing climate security phenomenon to be:

1. Extreme Heat;
2. Precipitation Change;
3. Sea Level Rise;
4. Population Center Disruptions;
5. Oceanic Disruption.

II. Across all three time periods, the *categories* **of climate security phenomena that respondents deemed to be the most risky were:** Ecosystem Security; Health Security; National Security; and Water Security.

Risk Rankings, by threat category	2021	2031	2041
1	Water Security	Ecosystem Security	National Security
2	Ecosystem Security	National Security	Water Security, Ecosystem Security
3	National Security	Health Security	Health Security
4	Health Security	Water Security	Food Security
5	Economic Security	Food Security	Infrastructural Security
6	Food Security	Economic Security	Economic Security
7	Infrastructure Security	Infrastructure Security	International Security
8	Military Security	Military Security	Military Security
9	International Security	International Security	Novel Security Risks
10	Novel Security Risks	Novel Security Risks	

III. As soon as ten years from now, respondents expect **a majority of risks will pose high to catastrophic levels of risk to security**. Ten and twenty years from now, respondents expect very high levels of risk along nearly every type of climate security phenomena. See Figures 1-3 below.

IV. When considering how climate security risks will interact with each other to pose compound threats, the group of respondents detailed relationships among nearly all categories of phenomena. The **most interconnected categories of risk** were water security, ecosystem security, economic security, and health security. See Figure 4 below.

Climate Phenomenon Risks by Year

2021 | 2031 | 2041

■ Low ■ Moderate ■ High ■ Catastrophic

Percent of Responses

Climate Phenomena

Climate Phenomenon Risks by Year

2021 | 2031 | 2041

■ Low ■ Moderate ■ High ■ Catastrophic

Percent of Responses

Climate Phenomena

Climate Phenomenon Risks by Year

2021 | 2031 | **2041**

■ Low ■ Moderate ■ High ■ Catastrophic

Percent of Responses vs Climate Phenomena

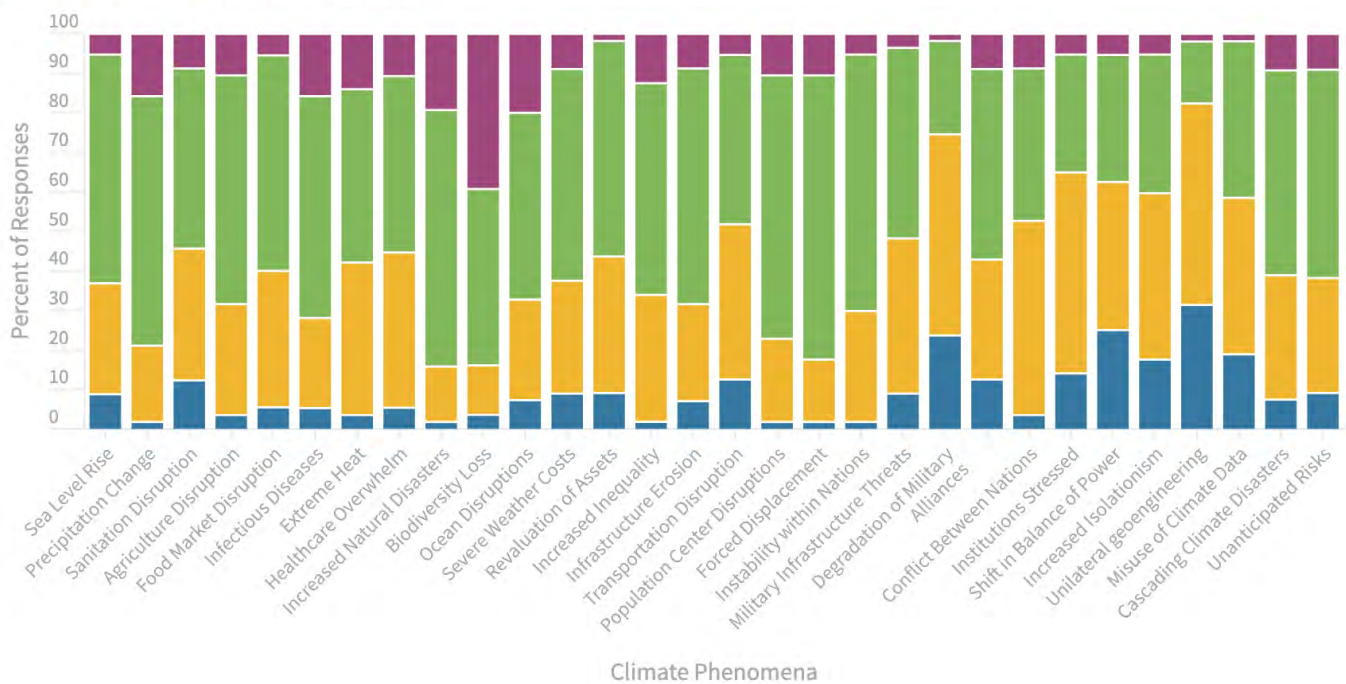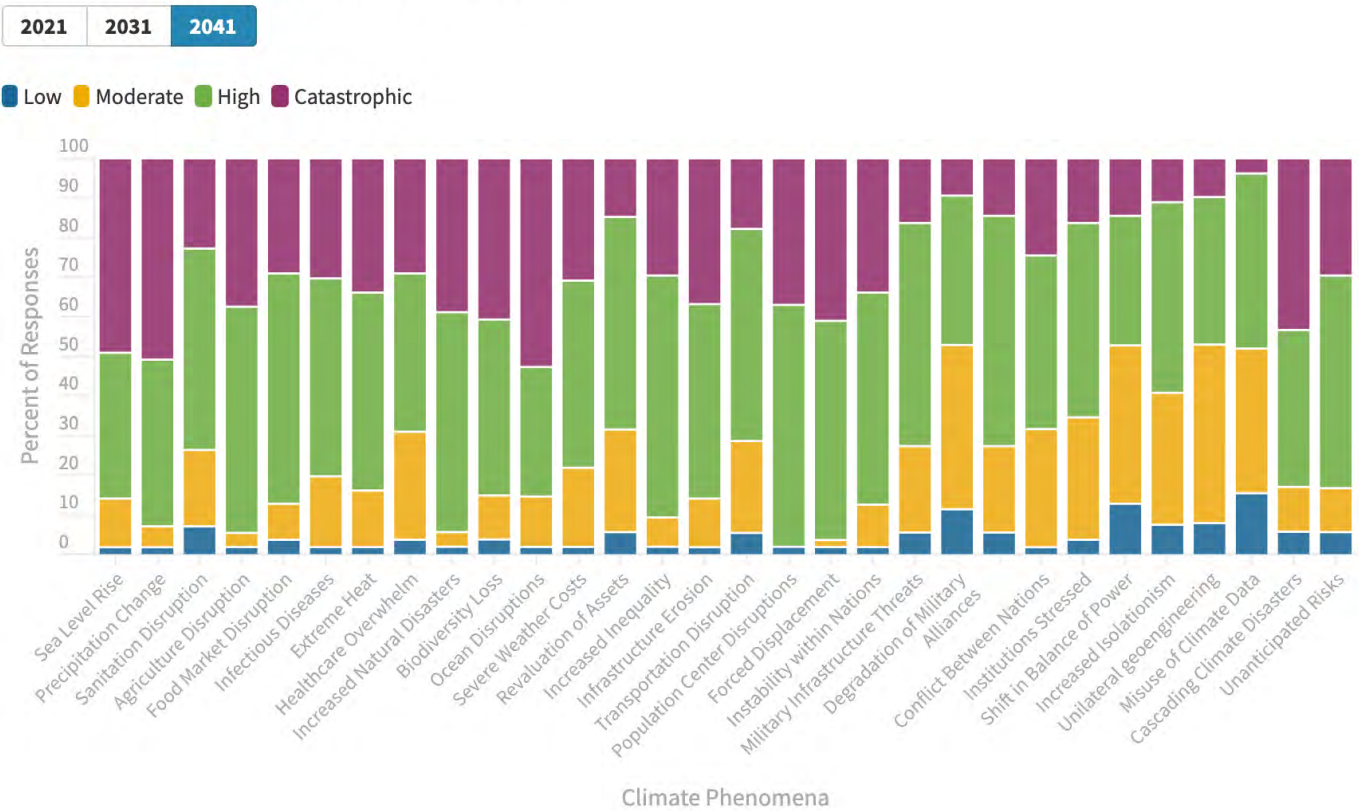Climate Phenomena (x-axis labels): Sea Level Rise, Precipitation Change, Sanitation Disruption, Agriculture Disruption, Food Market Disruption, Infectious Diseases, Extreme Heat, Healthcare Overwhelm, Increased Natural Disasters, Biodiversity Loss, Ocean Disruptions, Severe Weather Costs, Revaluation of Assets, Increased Inequality, Infrastructure Erosion, Transportation Disruption, Population Center Disruptions, Forced Displacement, Instability within Nations, Military Infrastructure Threats, Degradation of Military Alliances, Conflict Between Nations, Institutions Stressed, Shift in Balance of Power, Increased Isolationism, Unilateral geoengineering, Misuse of Climate Data, Cascading Climate Disasters, Unanticipated Risks

Compound Climate Phenomena: Risk Relationships
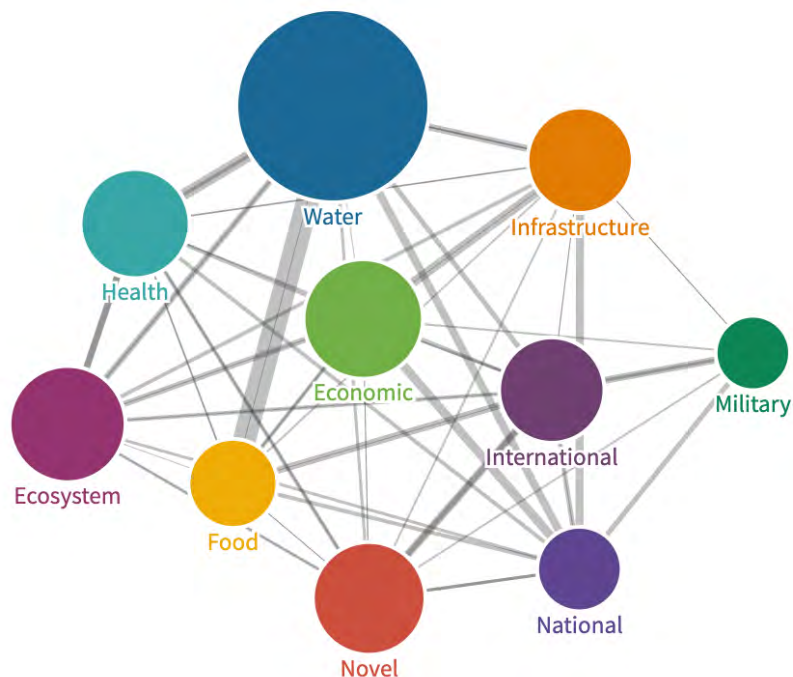
This network graph details the linkages that respondents noted between categories of climate risk. The bigger the node, the more connections that risk category has with the others. Likewise, the weight of each line shows the number of connections respondents noted between each category.

CLIMATE SECURITY RISK MATRIX: METHODOLOGY AND ASSESSMENT

Analysis by:

Femke Remmits
Assistant Strategic Analyst
The Hague Centre for Strategic Studies

Elisabeth Dick
Data Analyst
The Hague Centre for Strategic Studies

Michel Rademaker
Co-Founder and Deputy Director
The Hague Centre for Strategic Studies

INTRODUCTION

Risk assessments are developed using different methodologies and visualizations. The output of this methodology is the Climate Security Risk Matrix, a visual tool that helps to identify and evaluate climate-driven risk by assessing the probability and consequences (impact) of potential hazardous events. The matrix is a plot based on an X-axis that delineates the probability of the occurrence of a natural hazard, and a Y-axis that delineates the potential impact of the specific natural hazard. Such a matrix was developed to assess climate security risks at different geographical levels: global, regional, and national.

This risk assessment exclusively considers climate change-related natural hazards. These are natural hazards that have been or will be directly influenced and/or aggravated by global climate change. The risk assessment adopts this focus because of the projected increase in the frequency and intensity of natural hazards that are a direct result of a changing climate. Relevant hazards included in the assessment are: flooding (coastal and riverine), tropical storms (cyclones, hurricanes, typhoons), landslides, droughts, heat waves, and wildfires.[4]

DEFINITION OF CLIMATE SECURITY

This chapter and the corresponding report[5] published by *The Hague* Centre for Strategic Studies (HCSS) address a broad spectrum of the security risks of climate change. These risks were articulated in the *2020 World Climate and Security Report* as follows:

- *Where human security risks spill over into higher-order security risks, such as political instability, conflict, major natural disasters involving significant military and humanitarian responses, mass displacements of peoples, and threats to critical resources and infrastructure*

- *Geopolitical impacts of climate change including regional and inter-state tensions and conflicts*

- *Impacts of climate change on military and defense, including military infrastructure, force readiness, military operations and military strategy[6]*

The way in which climate-related disasters and national security and human security interrelate and interact with each other is illustrated in the following conceptual model of climate security (Figure 1).

**Figure 1.** The conceptual framework of climate security
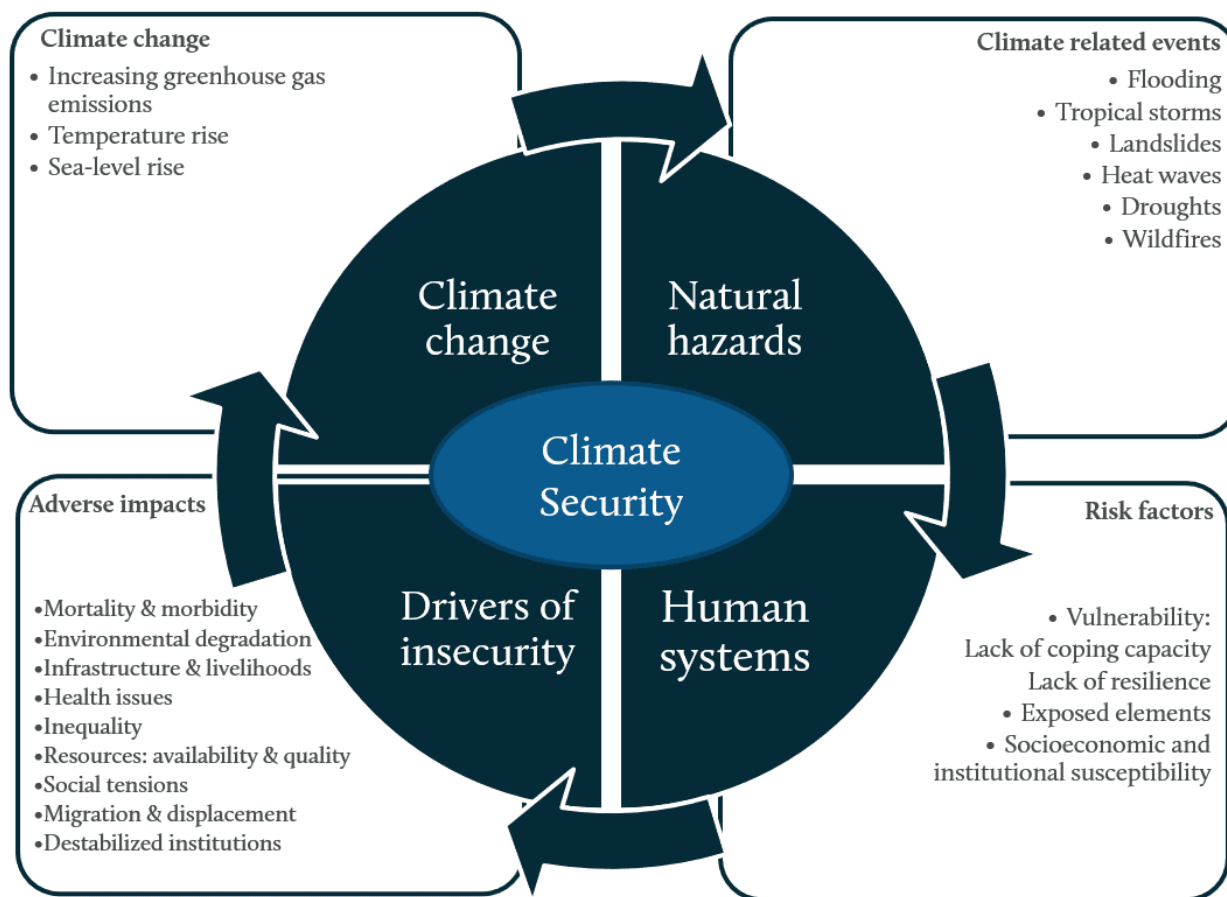
RESEARCH DESIGN OF THE MATRIX AND ASSESSMENT

A number of key components and variables underlie the risk assessment methodology and the broader design of the Climate Security Risk Matrix. Based on extensive research into the disaster risk management literature and existing risk assessment methodologies, the following components were identified: risk, natural hazard, probability, vulnerability, coping capacity, resilience, potential impact, susceptibility, and exposure.[7] Climate security risk is calculated as a function of probability and potential impact. Probability refers to the likelihood of a natural disaster occurring in a country. The probability of disaster risk is shaped by the onset of a natural hazard – a climate-related extreme weather event – and the vulnerability of a country to the incidence of that specific hazard, determined by its capacity to manage, mitigate, or avert its physical shocks. Potential impact refers to the magnitude of consequences in terms of losses, damages, and negative effects that a natural disaster could generate in a society due to the exposure of susceptible elements to this hazard. Together, the probability of a natural disaster and its potential impact produce climate security risk. It follows that the formula for climate security risk, as with many other risks, can be articulated as:

Risk=Probability*Potential impact

In this formula, the probability of a hazard – or the potential future occurrence of a hazard – is determined by the onset of the natural event and the vulnerability of a country to that specific event, caused by a lack in the capacity of a country to avert, mitigate or adapt to the physical shocks of that natural event. The potential impact of a climate-related hazard on a society – or the consequences in terms of losses, damages, and adverse effects to human lives and vital ecosystems, resources, livelihoods, infrastructures, and institutions – are determined by the exposure of susceptible elements. The resulting methodological framework provides the main foundation for measuring climate security risk. This framework is outlined in Figure 2 below. An in-depth technical description of this approach to assessing climate security risk can be found in a separate report "Climate Security Assessment: A Methodology and Assessment of the Nexus between Climate Hazards and Security of Nations and Regions."[8]

**Figure 2.** The methodological framework to measure climate security risk
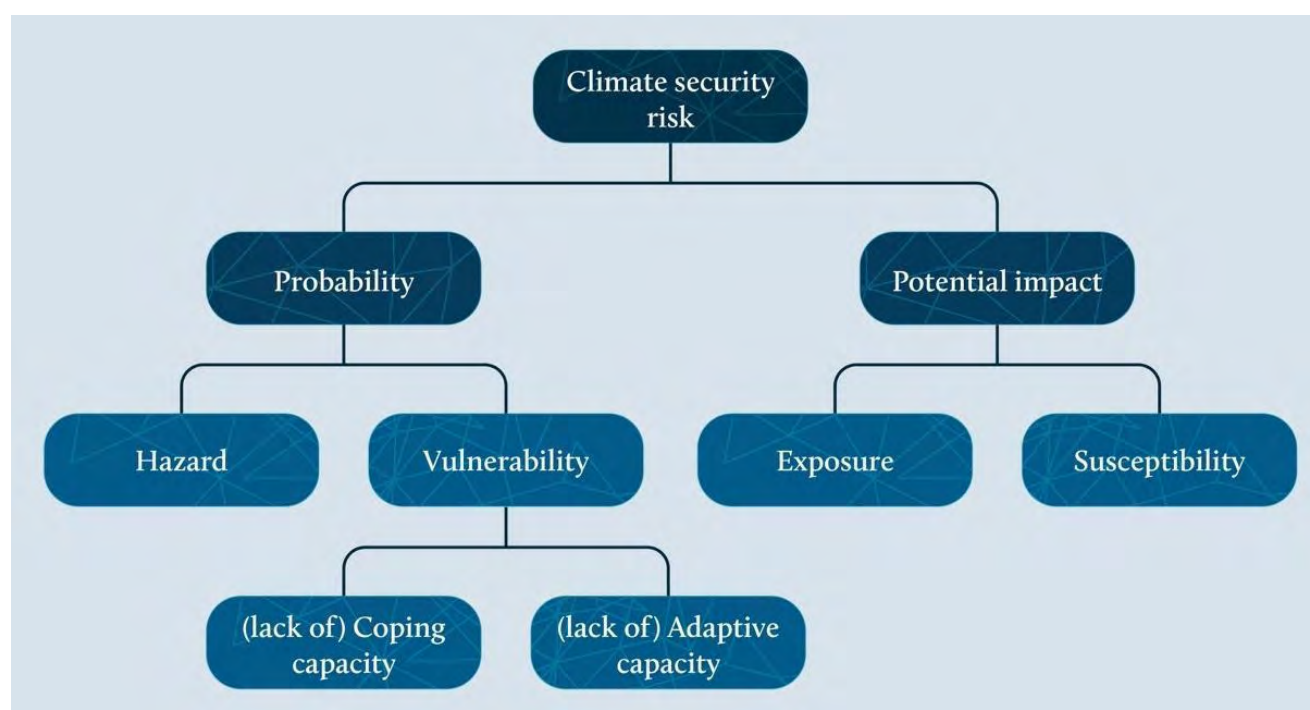
To assess climate security risk, this risk assessment methodology adopts a comprehensive and holistic approach to the measurement of exposure, susceptibility, coping capacity, and resilience. The overall exposure and susceptibility of societies to critical losses, damages, and consequence in the face of natural hazards, and the capacity to avert such impacts, is measured in relation to socioeconomic, institutional, and environmental factors. Moreover, the selection of indicators reflects and incorporates – as a proxy for the underlying drivers of climate security risks – the key themes of sustainable development addressed by the UN Sendai Framework for Disaster Risk Reduction and Sustainable Development Goals (SDGs).[9] Through these specific factors and indicators, the risk assessment methodology allows for the translation of the more abstract components of coping capacity, resilience, exposure, and susceptibility into distinguishable, communicable, and actionable targets for policymakers and security officials to mitigate and avert climate security risks (see Figure 3). Moreover, progress in disaster risk reduction can be measured and the effectiveness of certain strategies assessed.

Current Methodology and Data Limitations

The function of this risk assessment methodology is to quantify climate security risk to provide specific, actionable, and assessable targets. Still, the composite index of climate security risk and plots of countries on a matrix convey simplified representations of real conditions and this should be kept in mind. Understanding risk, in general, is a complex undertaking and involves the quantification of multi-dimensional factors and dynamics.

Other limitations primarily concern constraints of the methodology or in the available data. This risk assessment methodology is not able to cover all dimensions and factors of climate security risk. The final analysis of this risk assessment methodology results in climate security risk scores for approximately 140 countries.[10] Primarily smaller countries that do not have sufficient data, either because they did not report certain data or because statistics are dated, are excluded from the final results. This is problematic especially when these countries are facing significant challenges from climate-related hazards, such as the Small Island Developing States (SIDS). Additionally, several countries are currently lacking some data points.[11]

Figure 3. Composition of the climate security risk index: components, dimensions and indicators
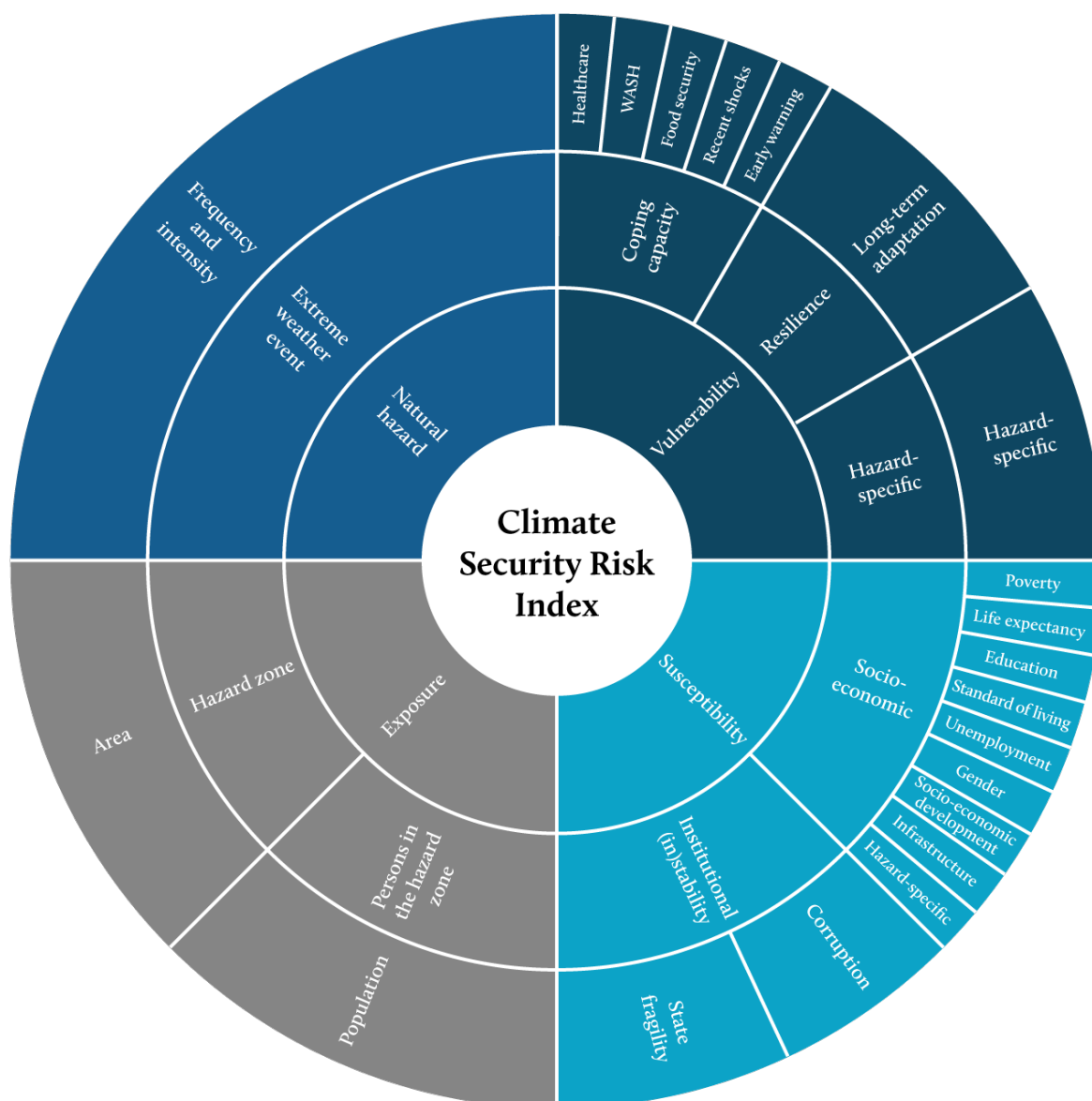
APPLICATION AND INTERPRETATION OF COUNTRY CLIMATE SECURITY RISK SCORES

The probability and potential impact of a certain hazard in a given country is represented as a score ranging from 0 to 100. Higher scores indicate worse performance and a higher risk to climate security impacts, with the value of 100 representing the country with the highest probability or likely impact of a certain climate-related hazard. The notion that higher scores indicate worse performance and higher risk is likewise applied to the four components of climate security risk – exposure, susceptibility, coping capacity, and resilience – and their underlying dimensions and indicators. The notion that higher scores indicate worse performance and higher risk is likewise applied to the four components of climate security risk – exposure, susceptibility, coping capacity, and resilience – and their underlying dimensions and indicators. It is important to emphasize that as "probability" includes both the natural hazard and vulnerability, the resulting scores are *relative* to one another. They are not absolute scores. Therefore, a score of 100 does not mean the probability of experiencing climate risk is 100 percent for that country, nor that a score of 0 means there is no risk at all. Instead, 100 represents the highest risk relative to all other countries and 0 the lowest.

The climate security risk scores are plotted on risk matrices that visualize the relative climate security risk of countries in relation to a specific climate-related hazard. The dots that appear on such a risk matrix represent the climate security risk scores for individual countries. The world scatter plot of a specific hazard type represents an overview of the relative climate security risk scores of all countries. The value of 100 represents the country with the highest probability or highest likely impact of a certain climate-related hazard relative to other countries.

The results of the world scatter plot are also visualized in world heat maps for a single hazard type. These maps provide a global geographical overview of locations where certain hazard types are more prone to arise and produce climate security risks. Such a heat map might reveal certain climate-related trends.

VISUALIZING THE RESULTS

The climate security risk scores for the different hazard types can be visualized on the global level in scatter plots and heat maps. We include an example below, riverine flood risk, and more can be found in the full report. In the scatter plots, the individual country scores are represented by country codes and categorized per region. The heat maps visualize the relative risk values of countries based on a color scheme in which darker colors indicate higher risk scores. White indicates missing data, not lowest relative risk.

RIVERINE FLOOD RISK

Figure 4 and Figure 5 below visualize the climate security risk scores of countries in relation to riverine flooding. India has the highest riverine flooding security risk relative to others. Bangladesh, Brazil, China, Indonesia, Japan, and Russia also score relatively high on riverine flooding security risk. The Maldives have the highest potential impact, followed by Vietnam.

Figure 4. Global plot of riverine flood risk including country codes.

Global plot of Riverine Flooding Risk including Country Codes
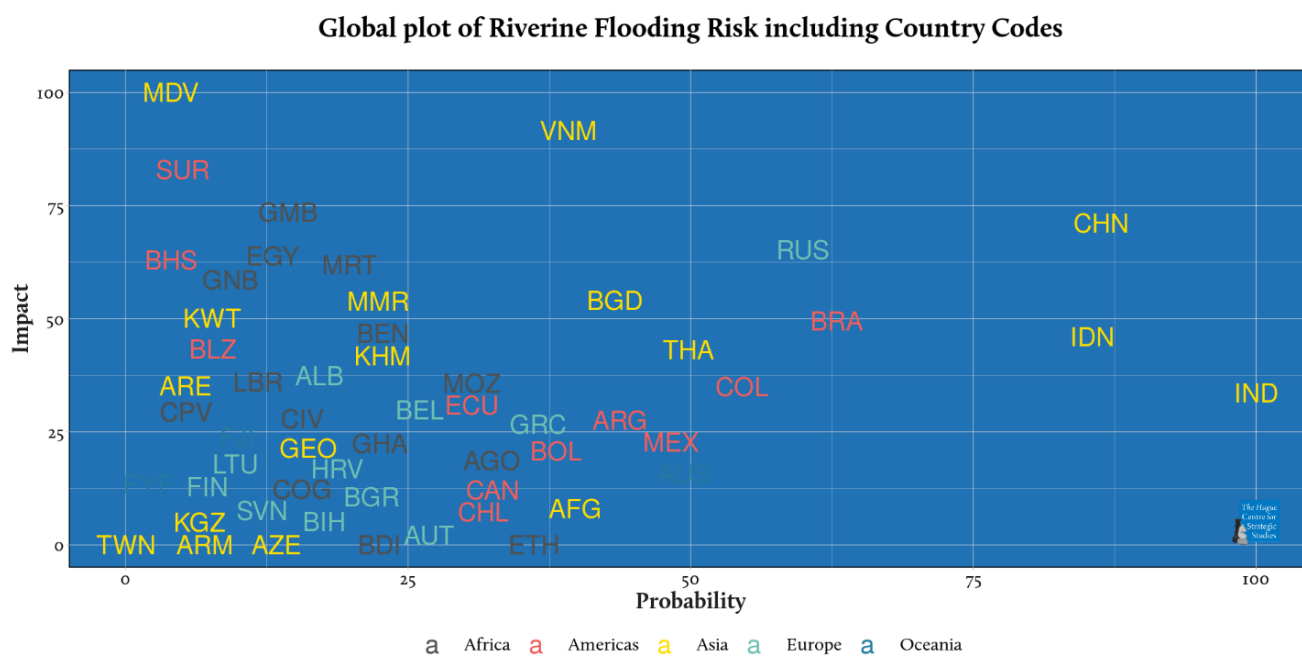
Figure 5. The relative climate security risk of riverine floods.

The relative climate security risk of riverine flooding

A darker color indicates a higher security risk from riverine flooding events.
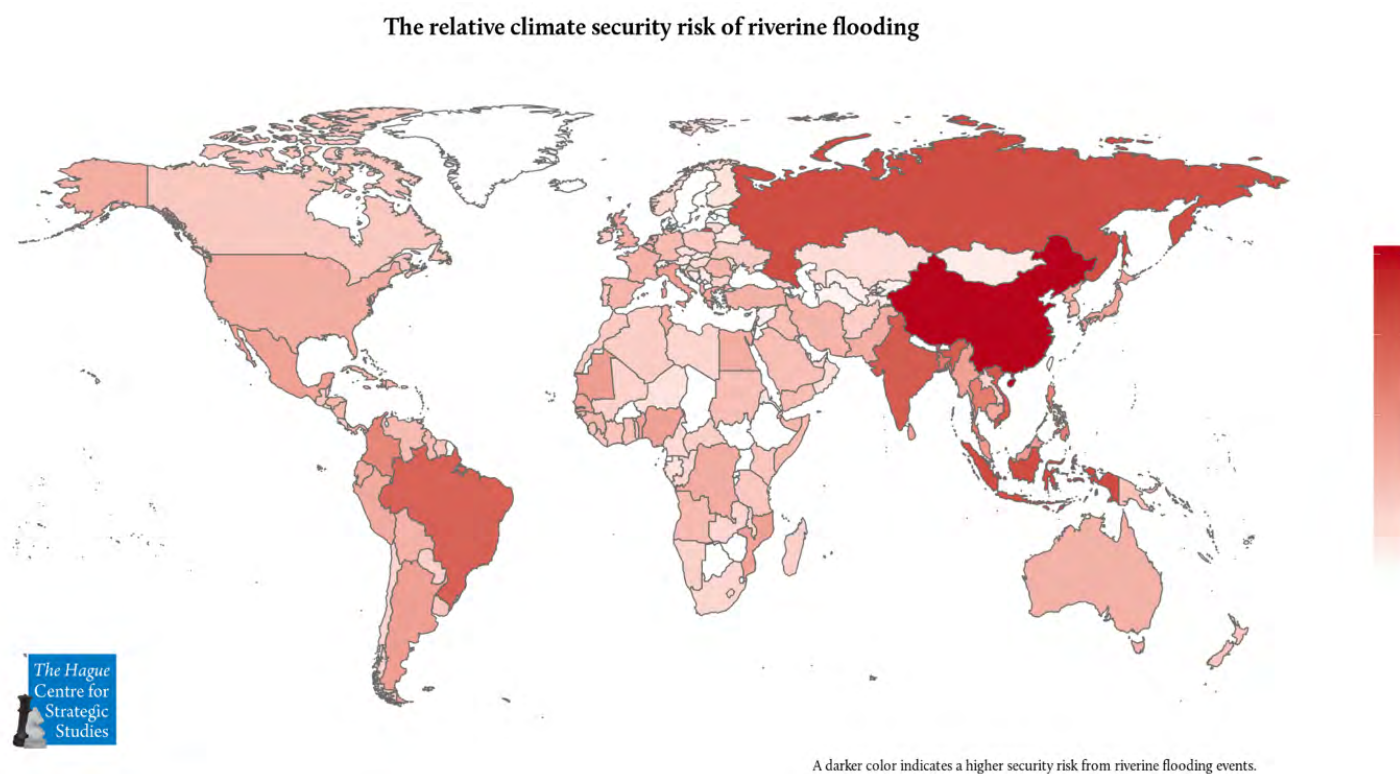
Based on the observations from the global plots of riverine flood risk, it is interesting to zoom in on countries that stand out, such as India or the Maldives. The Climate Security Risk Assessment methodology also allows for the creation of national climate security risk plots in which a country's risk scores for various climate-related hazards are plotted on the country-level. Figure 6 below visualizes such a national climate security risk plot for India.

Figure 6. National Climate Security Risk plot of India

National Climate Security Risk: India
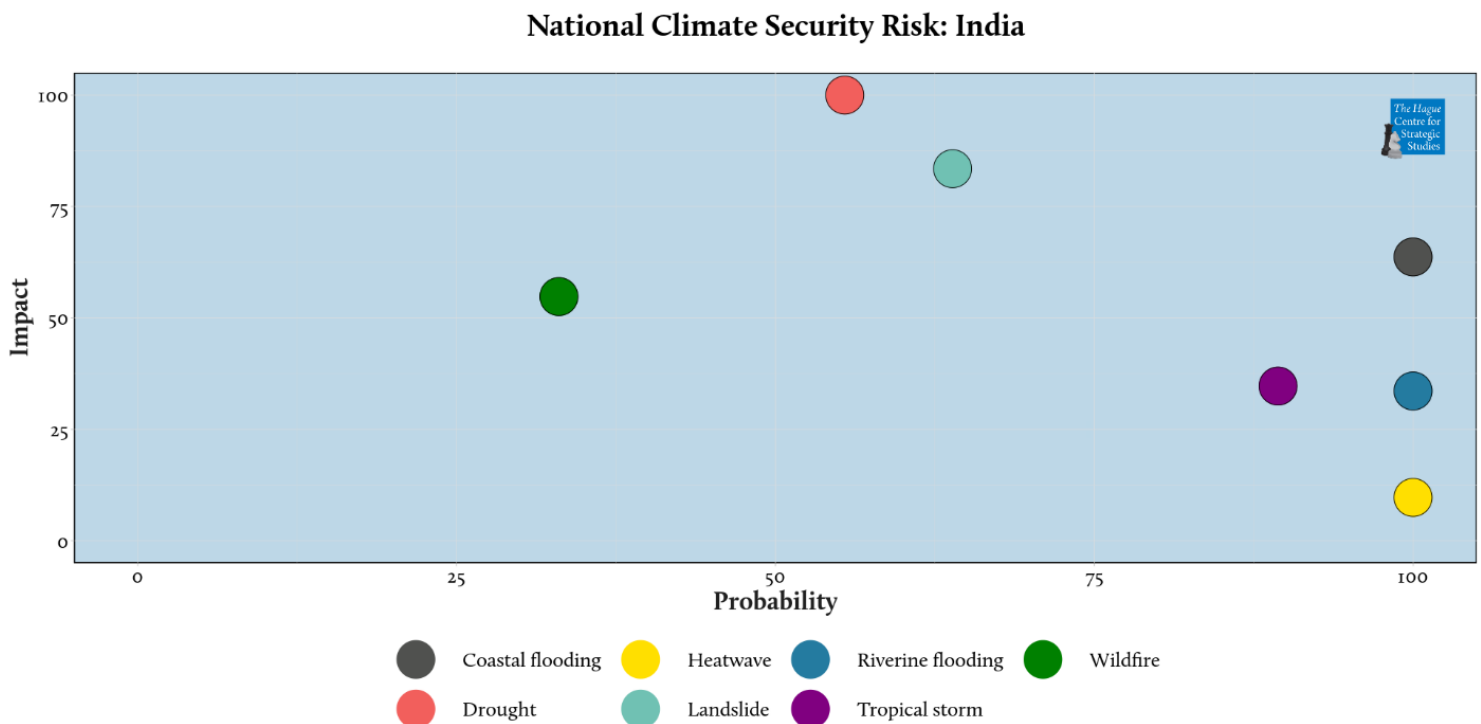
Figure 6 shows that India scores 100 (highest relative score) when it comes to the probability of facing heatwaves, riverine floods and coastal flooding. The probability of a tropical storm in India is also very high. At the same time, the impact of these frequently occurring hazards is lower in the country than the impact of droughts and landslides. Droughts and landslides may occur less frequently in India compared to other countries but are relatively more impactful.

National climate security risk plots can produce significant insights into the most considerable climate-related hazards for a country and, through analysis of the underlying data, indicate particular needs for substantial disaster risk reduction policies and strategies. In addition, national climate security risk plots serve to inform whether multiple types of climate-related hazard affect one specific country that could interact and/or aggravate each other's impact on a given society, generating compounding effects and heightened climate security risk.

CONCLUSIONS AND NEXT STEPS

The climate security risk world scatter plots and heatmaps can be used to make inferences concerning which hazards threaten certain regions or countries most, relative to one another. The individual country plots offer a more detailed risk overview of the threat from various climate-related hazards in a certain country. The country probability and potential impact scores, as well as the underlying component and indicator scores, can be used to identify and evaluate climate-driven risk of potential hazardous events and serve as the basis for more detailed case study research. As the selection of indicators reflects and incorporates the key themes of sustainable development by the UN Sendai Framework for Disaster Risk Reduction and the SDGs, these can be translated into specific and actionable targets for policymakers and security officials to address potential national and regional security impacts of climate-related extreme weather events. As we continue to build out this capability and methodology we plan to integrate additional datasets and update our visualizations accordingly.

PRACTICES TO REDUCE CLIMATE SECURITY RISKS: A FIRST REFLECTION

Analysis by:

Louise van Schaik
Head of Unit
EU & Global Affairs, The Clingendael Institute

Tobias von Lossow
Research Fellow and Project Leader
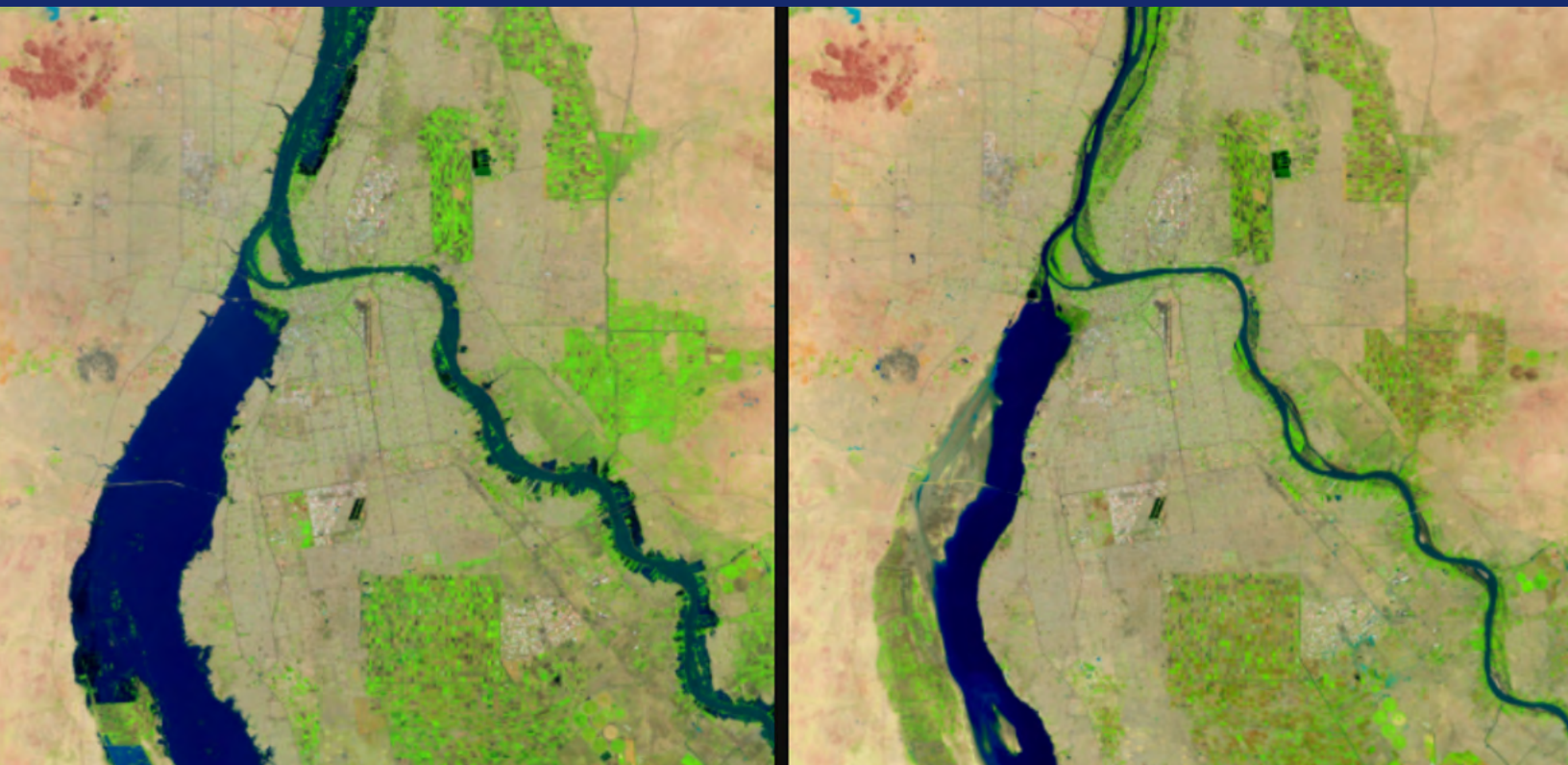Planetary Security Initiative, The Clingendael Institute

Anouk Schrijver
Former Research Assistant
Planetary Security Initiative, The Clingendael Institute

Maxime van der Kroon
Former Research Assistant
Planetary Security Initiative, The Clingendael Institute

Flooding in Sudan's capital, Khartoum, on Sept. 2, 2020 (L), compared to a more typical rainy season in 2016 (R). **NASA.**

INTRODUCTION

Direct consequences of climate change impacts, such as rising temperatures, rising sea-levels or higher prevalence of extreme weather events can aggravate political and socio-economic tensions, leading to displacement, irregular migration, poverty, state instability and sometimes violent conflict.[12] Climate impacts already pose security threats in fragile and unstable countries. The 2020 floods in Sudan, for example, exacerbated the country's fragile security environment, concurrently destroying people's livelihoods and compounding the burden on the government to expand or establish recovery or support mechanisms. Such extreme-weather events also directly affect militaries in the region, as they are among the actors that can most readily respond to such events. For example, the Egyptian military assisted in delivering humanitarian aid to Sudanese citizens trapped in areas only accessible by helicopter.

Reducing climate-related security risks in theory therefore requires multiple different actors across many fields, to include peacebuilding, mediation, disaster preparedness, climate adaptation and climate mitigation. In practice, climate or environmental peacebuilding measures are often part of a more comprehensive effort to promote peace and stability, or a peace dividend is an implicit effect of a climate, water, food or land development intervention. Militaries increasingly recognize the impact of climate change on operations, as well as the role a deployed force can have in increasing pressures on natural resources in its mission area. They also appear open to assessing how they can support environmental peacebuilding efforts by civilian actors, though a recent review of climate security practices has indicated that such efforts are nascent.[13]

Climate security practices are defined here as tangible actions implemented by a local or central government, organization, community, private actor or individual to help prevent, reduce, mitigate or adapt to security risks and threats related to impacts of climate change and environmental degradation. Conclusive evidence on the impact of climate security practices is currently lacking, given that climate security is a young field, public information about

such activities remains scant, comparability of such practices is difficult, and different conflict situations have very particular characters that can resist generalizations.[14]

In this chapter, we first address the challenges of assessing climate security practices. This is followed by an overview of peacebuilding and the reduction of security risks. The integration of climate and security is then discussed, including a section on what the broad horizon of climate security means for the different types of practices in this field. Subsequently, the Climate-Security-Triangle model is introduced, in which climate security practices are placed on a spectrum from climate to conflict-driven practices. We then review a number of existing practices, focusing on the type of practices, the field in which practices occur and implementing actors.[15] The review highlights the breadth of the field in which climate security action is implemented. This chapter concludes with the judgment that the field is currently dominated by *policy intentions* rather than *implemented action*. In that context, we recommend that the diverse actors involved, including the military, should now begin engaging in the next step - transitioning to implementing climate security measures rather than simply addressing them on paper.

CHALLENGES OF ASSESSING CLIMATE SECURITY PRACTICES

Quantitative and qualitative analysis of climate security measures face myriad challenges. First, it is difficult to assess the direct or indirect impact of climate-related practices and whether they are deliberately or unintentionally addressing climate security. For instance, a land restoration project may be initiated as a climate adaptation effort, but concurrently create a new carbon sink (mitigation), new opportunities for food production and new livelihoods, and thereby an alternative to joining a local militia.

Second, it is difficult to assess the effectiveness of environmental or climate security interventions, as it is almost impossible to prove that some specific measure has prevented conflict or directly contributed to peace. This is a general feature in the field of peacebuilding, but with other efforts such as collecting weapons or sending a UN mission, the contribution to peace and stability is more automatically taken for granted.

Third, the complexity of indirect links between climate change and security adds another challenge to understanding the impact of climate security practices. Climate change is typically regarded as a generic threat multiplier and its link with conflict risk is less established in academic literature compared to other risk factors such as oppression, the presence of weapons, a history of conflict and weak governance. Hence peacebuilding projects outlining a theory of change based on the collection of weapons, for example, are more likely to be accepted than projects focused on climate adaptation or dialogue over natural resources projects.

Fourth, the inherent complexity of the sectors which climate change affects, such as food, water and land, makes it difficult to ascertain the degree to which the problems arising in that field are solely or primarily a result of climate change.

Fifth, the broad range of actors in the climate security field all approach the issue from a different angle; measures undertaken can also differ greatly depending upon assumptions about the relationship between climate and security and their goals.

Finally, conflict is always context-specific, as the underlying causes of insecurity differ. Climate security actions can and must account for this fact.

HOW TO REMEDY CONFLICT AND REDUCE SECURITY RISKS?

After decades of relative decline, the occurrence of violent conflict has increased.[16] Additionally, the number of internationalized conflicts increased – defined as a conflict between a state and a nonstate actor in which another state intervenes on behalf of one of the initial parties.[17] Drivers of these violent conflicts are diverse and context-dependent.[18] Factors include the availability of weapons or a history of conflict. Most germane to this analysis, there is an emerging body of literature about the need for climate policy interventions to be conflict-sensitive.[19]

Inequality among and exclusion of groups in society – and possibly more critically the perception of exclusion and inequality – are important drivers of violent conflict.[20] As the United Nations and World Bank found in a 2018 report, inequality can cause tensions among individuals, households or between groups but the exact relationship between inequality and violence is complicated and findings are mixed.[21] However, it is generally accepted that the perception that there is no viable alternative for expressing grievances increases the likelihood of violence, which is validated when exclusion is enforced by state repression.[22]

Underlying grievances are a significant conflict-driver. These can arise from all types of exclusion, including economic, political or social. A UN and World Bank report on conflict prevention indicates four arenas in which exclusion has a high impact on basic livelihoods and inequality, and are thus often a source of violent conflict.[23] These policy arenas are related to: access to political power and governance; land, water, and extractive resources; delivery of basic services; and justice and security.[24] These domains represent the larger societal power balance, and reform is often complex and difficult.

The impacts of climate change also affect these policy arenas; the unwillingness or inability of a state to mitigate or assist with adaptation may exacerbate insecurity and contribute to the perception of illegitimacy and inequality. It is therefore important to include climate change impacts in conflict analysis and conflict-mediating practices, as well as include a conflict-sensitive approach in climate change adaptation and mitigation policy. The two domains are intertwined and benefit from a holistic approach.

HOW DOES CLIMATE CHANGE FIT INTO THE SECURITY REALM?

The security realm used to be reserved for policies to protect and enhance national security, through military defense and border control, for example. However, dynamics of the post-Cold War era proved the need for the concept of security extending towards the security of *people* rather than solely national boundaries. Human security, broadly defined, includes the socio-economic, political and environmental security dimensions of human life within nation states. The risks to these security dimensions also extend from traditional national security threat definitions, as they include risks to people's livelihoods, such as droughts affecting agricultural output, increasing poverty and marginalization.[25] Threats to human security can also undermine the legitimacy of the ruling authorities, and thus weaken national security from within a state.

Indian army soldiers rescue flood affected people in Chennai, India. **AP.**

Climate change impacts not only directly affect human security, but also modify the working environment of security actors. Extreme weather events increasingly occur, with significant impact on military capabilities. The headquarters of the U.S. Atlantic fleet, located in Norfolk, Virginia, already floods about ten times a year.[26] The 2020 U.S. wildfires damaged military bases and training equipment, in addition to civilian infrastructure.[27] Droughts and dust storms make operations increasingly difficult and the footprint and impact of deployed military elements can add pressure to scarce local resources. Geopolitically, climate change contributes to a relatively new potential conflict in the Arctic, where several large and powerful countries scramble for resources and trade routes.

Strategically, climate change affects people within states, potentially contributing to conflict, while also directly affecting military readiness and operations at the operational and tactical levels. Global security is thus declining as a result of climate change. It is therefore important that climate-security action is undertaken in the diplomacy, defence, development and humanitarian sectors.

The need to address the climate-security nexus is increasingly recognized by security actors, but it is currently less clear what can be done, by whom, and what we can learn from it? The selected projects, initiatives and recommendations presented below were found in a broad search on practices of different organizations on the international, national, NGO and local levels. Project identification also builds upon networks developed through the Planetary Security Initiative, a hub for climate security information to the community of practice working in this field.[28] The list is broadly representative, but non-exhaustive.[29] The objective is to expand this list in order to have an overview of existing practices in the field which allows us to develop metrics for evaluating them, to inspire others interested in this field and showcase the broad range of possibilities in climate security practices.

TYPES OF CLIMATE SECURITY ACTION AND THE CLIMATE SECURITY TRIANGLE

Activities in the climate security realm are often implicit or explicit additions to peacebuilding, conflict prevention and mediation efforts. For example, peace agreements sometimes include a section on natural resource-sharing to reduce the risks of conflict resumption due to unequal natural resource access.[30] Conversely, climate action can also have a security dimension that aims at stability and peace.[31] Climate security activities presented here include both implemented action and research and recommendations that are yet to be implemented. Due to the limited number of implemented practices and the inherently context-dependent nature of conflict, hard evidence on what works best is lacking. To begin filling this gap and facilitating further action, the proposed Climate Security Triangle is a model to map the different types of activities in the field, characterizing to what extent they are driven by climate change, security considerations, or both.

Climate security initiatives are mapped horizontally on the Climate Security Triangle based upon a relative assessment of the degree to which the initiative is climate-driven or security-driven. To illustrate the climate and security dynamics examined through this tool, consider the example of an intervention to create agricultural resilience to climate change impacts by bringing together hostile communities to jointly implement agro-ecological farming practices. Such an effort could both build communication and trust between two traditionally hostile communities, while also increasing the availability of food and sustainable farming. A second assessment of the impact of the action positions the initiative vertically – the further up, the bigger the potential impact.
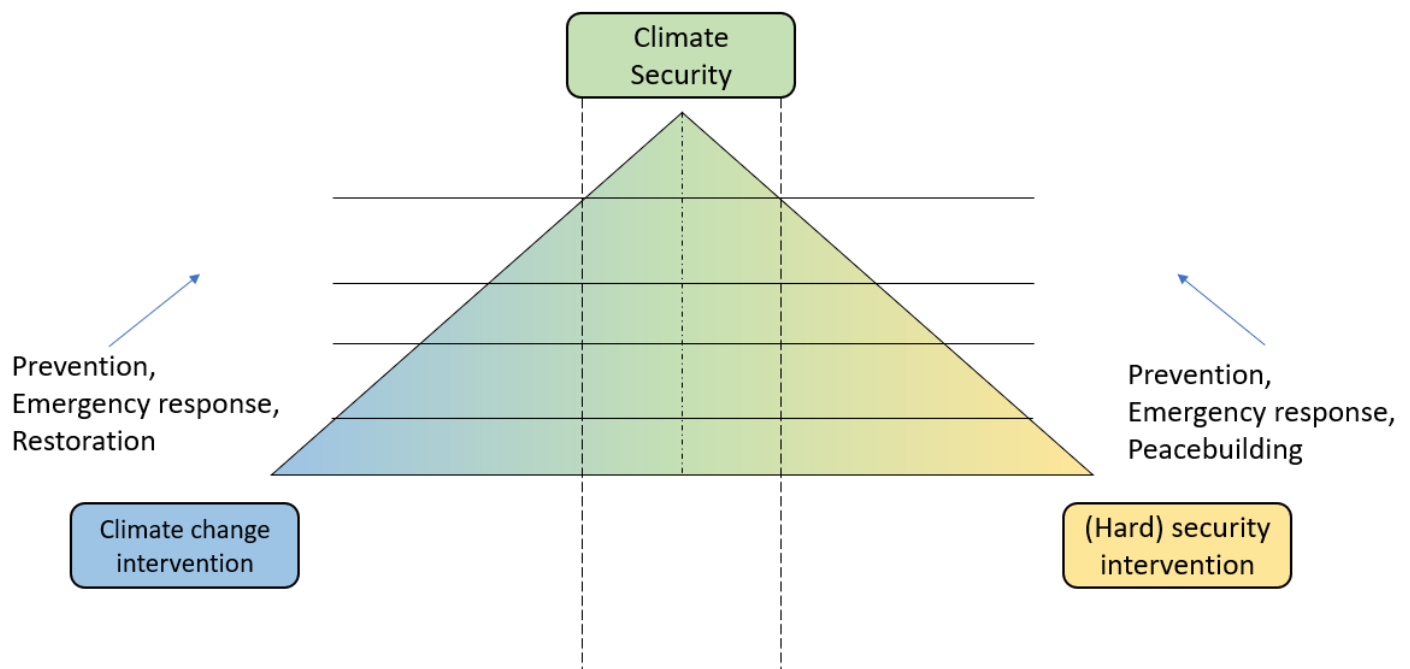
Climate-Security-Triangle, PSI/Clingendael 2020

CLIMATE SECURITY ACTION: CASE STUDIES

The following selection of climate security practices distills the authors' extensive research in the field. Bilateral calls and high-level events with relevant actors from academia, NGOs, security actors, regional and international organizations as well as decision-makers, provided a broad knowledge base about different efforts across the development, diplomacy, defense, and humanitarian fields. Additionally, desk research on climate security projects complemented the effort. Due to the nature of some climate security practices, that either implicitly affect security or climate without being the main objective – the focus remains quite broad to include development organizations, defense and diplomacy policy and practice. We distinguish between actual practices and institutional mechanisms and organizations that aim to stimulate such practices.

Practices aim to operationalize climate-security objectives, from either institutional or non-governmental sources. Climate-security practices are not limited to governmental decision-making processes, mechanisms, risk assessments and strategies, but are activities implemented on the ground. In the below we cover both case descriptions of actual practices (e.g., EcoPeace Middle East project) and institutional arrangements to set these into motion (e.g., UN climate-security mechanism). A longer list with actual climate security practices can be found on www. planetarysecurityinitiative.org, and in the coming year will be updated with new practices.

1   Defense and renewable energy

International organizations are increasingly incorporating climate security into mandates and resolutions, including to prevent doing more inadvertent harm than good. For example, some military missions into conflict zones are "greening" their efforts, by increasingly relying on renewable energy rather than oil or diesel.[32] Such efforts can directly and positively affect both the peace initiatives and the climate, as fuel transport is often targeted by adversaries. Transitioning to renewable energy also reduces the carbon footprint of military operations, which directly contributes to an overall reduction of greenhouse gas emissions.[33] Moreover, energy innovations in the field can be shared with the local population as a benefit. The unit then not only observes the peace agreement, but also contributes to potentially reducing grievances and preventing the future resumption of conflict.

For instance, the French armed forces have long acknowledged the importance of including the environment in military strategic planning. Not only does the French Defense and National Security Strategic Review identify climate change as an important factor aggravating crises, the Sustainable Defense Strategy of 2016-2020 also aligns the actions of the armed forces with the sustainable development strategy.[34] In the period 2020-2026, France will spend nearly $600 million in order to decrease energy consumption on French military bases.[35] The plan includes a 40 percent reduction of energy consumption on deployed military camps by 2030.[36] The French Ministry of Armed Forces thus acknowledges the role of fossil fuel consumption in increasing risks for missions abroad, as well as its responsibility to reduce the carbon footprint of the defense forces in order to avoid additional pressure on fragile countries themselves.

Similarly, the Energy and Environment Program of the European Defense Agency aims to make member nations' Ministries of Defense (and/or Armed Forces) more resilient to "existing and emerging vulnerabilities resulting from strategic considerations concerning energy security and dependence on fossil fuels, resources security of supply, water security, and environmental change."[37]

Electrical generators at a Peacekeeping mission in Goma, Democratic Republic of Congo.
Mads Uhlin Hansen / Energy Peace Partners

Potential reduction of military carbon footprints is analyzed by Energy Peace Partners, an organization that through its *Powering Peace* project uses different methods, such as data collection, research and advocacy to support the transition of UN missions to renewable energy. Their assessment of the UN Mission in the Democratic Republic Congo very clearly laid out the incentives of the transition and the options as to how the mission can use renewables. This is a prime example of the large efforts that exist in informing, researching and recommending action in the climate security sphere that are not yet being implemented but hold great potential.

2   United Nations Climate Security Mechanism

The UN has launched the Climate Security Mechanism (CSM) in order to raise awareness about climate security within the UN system. The UN Security Council has already adopted climate security into its proceedings and approximately 14 resolutions specifically mention climate security – for example, the UNSOM resolution (see sections 6.7 and 6.8 below). The aim is to incorporate climate security risk assessments into the conflict assessments that are already undertaken. Political missions in Africa, notably in Central Africa, are currently starting to gather information to increase knowledge on climate security risks; for other UN missions data collection on climate security risks is being expanded. A specific toolbox, created by the UN CSM, is circulated into the UN system in order to "green the blue" – raising awareness on the topic and providing a framework that different departments can adapt and then apply towards their own situations.

Overall, the results of efforts in the military and political spheres are difficult to assess at this early stage. The future benefits could potentially be larger when the discourse and practice have been incorporated into all systems. As the UN is a large system, the full impact of these efforts will likely require some time to manifest.

3   European Union

Within the European Union (EU), a more integrated approach involving climate in the context of peace and security is well underway, via a roadmap detailing the integration of climate change into the EU's Common Security and Defence Policy (see EU chapter later in this report). Climate change has also been added as a necessary component of conflict analysis. Moreover, senior mediators based at EU delegations receive training specifically focused on introducing climate change in their work. This will enhance the understanding of the links between climate change and conflict and may better enable mediation efforts to address the root causes of conflict.

The EU also strengthens climate adaptation in its development cooperation efforts. The European Commission proposed that 25 percent of the EU external action budget spent in the neighborhood of Europe must be climate-related between 2021-2027.[38] Later, it was agreed that 30 percent of the EU's overall budget needs to be climate-related, which is likely to trickle down into the realm of EU external action - including funding for development and peace and stability.

Efforts within the EU have focused on integrating climate into the security realm and including security in development or donor efforts. The combined impact of these different approaches could potentially be large, as the EU funds many projects and also functions as a mediator in conflicts. However, the different domains in which climate security action can take place – development, diplomacy, defence – are often still separated from each other. A more integrated and holistic approach could increase the impact of the EU in the climate security realm, but would require more flexibility on development projects (with regard to theories of change, impact indicators, etc.), and a broader understanding among security actors about development and diplomacy efforts being considered (or in place), and how they could contribute to them.

European Commissioner for the Green Deal Frans Timmermans, who is preparing to roll out the European Green Deal, a sweeping policy package aimed at reaching net zero emissions by 2050, speaks during a media conference in Brussels, Belgium, 24 February 2021. European Commission.

4   CGIAR Weather-index insurance

In an effort to bolster resilience against weather-based disasters, CGIAR's Research Program on Water, Land and Ecosystems together with the International Water Management Institute, have developed weather-index insurance for smallholder farmers.[39] Under this system, farmers pay a premium and, via either measurements of weather deviance from the established "norm" at local weather stations or through satellite map data, insurance money is paid out to smallholder farmers that are affected by weather abnormalities.

Implementation of the weather-index insurance schemes in Sub-Saharan Africa proved difficult, due to a lack of trust. Additionally, the project was implemented in a year following a good harvest – reducing the immediate need for insurance. Determining whether or not a farm had been affected also proved challenging, as the weather stations could be placed up to 25 kilometers away. Although the idea offers significant potential, lessons learned from implementation in Sub-Saharan Africa can be used to improve the program.

In India, CGIAR and partners developed the Index-Based Flood Insurance Scheme (IBFIS), in order to prevent floods from posing extreme financial risks to smallholder farmers.[40] Three pilot programs helped farmers recover after floods had destroyed their farms. As these pilots show, insurance can be an appropriate disaster risk management tool, building resilience against climate change impacts from extreme weather events. By building farmers' resilience to climate shocks, governments have a greater chance of reducing the impact of natural disasters and promoting more consistent economic growth. A similar insurance scheme for agricultural risks is being implemented by CGIAR's Climate Change, Agriculture and Food Security body, which has scaled up in India, East Africa and West Africa.[41] Two key lessons to be learned from this program include that farmers should be involved in the design and the insurance should be integrated with other development interventions.

The Indian IBFIS was designed in cooperation with local farmers in order to best match local needs. As a result, trust and "buy-in" were established from the outset, contributing enormously to successful implementation. However, it is important to note that such index insurance may not be a viable long-term option for disaster preparedness with the occurrence and intensity of extreme weather events increasing and farmers affected more and more often. Moreover, this practice assumes that the farmers are selling their food rather than existing at a subsistence level (i.e., dependent on the food they produce for their own food security). Especially in remote areas, food might not be available to be purchased using the insurance money that is paid after extreme weather events.

One of the rice production farms in Jawhar, Maharastra, India that Climate Change, Agriculture and Food Security (CCAFS) is working with to develop 'Climate-Smart Villages' to improve farmers' income and resilience to climatic risks and boost their ability to adapt to climate change. Neil Palmer / CCAFS / Flickr.

A study tour on cross-border water issues as part of the GWN Project. **EcoPeace Middle East.**

5   EcoPeace Middle East: Good Water Neighbors Project

EcoPeace Middle East aims to promote cooperative efforts to protect the shared environmental heritage of Israel, Palestine and Jordan, by bringing communities of the three countries together to work on common issues regarding their environment. Based on environmental peacebuilding, the bottom-up "Good Water Neighbors" project works with communities and municipalities across the three borders to develop a regional understanding of the problems, especially of polluted rivers and water allocation to the three regions.[42] This project aims to raise awareness of the shared water reality, create political will for transboundary cooperation, and build trust in order to solve the issues and build peace among communities.

The project has been running since 2001 and has expanded its participants from 11 to 28 communities which share water resources with at least one community across the border. Mayors of Israeli, Palestinian and Jordanian towns have informally come together to address the shared problems around water. When people are brought together to discuss shared grievances about the natural environment they live in, they are capable of seeing past the political and social divides that separate them. Using the environment as an urgent and un-politicized theme to foster cooperation between the different parties may help foster peace in the long term; at the least it establishes precedent for a more collaborative approach to conflict resolution. This initiative has also produced tangible outcomes related to the shared environment, such as connecting a Palestinian sewage network to the neighboring Israeli network, resulting in reduced wastewater pollution.

Due to the highly politicized environment in which they operate, not all the work and results of EcoPeace Middle East are available online. Therefore, there may be additional positive outcomes that have been accomplished "under the radar" from which lessons could be gleaned. It may be possible to replicate this effort in other river basins, where climate change puts additional stress on already scarce water resources.

6   UN Assistance Mission to Somalia: Drought Operations Cooperation Centre

The United Nations Assistance Mission to Somalia (UNSOM) recognizes the negative impact of climate change on its ability to achieve the goals in its mandate. UNSOM was created by the UN Security Council to support the establishment of the Somalia federal government and bureaucracy, particularly in the areas of peacebuilding, state

building and democratization, in which climate considerations are being more and more embedded. In some regions, climate change can increase conflict between farmers and herders, increasing livelihood losses and poverty – which are all factors exploited by Al-Shabaab in its recruitment process. The promise of direct belonging and more stable income forms an important motivation for people to join sub-national or terrorist groups.[43] These dynamics complicate UNSOM's peacebuilding efforts.

In response to the increasing impact of climate change on the occurrence and intensity of droughts in Somalia, UNSOM established a Drought Operations Coordination Centre (DOCC).[44] The DOCC is an effort to harmonize and coordinate humanitarian relief efforts. In order to prevent droughts from turning into famine, the DOCC seeks to make responses to droughts as effective as possible and provide assistance as quickly as possible. The coordination runs between the UN, intergovernmental and governmental actors. The efforts undertaken by DOCC and its partners to coordinate relocation of drought-affected internally-displaced people were assessed to be successful and a best practice by the UN.[45]

A coordinated and an integrated response to climate change impacts in conflict zones proved to be efficient in this case. Combining expertise, knowledge and power to act on a humanitarian crisis enhanced the security of the people affected. From this example, it appears the UN can take the initiative to bring together different actors to work towards a joint goal. This also shows that actors in defense, diplomacy, development and the humanitarian sector should not just look at similar actions in their field, but can learn from each other. As with any program, it should be tailored to the context, but it clearly holds promise.

7   Environmental advisor to UNSOM

To support implementation of the UN mandate, an environmental advisor was appointed to UNSOM in June 2020 to bring environmental security approaches into the mission.[46] With support from the UN Climate Security Mechanism, the environmental advisor works with the political arm of the mission, supporting them in implementing environmental peacebuilding initiatives and building legal institutions. Moreover, the advisor supports the Federal Government of Somalia and other institutions, and works with FAO and UNEP (among other institutions) to gather more data on climate security problems.[47] Lastly, the advisor also analyzes the socioeconomic impact of environment-related projects, to ensure they do not exacerbate conflict.[48]

United Nations Assistance Mission in the midst of a severe drought in Somalia. UNSOM.

The recent appointment of the environmental advisor makes it difficult to assess its impact so far. However, one can note an increasing recognition of the implications of climate security for the field of peacebuilding and efforts to address them, at least at the UN in Somalia. This could inspire and guide future military or other security efforts to fully consider climate change and its complex impacts on conflict dynamics when developing engagement strategies.

8   Colombian Peace Process

The Colombian peace process provides a powerful example of how the creative application of climate policy to seemingly unrelated challenges can solve intractable conflicts. The Colombian Peace Agreement was the first in history to have climate, sustainability, and rural economic development as core principles.[49]

The Revolutionary Armed Forces of Colombia (FARC) controlled vast swaths of the Colombian rainforest for decades, essentially keeping them off limits to economic exploitation and development. Recognizing that unsustainable logging and slash and burn agriculture were likely to devastate a critical global carbon sink when the FARC disbanded, the Colombian government sought to enlist those most invested in preserving its forests. European nations led by Norway had invested billions in rainforest carbon offsets. Bogota brought them into the peace process as highly capable, well-funded stakeholders. In 2017 Colombia instituted a nationwide carbon tax to in part pay for FARC member reintegration. Additional financial commitments by the Europeans helped underwrite sustainable implementation of the accords.[50]

The Colombia peace process is an example of climate cooperation as a creative tool to help resolve a decades-old, previously intractable conflict. It is also instructive on the benefits of comprehensive, integrated climate security outcomes that a more inclusive, diverse, climate-conscious national security decision-making apparatus can identify and deliver. Such creative outcomes will become more frequent with a climate security-focused decision-making process for national security.[51] The case also points out how difficult it is to generate a long-lasting effect. The rejection of the initial peace deal with the FARC in a public referendum in 2016 as well as the 2021 announcement by the United Nations Security Council to extend its monitoring mission due to concerns over violence by pro-government forces demonstrates a lack of domestic and international confidence in the peace process.

Colombian President Juan Manuel Santos and the head of the FARC guerrilla Timoleon Jimenez sign the historic peace agreement on September 26, 2016. Gobierno de Chile / Flickr

KEY CLIMATE SECURITY IMPLEMENTATION ACTORS

Climate security practices are implemented by a broad range of actors that each have different political, social and financial positions that affect their work. However, with overlapping goals, different actors have an interest in learning from each other's lessons. As seen in the previous section, actors in the climate security field include international organizations, such as the UN and the EU, as well as NGOs such as EcoPeace, and militaries. Other prominent actors are donors that play an important role in funding climate security projects. Moreover, local governments are involved in policy making that supports climate security projects. See the table below for a non-exhaustive overview of actors involved in the field.

Table of climate security implementation actors

Type of Actor	Actors
Donor	DANIDA; DFID; USAID; SIDA; EU; etc.
NGOs	Mercy Corps; ICRC; EcoPeace Middle East; PAX for Peace; Energy Peace Partners; CGCIAR; etc.
International organizations	UNDP; UNEP; QUNO; European Union; African Union; etc.
Security actors	US military; United Nations Missions; European Defense Agency; French Defense Forces; etc.
Private organizations	Solar Now; etc.

In some cases, several types of actors are active in the same effort, which has proven to be effective. In particular, cooperation between defense, diplomacy and development agencies can lead to comprehensive and long-term impact, since they address different aspects of the climate-security nexus. Where the defense sector may have the technology and equipment necessary to reach people, development donors (and national governments) have the power to set policies and stimulate climate security practices, and international diplomacy can highlight and reinforce the issue among partner countries. Integration of donors, NGOs, humanitarian actors and defense is ideal to comprehensively address climate security challenges.

As the military is already on the frontline of responding in times of extreme weather events, there is potential for the military to also be included in climate security practices outside of emergency response in the context of prevention or adaptation practice.[52] Climate security practices are often implemented in regions where basic safety is met, as those development projects are less inclined to risk lives than projects in conflict or insecure areas. The military could play an important role in providing a safe space for humanitarian and development actors to implement their climate security work in areas that would most benefit.

RECOMMENDATIONS

From the broader analysis of climate security activities a number of observations have come to the fore.

First, while a great deal of writing has been done on the importance and potential of incorporating climate security measures, or on the importance of integrating the climate security nexus into development, diplomacy and defense activities, the actual number of practices implemented is small. Therefore, the first recommendation is that the transition from concept to implementation is critical. The efforts being undertaken by institutions such as the UN and the EU to address climate security in their systems is an important step in the right direction, but the reality of current climate security risks that threaten peace and stability today requires a broader and more rapid effort to start-up new practices and scale-up existing ones by all stakeholders; and to learn more systematically about what works and what does not.

Second, climate security activities thus far are often implemented in regions which are relatively stable. While it is an important preventative approach to address climate-security risks in relatively stable societies, the absence of climate-security measures in conflict zones or fragile states is notable. The military has a very important role to play in these higher-risk areas to support a safe environment for humanitarian and development agents to do their work on climate security. Moreover, the military, as one of the only actors in conflict zones, could also more clearly articulate to key government officials and political elites the risks to stability caused by climate change.

Third, quantitatively measuring the impact of climate security action is extremely difficult. This hampers the effort to understand when and how climate security practices may be successful, as well as how much they should be resourced relative to other efforts. Climate change impacts and potential policies must be weighed in light of the context-specific drivers and variables of a given conflict. Therefore, it is difficult to create anything more detailed than a general, basic framework. However, the lack of a universal blueprint is not an excuse for inaction and study of diverse scenarios can inform policy-making and strategic engagement. Appetite for experimentation should actually grow, now that this review of existing practices has made clear that this field holds a lot of potential.

Fourth, whatever effort is taken to either address climate or security or both, the design of the practice should avoid heightening tensions among other groups over natural resources. This can be helped by better integration of work among the myriad actors in the climate security field. Different actors are each addressing a small part of the problem; integrating those parts could create a more comprehensive approach to addressing climate security. Learning from diverse actors and across regions should also take place more broadly, as it is ultimately the impact of an initiative that counts, and not which actor has implemented it. Therefore, understanding that a common goal can be approached by different actors in a similar way can increase cross-sectoral and cross-regional learning and benefit the community of practice.

REGIONAL CLIMATE SECURITY RISK ANALYSIS

Sub-Saharan Africa analysis by:

Sofia Kabbej
Research Fellow at the Climate, Energy and Security Program
The French Institute for International and Strategic Affairs (IRIS)

Julia Tasse
Research Fellow and Head of Climate, Energy and Security Program.
Co-Director of the Climate and Defense Observatory
The French Institute for International and Strategic Affairs (IRIS)

EU analysis by:

Louise van Schaik
Head of Unit
EU & Global Affairs, The Clingendael Institute

Akash Ramnath
Research Assistant
Planetary Security Initiative, the Clingendael Institute

Anouk Schrijver
Former Research Assistant
Planetary Security Initiative, the Clingendael Institute

Year in Review analysis by:

Captain Steve Brock, U.S. Navy (Ret)
Senior Advisor
The Center for Climate and Security, an institute of theThe Council on Strategic Risks

Captain Roger Ullman, U.S. Navy (Ret)
Member, International Military Council on Climate and Security

Oliver-Leighton Barrett, U.S. Navy (Ret)
Senior Research Fellow
The Center for Climate and Security, an institute of The Council on Strategic Risks

Rachel Fleishman
Senior Fellow for Asia-Pacific
The Center for Climate and Security, an institute of The Council on Strategic Risks

INTRODUCTION

The years 2020 and 2021 will be remembered for the global COVID-19 pandemic above all else, but in decades to come they may also be increasingly remembered as a turning point in global climate action. The world's two largest economies and arguably most influential nations, the United States and China, made major new commitments on addressing climate change. Other leading nations quickly charted a similar course or accelerated existing commitments. From wildfires in Australia and the United States, to tropical storms in Central America, the Indo-Pacific and Africa, to heatwaves in Europe, climate security risks were apparent across the globe.

In this report, our regional analysis is presented in two parts. First, we present "deep dives" into climate security risks in sub-Saharan Africa, followed by Europe. Then we present "year in review" snapshots of key climate security developments in a handful of key regions and countries in the past year: the United States, East Asia, Central America, Brazil and Russia. These regions and countries were selected because they experienced particularly significant climate security related events or policy changes in the past year.

For more detail on climate security risks by regions, readers can also see the following reports published by the Expert Group of the International Military Council on Climate and Security and the Center for Climate and Security after the release of the World Climate and Security Report 2020:

Climate and Security in the Indo-Asia Pacific, Expert Group of the International Military Council on Climate and Security - July 2020

Climate and Security in Brazil, Expert Group of the International Military Council on Climate and Security - November 2020

Climate Security and the Strategic Energy Pathway in South Asia, Expert Group of the International Military Council on Climate and Security - February 2021

Climate Security and the Strategic Energy Pathway in Southeast Asia, Expert Group of the International Military Council on Climate and Security - February 2021

Climate Change and Security in the Arctic, The Center for Climate and Security - February 2021

A Climate Security Plan for Canada, The Center for Climate and Security - February 2021

DEEP DIVE: CLIMATE SECURITY IN SUB-SAHARAN AFRICA

Communities in countries across sub-Saharan Africa are facing the impacts of climate change and environmental degradation. These impacts manifest across the continent through the increased occurrence and intensity of droughts (Southern Africa and Eastern Africa), desertification (Western Africa), floods and landslides (Eastern Africa being particularly affected in 2020), rising sea-levels (Western Africa), as well as extreme weather events such as cyclones (Eastern Africa). Concurrent environmental degradation is having both visible and less visible impacts – deforestation, overgrazing, species infestation, disease emergence and intensification, soil degradation and biodiversity loss.

The reliance of a large portion of the African population on agriculture and fisheries for livelihoods makes people particularly vulnerable to both climate change and environmental degradation. These phenomena exert significant additional pressures on food systems (by causing crop losses and fish migration), social dynamics (by affecting households' revenue streams and expenditures or causing population displacements) and critical infrastructure (by affecting energy supplies). Although it is possible to identify common vulnerabilities across African countries, the ways in which climate change and environmental degradation contribute to the emergence of security risks depends on the specificities of local context.

Addressing climate change and environmental degradation impacts on communities and livelihoods in Africa requires increased knowledge of the interactions these two phenomena have with local social, political, economic, cultural, and historical factors. This requirement is particularly relevant with regard to ongoing tensions or conflicts linked to climatic or environmental factors, such as tensions between itinerant herders and farmers and those around fisheries or the management of transboundary resources. In all these cases, one key element that determines a country's vulnerability is its capacity to anticipate, prepare for and respond to both climate change and environmental degradation impacts, as well as other factors such as population growth and geopolitical competition that contribute to security risk dynamics.

Several policy responses are being implemented across the continent to respond to climate change and environment-related security risks: from agriculture and fisheries' adaptation policies,[53] to renewable energy or reforestation projects (e.g. Great Green Wall[54]), or early warning systems. However, most initiatives have yet to show their efficacy and remain largely insufficient in preventing the emergence of or attenuating security risks. Responses, if poorly designed, can actually enhance vulnerability and, while mitigating one aspect, be detrimental to another.

Two main points are critical to improving policy responses in Africa. First, efforts to simultaneously address climate change and biodiversity loss must be integrated as the issues are closely interrelated. Policies that solely aim to address climate change can threaten biodiversity – such as projects aiming to use carbon sinks situated in Africa for carbon capture and storage. Second, input from local communities must be integrated in the design of responses. This approach not only allows interventions to benefit from locals' regional knowledge, but also ensures policies match the cultural context and best address the needs of local populations. Additionally, it increases the likelihood of the communities' active participation.

Climate change and environmental degradation also impact armed forces' missions on the African continent. As is the case in other regions of the world, military forces are increasingly called upon to intervene for civil security missions

linked to climate change. The evolution of military missions ought to trigger a reflection on the design of military structures and the relationship between citizens and militaries. In the case of African countries, it is especially relevant to pay attention to the societal perception of militaries and, more broadly, to government-citizen relationships, as those are often characterized by a relatively high level of distrust, due most notably to historical factors.

The African continent is also characterized by a high level of foreign intervention: including the design and finance of policies, training or support in the intervention of armed forces, or construction and management of critical infrastructure. Beyond the intervention of foreign parties in national affairs, the continent's ecological and human security is also affected by the dependency of countries outside Africa on resources located on the continent. The extraction of such resources often has negative impacts on the natural environment, directly increasing the vulnerability of African communities that depend upon it.

SOUTHERN AFRICA OVERVIEW

In 2020, the Southern region of Africa suffered from its worst drought in many decades. Its changing climate is delivering diminished and late rainfalls, as well as long-term temperature increases. For several years, the dry season has been growing longer and hotter, causing significant food shortages.[55]

In 2019-2020, droughts affected an estimated 39 million people in Southern Africa. Populations in South Africa, the Democratic Republic of Congo, Zimbabwe and Mozambique were particularly at risk, with more than 32 million, 12.5 million, 12 million and 10 million people exposed to drought, respectively.[56]

Droughts have a direct impact on agriculture and livestock, two major revenue sources for populations in the region. In 2019, grain production decreased by 30 percent in Southern Africa as a whole, and 53 percent in Zimbabwe compared to 2018.[57] Parts of Lesotho, Eswatini, southern Madagascar, southern Namibia and Mozambique, also face poor crop performance.[58] Overall, livestock farmers suffer losses due to shortages of water and feed, while lower water levels in rivers contribute to the collapse of fresh-water fish stocks.[59]

In addition to food security, droughts also negatively impact energy supplies in Zambia and Zimbabwe due to the lower water level of the Zambezi River. The latter has barely sufficient water to keep the hydroelectric Kariba Dam running, which supplies about half of the two countries' electricity.[60]

EASTERN AFRICA OVERVIEW

Eastern Africa (EA), the most drought-prone region of the African continent,[61] has three rainy seasons: 1) the "short rains" from October to November; 2) the "long rains" from March to May (i.e., the primary rainy season) and; 3) the boreal summer from June to September. All three seasons are experiencing droughts and rainfall variations due to climate change.[62]

Carcasses of sheep and goats amidst a severe drought in Waridaad in the Somaliland region, 2011.
Oxfam East Africa / Flickr

Overall, precipitation and water storage have undergone an abrupt decline in EA. Droughts tend to be more frequent, longer, and more severe during the long rains season, which has seen a decline in rainfall due to shorter, but no less intense rains.[63] The short rains season (October-November) on the other hand, has seen a decrease in drought frequency[64] and an increased tendency of rainfall.[65]

Below-average rainfall forecast for the 2021[66] long rains season (March to May) is expected to exacerbate food insecurity in the region in 2021. In the longer term, the drought area in EA is expected to increase by between 16 percent on the low end and 54 percent on the high end, depending on the RCP scenario.[67] East Africa's complex terrain, large inland water bodies and land heterogeneity, as well as large-scale climate interactions, make long term projections on droughts and rainfall patterns difficult.[68] Such uncertainty renders planning complicated for public authorities and other stakeholders, thus significantly impacting human security and adaptation capacity in the region.

In addition to directly impacting livelihoods and communities, rainfall increases lead to deadly floods and landslides in EA.[69] In 2019, such extreme climate events adversely impacted over 2.8 million people in the region (cf. Figure 2), and caused the death of 280.[70] As of May 2020, 1.3 million people had been affected by flooding in EA, including at least 481,000 displaced[71] (cf. Figure 3); 200 and 65 people died in Kenya and Rwanda, respectively.[72]

From June to September 2020, precipitation was also above average over the northern and western sectors of the EA region, causing devastating floods at the peak of the season, displacing millions of people, many of whom were already suffering economically due to the COVID-19 pandemic and ongoing conflict.[73] Additionally, governments faced concerns about health security risks, in particular for children, as displaced populations' are often in overcrowded and unhygienic conditions.[74]

Water level elevation in multiple locations in EA, from the intense 2020 rainfalls, burst riverbanks and caused lakes to overflow. Lake Victoria experienced its highest elevations in more than 50 years and an elevated risk of flooding is anticipated.[75] Water levels in other major lakes, rivers, and dams were also among the highest on record in 2020, especially in major Rift Valley lakes, as well as the White and Blue Nile Rivers.[76]

Overall, these climate factors have combined with other risks in the region during the past year to undermine the economic growth and development pathways of East African countries, especially fragile states with weak institutional capacities.[77]

Rising Waters on Kenya's Great Rift Valley Lakes.
ASA Earth Observatory images by Lauren Dauphin, using Landsat data from the U.S. Geological Survey

Kenya: Risks of merging and contamination due to overflowing of Bogoria and Baringo Lakes

The increase in water volumes of Bogoria and Baringo Lakes in Kenya's Rift Valley are of increasing concern. Overflow has submerged infrastructures, houses, and farmlands, undermining two key economic sectors - tourism and agriculture - and displacing 28,428 people.[78] In the long run, there is a risk of contamination of the Bogoria (salty) and the Baringo (freshwater) – the latter providing water to tens of thousands of people.[79] Whereas the two lakes were situated around 20km apart in 2013, they have since expanded by 25 and 60 percent, respectively, and now sit only 13km apart.[80] Merging of the two lakes would be disastrous for ecosystems and for tens of thousands of people living in the region.

Beyond human costs, droughts, floods, and landslides have critical impacts on infrastructure (e.g., roads, bridges, hospitals, schools, energy facilities). During the 2020 long rains, Kenya and Uganda suffered nationwide electricity outages, leaving tens of millions of people without power.[81]

Below-average rainfall from January to June 2020, combined with climate events such as droughts or floods, resulted in significant crop losses. Such losses reduce demand for agricultural labor and hence remove a key income source for poor households, likely having limited their capacity to purchase food in early 2021. Crop losses also result in a reduction of food availability, contributing to increased food prices up to and after the January/February 2021 harvests.[82]

Precipitation during the long rains is also critical for livestock production in pastoral areas of southern and southeastern Ethiopia, Somalia, and Kenya, enabling pasture regeneration. Incremental food price increases might result in a decline of the *goat-to-cereal* terms of trade, which will impact household purchasing power.[83] Moreover, changes in rainfall patterns (both decreases and increases) are associated with atypical livestock migration patterns and higher household expenditures on water, livestock feed, and/or transport. Poor households are expected to increasingly engage in unsustainable livestock sales to purchase food or will experience food consumption gaps.[84]

SELECT CLIMATE SECURITY RISKS ACROSS SUB-SAHARAN AFRICA

Food Security

In 2020, climate change-induced droughts or floods intersected with a locust infestation and the COVID-19 pandemic to put increased pressure on already fragile regional food systems.[85][86] The locust infestation severely hit Ethiopia, Kenya and Somalia, though other African countries were also affected, including Djibouti, Eritrea, Tanzania, Uganda, Sudan, and South Sudan.[87]

Several factors contributed to the migration of desert locusts from the Arabian Peninsula to Eastern Africa, among which human modification of the environment through local environmental degradation, overgrazing and deforestation figure prominently.[88] Climate change consequences such as cyclones and heavy rains also contribute to create favorable wet conditions for the reproduction of locust swarms.[89]

The desert locust is considered among the most destructive migratory pests in the world.[90] The 2019-2020 outbreak-related losses are estimated at US$8.5 billion for countries in the wider East Africa region, Djibouti, and Yemen. In Ethiopia alone, the locusts caused "356,286 metric tons of cereal loss, along with destruction of 197,163 ha of cropland and 1,350,000 ha of pasturelands, with more than 1 million Ethiopians in need of food assistance as result".[91]

Since January 2020, action taken against locusts has averted a loss of cereal worth about half a billion dollars in the Horn of Africa alone – enough to feed 10 million people for one year.[92] Nevertheless, the Somali Ministry of Agriculture declared a state of emergency in February 2020. Countries are fortunately now better prepared to face another outbreak, which would be less dramatic in numbers[93] thanks in part to the development of an early warning system.

Tensions Over Fisheries

Africa's population is highly reliant on fisheries for its subsistence. Overall, fish provides 19 percent of African populations' protein intake[94] and fisheries employ up to 90 percent of the population in some countries, representing a critical economic sector.[95] Climate change impacts on fish stocks thus endanger livelihoods in many African coastal and island states.[96]

African fish stock forecasts are alarming: estimates range from a 30 to 40 percent decrease in fish biomass[97] in the intertropical belt around Africa by 2100 to a 30 percent decrease as early as 2050.[98] These estimates are based on climate models and mathematical forecasting; fish stock assessment is inherently complicated. Indeed, assessments currently require scientific campaigns to mobilize costly equipment for several months. Such campaigns are less regular than they were at the end of the 20th century and are less likely to rely on fishermen declarations, in light of ever-growing illegal, unreported, and unregulated fishing (IUU). Fish are exposed to both pressures from small-scale local fisheries and industrial fleets, often coming from foreign countries. As a result, while current fish stock estimates are highly uncertain, they are probably equally optimistic.

Confronted by a swelling demand for fish, in Africa and worldwide, the decrease in catch potential in African countries' exclusive economic zones (EEZ) has several security consequences. Fishermen will take risks to follow fish as they migrate, traveling further out to sea, thus consuming more fuel for the same catch volume, operating in

foreign EEZs or marine protected areas, adopting more risky or forbidden fishing techniques, fishing other species, or shifting towards other revenue streams. Fish depletion off the coasts could also lead to tensions between fishermen, whether they be small-scale or industrial fleets, for access to remaining fishing zones.

All of these factors increase maritime insecurity around Africa. Even excluding other illegal activities such as trafficking, bunkering or piracy, these countries face a rise in illicit and aggressive behaviors. IUU fishing itself represented at least 3 to 6 percent of industrial fishing time in African countries' EEZs between 2012 and 2016.[99] Conflicts between local and foreign fishermen are multiplying. For example, in 2017, Cameroonian gendarmes' requirement that Nigerian fishermen pay a new tax on fisheries led to violent conflict: fishermen allegedly appeared to be armed and 97 of them died after gendarmes opened fire. ECOWAS and the UN interceded to neutralize the crisis between both countries, as the deadly incident took place in a disputed maritime zone.[100] This event illustrates rising tensions around a depleting resource, worsening maritime security and safety at sea for numerous coastal and island populations.

Mauritania and Senegal's strained relationship around fish stocks is another example. A new Mauritanian regulation in 2016 stated that Senegalese fishermen operating in Mauritanian waters should first unload in Mauritanian harbors. Senegalese fishermen refused both to register their boats and unload their catch, continuing to operate 'illegally'. In January 2018, members of the Mauritanian coast guard opened fire on a Senegalese fishing boat, killing a young fisherman and triggering massive uprisings in Saint Louis, Senegal.[101] An agreement between both countries was signed a few months later, opening Mauritanian waters to 400 Senegalese small-scale fishing boats and making unloading in Mauritania compulsory. The agreement mandates that 6 percent of the Senegalese catch should be sold in Mauritania, as the country faced fish shortages during the uprisings, due to their limited fishing fleet.[102]

At the continental level, responses to IUU fishing are patchy and uneven. Several countries have worked to strengthen their maritime security mechanisms. For example, around the Gulf of Guinea, coastal states have been discussing maritime security issues since 2013 under the umbrella of the Yaoundé Summit. Twenty-two countries and several intergovernmental organizations participated in this dialogue, which led to a Memorandum grounding coordination mechanisms for safety and security at sea. This process enabled an annual regional strategy and follow-up meetings, information sharing processes, and the establishment of an interregional coordination center in Yaoundé. While common patrols have been implemented and the harmonization of surveillance procedures is planned for the coming years, concrete operationalization of the memorandum remains incomplete. Coordination based on reinforced exchanges between countries through international structures is necessary to more efficiently address this global issue.

Deforestation

According to estimates, deforestation in Africa is principally followed by small-scale cropping (61.1%) with a lesser role for pasture (14.7%).[103] However, precise deforestation rates are difficult to estimate due to illegal logging,[104][105] the value of which amounts to approximately $17 billion every year (2014).[106]

Stakeholders trying to halt deforestation tend to confuse illegal logging with the informal wood trade which is intended to meet the subsistence needs of local populations. These populations could have a significant portion of their livelihoods criminalized by laws and regulations.[107] In some cases, regulations can also be detrimental to security in the region. The adoption of the 1997 Forestry Law in Burkina Faso, for example, was detrimental to the livelihoods of farmers, herders, fishermen and hunters and occasionally led to eviction of communities - many hunters would have become poachers and turned to banditry.[108]

A field where trees have been illegally cut down within Tiogo Forest, Burkina Faso, 2014. **CIF Action / Flickr.**

Deforestation also impacts local communities by directly affecting ecosystems. Lake Tanganyika – the world's second largest freshwater lake by volume, shared by the Democratic Republic of the Congo, Tanzania and Zambia – is threatened by sedimentation caused by land degradation due to deforestation in the lake basin. As the lake provides fresh water fish to communities in the basin, such degradation poses significant regional human security challenges.

To combat deforestation and illegal logging, several initiatives have been implemented in the region such as the 2015 Declaration on Illegal Trade in Timber and other Forest Products, signed by several Eastern African countries, or the Reducing Emissions from Deforestation and Forest Degradation (REDD+) schemes.[109] Moreover, reforestation may also become a motive for cooperation, sustainable development, climate action and peace, as illustrated by the Great Green Wall project[110] in the Sahel region--which convenes more than 20 African countries with international partners including the European Union and France with the aim to grow an 8,000 km "green wall" and improve food security, job and stability across the continent.

To increase agricultural productivity and reduce rural poverty, the Madagascan Ministry of the Environment, Ecology and Forests signed an agreement with the World Bank in February 2021. This agreement, worth $50 million, aims to reduce carbon emissions linked to deforestation and forest degradation between 2020 and 2024.[111]

Despite such initiatives, others that also aim at restoring forests have been qualified by some as "militarized"[112] – in a context of increased militarization of wildlife protection.[113] Among those, some have led to alleged cases of harm caused to local communities. This was the case in 2017 with the Baka people in Cameroon, who have been allegedly abused "by eco-guards trained by a private company and funded by WWF".[114]

Farmer-herder tension in the Sahel

According to the United Nations Office for West Africa (UNOWAS), clashes between herders and farmers "remain some of the most violent local conflicts" in the Sahel, an area extending from Mauritania to Sudan.[115] The region is currently characterized by an increase in the "frequency and severity of clashes involving farmers and herders across the Lake Chad Basin and Western Sahel, both locally and across national borders."[116]

Farmers' and herders' livelihoods are dependent on access to water and land in different ways. While farmers tend

to be sedentary, "nomadic and semi-nomadic pastoralists graze their cattle in line with the seasonal migrations and search for water and pasture that will sustain their herds, often crossing national boundaries in fulfillment with these needs."[117] Several factors contribute to increasing tensions between farmers and herders as they seek to access natural resources, including: climate change impacts, population growth, small arms proliferation, ineffective governance systems, and the presence of non-state armed groups taking advantage of governance and security vacuums.

Desertification and variability in climate patterns (especially rainfall) contribute to increased pressures on natural resources. The Sahel is characterized by limited access to arable land and reduced availability of reliable water sources. Nearly 70 million people are estimated to be affected by desertification in the region and around 30 million living in proximity to Lake Chad will be impacted by its variability.[118] In an area where around 50 million people depend on pastoralism, changes in rainfall patterns endanger both farmers' and herders' livelihoods.

The fragile security context is also the result of poor governance systems, insurgencies, and state collapse. In many parts of the region, state institutions are unrepresentative, ineffective, or altogether absent. Moreover, some groups affected by violence have been "historically marginalized from political and economic power" contributing to deep resentment and distrust towards public authorities.[119] This may also be due to identity-based distinctions.[120] As a result, farmers and herders tend to defend their livelihoods by 'taking matters into their own hands'.[121]

The demand for water and land are expected to increase due to population growth (e.g., demand for meat, milk, and eggs in West Africa will quadruple by 2050).[122] It is important to underline, however, that climate change and population growth do not inherently constitute factors for the emergence of conflict, but rather act as additional pressures or accelerants in dispute dynamics.

The dynamic of population growth and increased demand for animal products has encouraged new pastoralist trends in some areas, including larger herd sizes, professionalization of herding, and the use of "private security personnel and arms for self-defense and herd protection" who are increasingly well armed.[123]

The proliferation of small arms and light weapons (SALWs) has indeed become a defining characteristic of farmer-herder clashes. In a region where public authorities have difficulty reaching many rural areas, state fragility and porous borders allowed SALWs to flow illegally across national borders. However, rather than driving attacks, the availability of SALWs most notably increases their lethality.[124]

Foreign governments' military assistance in the region can feed this cycle of violence as "weapons that were sold throughout the region legitimately, by international partners hoping to support states in the Sahel, have found their way into the hands of criminals and community militias".[125] There is currently no concrete and coordinated policy in the region addressing challenges posed by SALWs.

Another factor contributing to increased violence between herders and farmers relates to the presence of armed groups in the region; as insurgent and jihadist groups' actions[126] tend to restrict herders' movements. Those groups also often take advantage of the governance vacuum and capitalize upon ongoing clashes to increase their influence. In Mali, for instance, the Islamic State in the Greater Sahara (ISGS) "promoted a liberation idea of freeing hired pastoralists from herd owners."[127]

Groups of armed bandits also operate in the region. Some of them, especially in Nigeria and southern Niger, steal cattle and attack communities using sophisticated weaponry. There is no evidence so far that a common ideology motivates these attacks.[128] In response to increased cattle theft, communities can seek protection from "vigilante groups,"[129] which are often organized along ethnic or sectarian lines. Such identity-based protection groups can contribute to increased violence among communities, as marginalization fuels recruitment narratives.

In February 2021, thirty-five people (including a soldier) were killed in an inter-community clash between pastoralists and farmers in Chad. This deadly confrontation originated from an attack by "road blockers"[130] on farmers. The farmers accused herders of being responsible for the incident and launched retaliation strikes, targeting herders in Salamat province in southeastern Chad.[131]

REGIONAL AND INTERNATIONAL RESPONSES TO CLIMATE-RELATED SECURITY RISKS

UNOWAS initiative on climate change and security

The UN Office for West Africa and the Sahel (UNOWAS) was created to craft synergies for better engagement with the countries of West Africa and the Sahel. The Office is responsible for preventive diplomacy, political mediation and facilitation efforts in the region and works closely with several cooperation fora, such as the African Union and the G5 Sahel.

To achieve its mandate, UNOWAS leads advocacy efforts for the implementation of the United Nations Integrated Strategy for the Sahel (UNISS). Recalibrated in 2017, it now includes cross-cutting issues such as climate change and gender-mainstreaming in UNOWAS mechanisms and processes for peacebuilding and conflict prevention. The resilience pillar of the strategy prominently features the need to mitigate the impacts of climate change.[132]

In January 2020, the UNOWAS mandate was further extended by the UN Security Council (UNSC) to take into consideration the adverse implications of "climate change, energy poverty, ecological changes and natural disasters, among other factors, and assist governments in the region and the UN system in undertaking risk assessments and risk management strategies" relating to climate change factors.[133]

Several initiatives are currently being implemented to tackle climate-related security risks, to include the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) that focuses on natural resource governance and monitoring. Additionally, UNOWAS carried out a study on conflicts between pastoralists and farmers in its jurisdiction. It is also encouraged by the UNSC to coordinate efforts with governments and other cooperation initiatives such as ECOWAS.

Early Warning Systems

Considering Africa's vulnerability to the multiplicative interaction of climatic and political factors, several early warning systems (EWS) have been created since the early 2000s and continue to be developed or expanded. Such systems aim to predict and sometimes prevent food crises, droughts, extreme weather events, or species infestation, including at the national and regional levels. Below are some examples of regional cooperation initiatives along these lines.

Developed by Action Against Hunger in 2010, the Pastoral Early Warning System (PEWS) aims to track drought impacts and "improve response capacity to the food and nutrition crisis in pastoral and agro-pastoral livelihood regions."[134] PEWS was expanded in 2018-2019 to support climate change resilience in the Sahel by adding data sets on livestock conditions, biomass and surface water productions and accessibility. In May 2020, the COVID-19 pandemic led to the incorporation of a monitoring tool to provide weekly information on pastoral households.[135]

To limit the further spread of locust swarms and prevent other infestations in East Africa, scientists in the region developed an EWS able to forecast locusts' movements using data on temperature, humidity, wind speed and direction, soil moisture and vegetation cover. Ultimately, the system aims to provide information to policymakers to better direct their spraying efforts and help "control the hoppers before they swarm."[136]

3D approach (Diplomacy, Development, Defense and Sustainability[137])

Responding to the complex interaction of various drivers to crises and conflicts, the "3D approach" aims to foster coordination between defense, diplomacy and development stakeholders by increasing the understanding of the root causes of crises and conflicts and enabling action to resolve or prevent their outbreak. While the 3D framework originated in the United States, this new incarnation (with sustainability as the driving force) is explicitly mentioned as a strategic orientation in some countries, especially in France,[138] where it mainly refers to the coordination among the Ministry of the Armed Forces, the Ministry of Europe and Foreign Affairs (MEFA) and the French Development Agency (AFD).[139]

The 3D approach is notably at the core of France's engagement in the Sahel. Beyond the involvement of defense forces and diplomatic actors, who are, respectively, in charge of restoring and strengthening stability[140] and improving the support and engagement of the UN and the EU, the AFD tries to restore economic opportunities for local communities, satisfy basic needs, and provide essential services, through investments and development projects such as water supply infrastructure.[141]

The implementation of the 3D approach requires a high degree of inter-agency and international coordination and a reform of mission planning to improve coordinated decision-making. It is essential to avoid the pitfall where such an approach could lead to new forms of silos in policy-making by inciting stakeholders to differentiate the Ds and to compete for recognition and resources.[142] However, it is this comprehensive (or "whole of government") approach that is best suited to addressing the complexity inherent in the contemporary climate security environment.

DEEP DIVE: THE EUROPEAN UNION AND CLIMATE SECURITY RISKS

The European Union (EU) has long recognized climate change as a threat multiplier in the context of global conflict and insecurity. In the realm of climate diplomacy, the EU has championed greater recognition of the impact of climate on security and defense policy. The need to address climate risks within and outside the EU's borders puts greater attention on the current instruments that the EU has available.

While the European Green Deal (EGD) and an agreement to spend 30 percent of the EU budget (2021-2027) on climate change action will give the bloc greater teeth in this fight, there is still much to be done to mainstream climate within the security and military sectors across the EU, and to ensure climate finance is used more in unstable countries. In 2020, the European External Action Service (EEAS) proposed a Climate Change & Defense Roadmap, which aims to integrate climate change into existing and future defense and military actions by the EU.[143] Moreover, in January 2021, EU Council Conclusions for the External Dimension of the European Green Deal were adopted, which looked at the further integration of EU climate objectives in the wider remit of EU external action. This supplemented an elaborate set of Council Conclusions on EU Climate Diplomacy that had already been in place for years. Considering the pace of these changes, this chapter will analyze the EU's contribution to climate security by proposing and answering four distinct questions:

1. What are the actual risks to European security because of climate change?
2. What instruments are available to the EU at this moment?
3. What are the key gaps or shortcomings in EU policy?
4. What recommendations can be made to enhance the EU's ability to address climate security?

Climate Risks Most Relevant for Europe

In the European discussion on climate security, the risks outside the EU are often emphasized. Here we will consider how these risks are relevant for the EU, and we will also discuss more direct threats, such as the possible halting of the Gulf Stream, heat waves, floods and new diseases entering the EU. The focus will be on risks most relevant for military organizations and defense sectors at large.

If we look at an atlas, it becomes clear Europe is surrounded by climate hotspot regions, notably the Arctic and the Middle East and North Africa (MENA) regions. These regions are suffering from climate change in different guises and the instability this creates poses direct and indirect risks to the EU's security.

To begin with, the warming of Earth's oceans and receding **Arctic** ice sheets have opened the region to greater resource exploration and faster maritime trade routes. In February 2021, Arctic sea ice was on pace for a record low of sea ice coverage.[144] This leads to new economic opportunities, but also to renewed tensions since access to sea lanes are contested issues in the Arctic. For the EU (and European countries that are NATO member states), Russia's claim

Russian nuclear icebreaker "Arktika", the first surface ship to reach the North Pole in 2006. Abarinov / WikiMedia

and activities in the region, often backed by China, are a point of concern. They demonstrate that the Kremlin is determined not only to extract more oil and gas from the region, but also to establish military installations to strategically outposition their European counterparts. In February 2021 the landing of Russian supersonic jets at bases in Nova Zemlya demonstrated the advanced Arctic capabilities of the Russian military.[145]

Moreover, Russia demands that ships which navigate through the Northern Sea Route from Europe to Asia make use of Russian icebreakers, pay for the use of the sea lane, indicate what they transport, rely on Russian search and rescue, and allow a Russian crew member to enter the ship for monitoring purposes. Even though some claim the sea lane is located in international waters, they lack the ability and projection of force to sail through independently.

In 2021 the EU is expected to present a new Arctic strategy that will aim to devote more attention to geopolitical tensions, while at the same time focus on mechanisms for confidence-building.[146] The EU traditionally attaches much importance to multilateral institutions such as the Arctic Council and international law that guides the UNCLOS Commission on the Limits of the Continental Shelf. This organ is responsible for deciding upon the merit of the respective claimants to the Arctic Sea territory - yet another issue subject for contestation among the Arctic coastal states.

The increased temperature in the Arctic also influences **fish stocks**, which are equally affected by potential shifts of the Gulf Stream and other climatic changes, especially in the Atlantic Ocean. China is also eyeing the fish abundance in the Arctic to satisfy an ever-increasing demand to feed its population.

Another strategic concern for the EU is the impact of climate change on the **MENA region**, including the potential for **new irregular inter-state migration flows**, even though solid evidence on climate change leading to additional migration to the EU is still lacking. If climate change results in additional migration, either directly or indirectly, this could be exploited by anti-immigrant political forces for their benefit, and contribute to increased ethnonationalism that is harmful to European security. These dynamics may also increase calls to the military to assist with **border control**, which could contribute to tensions and humanitarian concerns.

The MENA region poses challenges not just because of migration, but also due to the **rising risk of conflict**. Climate-induced impacts such as desertification, water scarcity and subsequent agricultural production collapses are significant

Syrian and Iraqi refugees arrive from Turkey to Skala Sykamias, Lesbos island, Greece. WikiMedia

threats to human security in the region. Crippling food and water shortages are likely to displace millions; their movement towards urban centers to find employment is likely to increase friction with established communities and with authorities, who either struggle to support more desperate populations, or use migrants as a scapegoat.

For instance, in Iraq, it is estimated that 90 percent of the land is at risk from desertification and land degradation (especially in the South of the country).[147] This issue combined with rising water salinity is ruining agricultural output and forcing many rural communities to abandon their lands and move towards urban areas. The resulting tension created by urban and rural communities cohabiting and the failure of the Iraqi authorities to manage the situation contributes to instability. In turn, EU security is threatened by an unstable and conflict-prone neighborhood.

Changes in sea levels and in particular changes to the flow of the **Gulf Stream** may have devastating environmental and geo-strategic consequences for the EU. A shift in or even disappearance of the Gulf Stream threatens to expose the continent to more volatile oscillation in temperatures, leading to more extreme weather phenomena such as droughts and prolonged colder periods. This would damage the EU's agricultural supply chain and production capabilities, public health and member states' military readiness, in addition to depleting the financial and physical resources of states to mitigate and adapt to such conditions. An increased need for military assistance for disaster response 'at home' could challenge security capabilities of military forces in Europe.[148] This, together with sea level rise and increases in summer heat waves, may also pose new risks to military installations, with an inventory of such risks currently still lacking for European militaries.

On top of this, calls for humanitarian relief and disaster assistance in **overseas territories** such as the Caribbean, Pacific and Greenland, as well as from countries in the climate-vulnerable ring around Europe, are on the rise. Already, the EU has committed $1.7B in 2021 to humanitarian relief efforts.[149] The calls are likely to grow, especially from countries disproportionately affected by climate change and the uneven development of the energy transition. Without further reforms and resources, the EU's disaster relief response could be easily overwhelmed with the sheer number of calls for support and natural disasters.

Climate change is changing **health conditions** in Europe as well. One consequence is the spread of vector-borne diseases such as the West-Nile virus northwards into Europe.[150] Since late 2020, the West-Nile virus has been detected in Italy, Greece, the Netherlands, Bulgaria, Spain, Germany, France, Portugal, Austria and Hungary.[151] The tiger mosquito is another potentially dangerous disease-vector, whose northward spread is linked to global warming.[152] This mosquito spreads Zika and Dengue virus. The tiger mosquito is already commonly found in Italian cities, where the climatic conditions have become optimal for the species to survive. More European countries will be affected by the spread of vector-borne diseases as their climatic conditions begin to match tropical regions, with implications for Europeans' health security.

The EU increasingly recognizes the security risks linked to the **energy transition** and its implications for relations between countries and geopolitics more generally. Paradoxically, in the Arctic, climate change is revealing new reserves of energy, particularly oil and natural gas. In many petrostates, climate change policies that aim to reduce the use of fossil fuels threaten their vital national revenues and subsequent legitimacy. In contrast, some other states that might historically have imported oil and gas are now endowed with abundant potential for renewable energy, reducing foreign dependency. In short, the energy transition that is arising from climate change will shake up the established international structure and power players; it is through this transition that friction may occur within the EU or its neighborhood.

The decision of Germany to press ahead with the **Nord Stream 2** gas pipeline despite outcry from the US and other EU member states illustrates that national interest based on fossil fuels is still alive, despite the agreed EU objective to be climate neutral in 2050.[153] This has reinforced fears that further Russian natural gas infrastructure across Eastern Europe will enhance the Kremlin's ability to switch off power to existing and future markets, especially given the fact that the pipeline is on track for completion. This risks furthering the fragmentation of the bloc and opening up Europe to strategic energy manipulation (through price and supply control) by external powers.

A final word should be given to the **economic cost** of climate change and its security implications. The EU predicts that at current levels of climate change, the bloc is set to face annualized economic losses of $14.1 billion; a warming of 3 degrees Celsius above pre-industrial levels could result in an economic loss to GDP exceeding $202 billion.[154] From a security perspective, the economic loss would undermine member states' ability to maintain a robust and sophisticated military, force cutbacks in foreign support to climate affected regions, and even lead to internal crises in the worst plausible cases.[155] Thus, the risks of not enhancing the EU's climate security readiness are too great to ignore.

Current EU Instruments

The EU has started to include climate security in its different realms of EU external action. In comparison to other big powers, it has the most elaborate policy framework in place to reduce greenhouse gas emissions. The European Council agreed in December 2020 to reduce emissions by 55 percent by 2030 compared to 1990 levels and to reach net-zero greenhouse gas emissions by 2050.[156] It is now working on proposals to adjust the current policies in place. The EU agreed that 30 percent of its expenditures for the period 2021-2027 need to be spent on climate policy, and the so-called European Green Deal is central in the post-Covid-19 recovery plans. This also means instruments for EU external action will shift substantial attention to climate mitigation and adaptation interventions.

As part of its **Common Security and Defense Policy (CSDP)**, the EU recently endorsed a **Climate and Defense Roadmap** that was prepared by the European External Action Service (EEAS). As of April 2021, the document has

been discussed by Ambassadors of EU member states meeting in the Political and Security Committee, but not yet by Defense Ministers. At its heart, the Roadmap aims to enhance climate resilience for current and future EU missions by identifying gaps in strategic and operational readiness. It entails a trajectory for short-, medium-, and long-term EU actions addressing the links between climate change and defense. The three tables below outline the EU's actions for the roadmap:

Figure 1. Operational Dimensions[157]

Operations/Action	Timeline Impact
An early warning system, conflict analysis tool, weather forecasting and climate prediction modelling capabilities integrated into CSDP missions (both military and civilian)	Short Term (2020-2021)
Mainstream climate change and environmental consideration into the planning and implementation of CSDP mandates	Short Term (2020-2021)
Enhanced assessments of preparedness and response to natural and humanitarian disasters across both civilian and military missions	Short Term (2020-2021)
Improving environmental/carbon footprint of CSDP military missions through research projects funded by the European Peace Facility	Short Term (2020-2021)
Further mainstreaming by inserting Environmental advisors in every CSDP mission and developing SOP's (Standard Operating Procedures) for each distinct mission based on climatic conditions	Medium Term (2022-2024)
Collection and analysis of data regarding CSDP missions energy efficiency and integrate findings into the annual review of the Roadmap and new 'green' defense innovations e.g. Smart Camps	Medium Term (2022-2024)

Figure 2. Capability Development[158]

Operations/Action	Timeline Impact
Collaboration of all relevant EU Commission services and other training providers to integrate environmental concerns and protection vectors into EU trainings and best practices	Short Term (2020-2021)
Exploration of 'Green Public Procurement' (reducing carbon footprint in the procurement process) for military infrastructure	Short Term (2020-2021)
EEAS and European Defense Agency (EDA) support for technological innovation around enhancing the efficiency of capability projects	Medium Term (2022-2024)
Usage of the upcoming European Defense Fund (EDF) to support research around 'defense-orientated solutions' for energy related issues	Medium Term (2022-2024)
Integrating climate objectives with defense transportation and logistics through the trans-European network for transport (TEN-T)	Medium Term (2022-2024)
Creation of a forum on the Circular Economy on European Defense (IF CEED) to address issues ranging from waste management, component tracing, water management etc.	Medium Term (2022-2024)
New mechanism managed by the Commission services to act as central hub for all data and research from the aforementioned activities	Medium Term (2022-2024)
EDA will research how to strengthen resilience of vital energy networks and infrastructure critical for defense activities	Medium Term (2022-2024)

Figure 3. Strengthen Multilateral Partnerships[159]

Operations/Action	Timeline Impact
EEAS will lead efforts with international organizations and external countries to identify and educate partners on the links between climate change and security	Short Term (2020-2021)
Establishment of structured discourse with relevant UN departments to communicate findings, best practices and foster on-the-ground cooperation	Short Term (2020-2021)
Direct communication with NATO to explore further areas of cooperation	Short Term (2020-2021)
Direct communication with African Union to explore further areas of cooperation	Short Term (2020-2021)
Greater collaboration with African states to support ability to respond to climatic shocks and disasters by enhancing civil protection agencies	Short Term (2020-2021)
Improving strategic UN-EU partnership by introducing climate change considerations into shared objectives	Medium Term (2022-2024)
Inclusion of climate change considerations into security/defense engagements with external countries	Medium Term (2022-2024)
Expansion of research network to explore the linkages between climate change and the impact on the security/defense sector and consequently the EU's crisis management capability	Medium Term (2022-2024)
EU leadership at global climate and environmental forum and policy	Long Term (2025 onwards)

Of particular interest is the focus placed on mainstreaming efforts at all levels of the security and defense sectors across the EU. From the insertion of environmental advisors on a ground level for all CSDP missions to the innovation around carbon-friendly defense procurement, the plan shows a strong commitment to placing environmental factors at the heart of the EU's security apparatus, with the hope that this will make missions more robust and responsive to a more complex risk matrix. Moreover, the EU wishes to maintain its position as a global leader in integrating climate considerations into security and sees the above actions as a potential roadmap for other regions to follow.

As part of its **Common Foreign and Security Policy,** the EU has an elaborate climate diplomacy program in place, which includes the climate security nexus as an issue area. Climate change is prominently included in many of the bilateral dialogues between the EU and other countries. For example, meetings were organized with Canada and China in response to the US withdrawal from the Paris Agreement under the Trump Administration. Climate security was included in the work of the conflict prevention and mediation support unit of the EEAS, and climate risks are part of its early warning and early action policies, as highlighted in the Roadmap.

European countries have been **a leading voice multilaterally** for climate security to be recognized at the highest of levels. In 2020, Germany, in its role as chair of the UN Security Council (UNSC), proposed a resolution to identify potential climate-related risks through a distinct mechanism, but this proved a bridge too far to the United States, China and Russia. German leadership in the 'Group of Friends'[160] on climate and security demonstrates the pre-eminent position in which EU member states are placed to affect climate security policy externally. France remains a leader on climate security topics at the international level as well, using its permanent seat in the UNSC to raise the climate security agenda. Finally, EU member states have thrown substantial support behind the UN Climate Security Mechanism, with the Netherlands and Sweden in particular being key leaders on integrating climate security into all levels of the UN. Clearly, the EU is pushing hard to be front and center in the fight against climate security both within the bloc and outside it.

The EU's efforts to include climate change in its external action are also reflected in the structure of the EU's instruments for international assistance. For the new **Neighborhood, Development and International Cooperation Instrument Global Europe (nearly 80 billion Euros in 2021-2027),** it has been decided to allocate 30 percent of the budget to climate-related activities.[161] Incentivizing climate-related action in development spheres in the neighborhood of Europe provides new opportunities for environmental peacebuilding. The EU is currently merging its different financial instruments into one combined instrument (the NDICI) that is more fluid in terms of financing projects which aim to address several policy challenges and objectives. These reforms aim to offer greater flexibility and targeting when appropriating funding to a conflict's source of origin, especially in the case of climactic drivers pushing regional instability. Spending needs to be done in a conflict-sensitive way, however, since climate funding can contribute to insecurity if it influences power balances between groups as a result of the selective provision of assistance to one group but not another.

The EU has also integrated climate change and sustainability into its **trade agreements** with third countries. They usually stipulate the ratification and implementation of the Paris Agreement on Climate Change. Also, the EU is currently preparing a Carbon Border Adjustment Mechanism, an import levy on carbon-heavy imports, such as steel and cement. EU industry currently faces costs from the EU's climate policy--notably its centerpiece, the EU emissions trading scheme. The new Mechanism is an effort to level the playing field and avoid industry relocation outside the EU. Other countries are already complaining about this trade measure, however, and this may lead to new tensions.

Lastly, in January 2021, the Council of the EU adopted the findings of the document "Climate and Energy Diplomacy - Delivering on the external dimension of the European Green Deal." This reaffirms the central role of the bloc as a global leader in **energy diplomacy**. The commitments made include reducing "further investments into fossil-fuel-based infrastructure projects in third countries," improving and expanding climate financing for renewable energies, while enhancing the readiness of global governance to deal with the growing geopolitics of the energy transition.[162] The EU – when combining the budget of the EU and the member states- has already committed $23.2 billion[163] to global public climate financing, more than double its 2013 figure. The Council conclusions once more acknowledge climate change as a threat to international stability and security,[164] especially affecting those in the most fragile and vulnerable situations. In the run-up to the UN Climate Summit COP26 in Glasgow – postponed to 2021 due to the COVID-19 pandemic – the EU plans to be a constructive and assertive partner, leading by example to devise ambitious long-term strategies and revising the Nationally Determined Contributions (NDCs).[165] Thus, the EU is seemingly prepared to deal with not just the immediate financing of the energy transition but also the geopolitical strains, such as uneven development and energy contestation, that will result from the transition.

Areas for improvement

Although the EU has invested significant effort in identifying climate security risks, there is still urgent work to be done across the union in terms of taking and implementing climate security actions. Without immediate attention, the safety and security of European citizens and those within the wider neighborhood will be threatened.

The first and most obvious area for concern is that the EU's roadmap is just that: a roadmap. Very little tangible progress has been made on the ground. The roadmap does not actually contain hard deadlines to achieve short, medium or long-term operational improvements and thus there is a risk that these reforms will be delayed or even shelved among the many other objectives of specific EU missions and the CSDP in general. In the meantime, security readiness to climate impacts will suffer.

Three more substantial aspects that the roadmap lacks are an **emissions reduction target for military organizations, a vulnerability assessment of military installations of EU member states,** and an **analysis of how climate change may impact the military capabilities of rivals**. The first is probably most sensitive. An exact overview of emissions of the defense sector is lacking and emissions of military missions abroad and international flights and shipping (including of submarines) are not included as part of the national emissions that are covered by EU policies. A recent study pointed to the cumulative emissions in 2019 of the defense sectors of EU member states equalling roughly 24.8 million tCO2e, the equivalent CO2 emissions of 14 million average-sized cars a year.[166] This statistic in itself should demonstrate the considerable contribution of military operations and equipment and the sector needs to be applied with similar rigorous targets as other sectors the EU is climate-proofing.

What is remarkable is that the push to "green the army" is primarily coming from within the defense sector rather than from climate policy-makers or activists. Even so, the defense sector in the EU is still not fully behind the need to climate-proof their activities and the importance of their contribution to combating climate insecurity. Some argue for instance that binding commitments on energy sustainability for defense could adversely affect the performance of existing capabilities or operational performance.[167] Climate change also competes for attention and funding with more established threats, such as cyber-security or Russia.

Unlike in the United States, there is hardly any information about the climate vulnerability of military assets in the EU, including installations, bases, buildings, equipment and land. It is currently not known how EU naval bases, for instance, are threatened by sea level rise. There is generally little objective information on what climate change may imply for calls for more domestic and international assistance and missions, beyond the general observations that such calls are likely to increase because of climate change. Equally, there is little assessment of how such developments may also affect strategic rivals of the EU.

Overall, the narrative presented by the EU still focuses on the long-term economic gains of transitioning to a low carbon economy, instead of the urgency of climate action within a security lens. Framing climate change as an economic topic focuses on the so-called soft gains and there is still considerable suspicion about the "securitization" of climate change, which is often confused with "militarization." The confusion and subsequent lack of urgency from the framing inevitably dulls member state proactivity and a better understanding of how climate change acts as a threat to peace and stability, but could equally be considered an entry point for conflict prevention and peacebuilding. Better understanding and framing of climate change as a direct influencer of hard security and subsequent interventions as a multilateral peace-building opportunity may receive more unanimity in support by EU leaders and groups.[168]

From a **budgetary perspective**, only one small project has been funded specifically for climate security reasons through the EU's "Instrument contributing to Peace and Stability."[169] This represents a tiny fraction of spending by foreign policy instruments and demonstrates that climate security has not yet been financially mainstreamed. The integration of the instrument may lead to more opportunities to fund the climate security nexus, but this will not be automatic. Another opportunity for funding might be the European Peace Facility, which will streamline and simplify the various financing instruments for security interventions, reducing complexity and enhancing speed at which resources can be made for climate security risks.

Within EU institutions, discrepancies around the **urgency** of climate-proofing the recovery also exists. While the European Commission and European Parliament continue emphasizing the urgency of a green recovery in line with the European Green Deal (EGD) growth strategy, the European Council, composed of the political leaders of the EU member states, instead emphasizes cohesion and solidarity for Europe's recovery.[170] The European Parliament adopted "solidarity, cohesion and sustainability" into its statement on EU recovery,[171] to ensure that EU recovery funding is invested in accordance with EGD guidelines. Within the agreed recovery package, the Green Deal maintains centrality. This highlights an Achilles heel to the EU's climate-proofing strategy; if national leaders still prioritize cohesion and solidarity over a rapid integration of climate change into any recovery, then the issue will continue to be a political football that has a strong chance of stagnation, which would undermine the very objectives the EU has spent great energy setting out.

Moreover, the EU lacks proper **coordination** around member states' efforts to mainstream climate security. Some states are ahead of others. This includes France, which has begun integrating climate security considerations into its military, and Denmark, which is incorporating climate security considerations into its development cooperation actions. However, this has not been aligned at an EU level. There is still hesitancy in climate adaptation and development circles to integrate a hard security angle, since in many unstable countries, the local security community is considered part of the problem rather than the solution. Additionally, some member states argue that climate mainstreaming within national defense sectors should be left to national governments, given that defense operations and structures are a national prerogative. Mainstreaming efforts on defense are conditional on the fact that all activities are optional for countries to participate in. The fact that the roadmap has not yet been discussed by the Defense Ministers, but only at an Ambassadors level, could indicate there is no full consensus yet.

RECOMMENDATIONS

The European Union is increasingly taking on the role as a leader in climate security policy. Recognition and integration of climate security policy measures have been proposed in the Climate and Defence Roadmap, and funding is directly linked to climate action. When compared to most other nations and organizations, it could be argued that the EU has made significant progress in integrating climate change into security and defense considerations.

However, much more needs to be done. Externally, since U.S. President Joe Biden took office, the EU is looking forward to intensifying its relations with the United States again. This has also opened opportunities to re-invite the US to the climate table – which is likely to have positive consequences for overall climate security in the world. Moreover, although the EU lost presence in the UNSC with Brexit, non-permanent seats held by European countries such as Ireland, as well as France's continued permanent membership, keeps the climate security agenda alive at the

UNSC. The climate-defense nexus clearly is an issue that offers the potential to collaborate with the UK and other non-EU countries as well, such as Norway. Since NATO is also stepping up its efforts and interest in the climate-defense nexus, the EU should begin increasing the tempo and scale of its actions on climate security.

To step up its contribution, the following measures could be considered by the defense and security community within the EU:

Development and Foreign Policy

- As part of its thinking on the external dimension of the European Green Deal and Council Conclusions on climate diplomacy, the EU should continue to consider how to integrate environmental peacebuilding further throughout its Common Foreign and Security Policy, Common Security and Defense Policy, as well as neighborhood policy, enlargement policy and development cooperation policies. Identifying the risk of climate change undermining stability is not enough; efforts should be put in place to improve the management and fairer distribution of natural resources, include climate change in peace dialogues and mediation, and promote the use of renewables and land restoration, including in conflict prone territories and areas with high numbers of refugees.

- Climate vulnerability assessments and a forecast of expected additional calls for international and domestic assistance should become part of the CARD process. CARD (Coordinated Annual Review of Defence) is a process of monitoring defense plans of all EU member states to determine spending and project coordination.

- In the EU CSDP mission, climate change-related security risks should be taken into consideration more explicitly, including on how they can help create a safe operating space for other actors to engage in environmental peacebuilding activities on the ground. Support to civil actors engaging in projects that improve situations of natural resource scarcity, provide renewable energy or combat desertification can also foster stability.

Defense

- EU Defense Ministers should embrace the Roadmap on Climate and Defense that was published by the EEAS and connect it to specific Council Conclusions on climate and defense.[172]

- EU Defense Ministers should consider adopting an emissions reduction target for the European defense sectors. Such a target could also be established via NATO.

- The EEAS or European Defense Agency should consider funding research on the vulnerability to climate change of EU military assets and capabilities, and such work should be linked to the discussions on a European Strategic Compass.

- PESCO (Permanent Structured Cooperation) could be used for mutual learning on how to build resilience and redirect attention to climate-mitigation and adaptation activities, especially through implementing more sustainable procurement capabilities and supply chains.

- Investments in defense R&D into low-carbon technologies, as well as studies on how climate risks affect the security environment, could be funded from the European Defence Fund (EDF) but also through Horizon

Europe, particularly with regard to dual use technologies and geopolitical analysis. If only a fraction of the EDF budget was redirected to more energy efficient propulsion systems or cleaner battery technologies, the EU's defense industry could become more competitive when military organizations start to realize the benefits for the costs of missions and operational autonomy.[173]

- Military organizations need to be aware of a lack of understanding and distrust in climate and development circles about the positive contributions they can make to decarbonization technologies, protecting climate adaptation and mitigation efforts in unstable regions and assistance with extreme weather events.

Analysis and Foresight

- Research should also be funded on how climate change affects the capabilities of strategic rivals of the EU, notably Russia and China.

- In early warning and foresight studies the risks of an unmanaged energy transition also need to be taken into consideration.

- The EU could consider funding efforts to learn from climate-security practices implemented by governments and NGOs from across and outside the EU to help facilitate greater learning for climate-proofing activities.

CLIMATE SECURITY DEVELOPMENTS IN SELECT COUNTRIES AND REGIONS

This chapter presents short snapshots of key climate security developments in the past year in a handful of critical regions and countries: the United States, East Asia, Central America, Brazil and Russia. These locales were selected both for their geopolitical importance and the changes that have occurred within each vis a vis climate security in the past year. These snapshots include both the security impacts of select climate change effects, as well as significant climate security policy developments.

YEAR IN REVIEW: **UNITED STATES**

Over the past year, no government experienced a more significant shift in how it addresses climate security issues than the United States. Throughout 2020, climate security was at the forefront of a U.S. presidential campaign for the first time. Upon taking office, President Biden issued an Executive Order, "Tackling the Climate Crisis at Home and Abroad." This EO requires all agencies to consider climate change an "essential element" of foreign and national security policies and outlined numerous climate security provisions for the Department of Defense and intelligence community. President Biden also appointed former Secretary of State John Kerry as his climate envoy, with a senior seat at the National Security Council - a significant elevation of the issue within U.S. national security policy-making. Secretary of Defense Lloyd Austin emphasized climate security in his first Guidance to the Force:

> *"We face a growing climate crisis that is impacting our missions, plans, and capabilities and must be met by ambitious, immediate action. In line with the President's direction, we will elevate climate as a national security priority, integrating climate considerations into the Department's policies, strategies, and partner engagements. We will incorporate climate risk assessments into our war-gaming, modeling, and simulation, and we will bolster mission resilience and deploy solutions that optimize capability and reduce our own carbon footprint. Where possible, we will seek to lead the way for alternative climate-considered approaches for the country."*

In the past year, wildfires in the west and an Arctic freeze across the south central United States underscored the domestic national security risks posed by climate change. These two major climate-related crises highlighted the role of the military to the American public as both the National Guard and the active duty force fought unprecedented fires across the West and delivered assistance in a devastating winter storm that paralyzed Texas and surrounding states.

In 2020, military assistance was required in the face of the largest, most intense fire season in California's history. Over 10,000 fires burned 4.2 million acres (over 4 percent of California). The August Complex was the first "Gigafire" in history, burning over a million acres. The fires did not spare US military bases. Naval Air Weapons Station China Lake suffered a large scale fire in August of 2020 and thousands were evacuated for the Christmas Eve fire that burned on and around Camp Pendleton north of San Diego. The Marine Corps' mountain warfare training center in Bridgeport, in the Eastern Sierras, suffered extensive burning in the summer of 2020.[174]

The 2019 "Report on the Effects of a Changing Climate on the Department of Defense" identified 36 major military installations vulnerable to wildfire. The report stated, "due to routine training and testing activities that are significant ignition sources, wildfires are a constant concern on many military installations….DoD spends considerable resources on asset loss, and suppression activities due to wildfire."[175]

As Brigadier General Jeffrey Smiley, Director of the Joint Staff of the California National Guard, told then-Secretary of Defense Mark Esper. "Our fire season starts sooner. Every year our fire season is growing in length."[176]

The value of the U.S. military response was brought home in dramatic fashion by the California National Guard's 40th Combat Aviation Brigade's harrowing rescue of 214 people trapped by the Creek Fire at a lake in the Sierra Mountains. That effort was part of a much larger California National Guard deployment involving 1,200 personnel fighting on the front lines and in the air. Guard units monitored fire movements with UAVs and aviation units dropped water and fire retardant.[177] The active duty force also joined the fight. U.S. Northern Command tasked U.S.

L: Marines with I Marine Expeditionary Force train to support the ongoing wildfire efforts in California. US Marine Corps Photo. R: The director of Joint Staff, California Joint Force Headquarters, Brig. Gen. Jeffrey D. Smiley, briefs Defense Secretary Dr. Mark T. Esper about California National Guard firefighting operations, at Marine Corps Air Station Miramar, Calif., Sept. 18, 2020. DoD photo.

Army North with overseeing military support to the ground response and ARNORTH deployed soldiers from Joint Base Lewis-McChord in Washington State to the August Complex fire burning in Northern California. The First Marine Expeditionary Force based at Camp Pendleton deployed its 7th Engineer Support Battalion to battle wildfires in southern California.

The Texas National Guard was a critical component in the response to crippling winter storms that hit Texas in February 2021, the first major climate change-related crisis of the year. Underscoring the converging nature of climate change risks with other security threats, U.S. Northern Command deployed active duty personnel to conduct COVID-19 vaccinations to underserved and marginalized communities hit hardest by both the pandemic and the winter storms. At the vaccination site, President Biden told the troops, "I learned a long time ago, you want to get something done, you get someone in uniform...".[178] That sentiment will continue to grow more widespread as the consequences of our changing climate grow more severe, potentially posing readiness challenges in years to come. The training and deployment regimen of a military force is highly synchronized and carefully calibrated to optimize its readiness for its primary mission set. Ever-increasing disaster response demands both domestically and abroad will likely strain defense forces in ways that may ultimately alter how they are equipped, trained, and deployed.

YEAR IN REVIEW: **EAST ASIA**

The past year brought important developments to the climate policies of East Asia's leading powers. In September, China, the world's biggest emitter of greenhouse gases, announced it would reach carbon neutrality by 2060. The region's other two biggest economies, Japan and the Republic of Korea, as well as many Asian businesses and Asia-based multinationals, pledged ambitious targets for reaching net zero by 2050.[179] With its announcement, some experts posit that China was seeking to alter global rankings of climate leadership being primarily dominated by Western countries.[180]

There are strategic security dimensions to the climate leadership on display in East Asia. Among strategic planners worldwide, there is growing recognition that national responses to climate change impacts will grow to be a key determinant of the distribution of political and economic power in the world. Leaders in Beijing, Tokyo, Seoul and throughout Asia likely recognize that the so-called "Asian Century" is not guaranteed. Climate change is a factor that can scramble all the trends and indicators pointing to Asian economic dominance in the 21st century. Climate instability will make trade and long-term investment difficult and climate risk will drive the cost of capital and insurance higher, reducing growth rates, productivity, and incomes.[181] Asia's primary centers of wealth and economic dynamism are concentrated in low-lying coastal regions that will be disproportionately affected by rising seas. China also experienced extreme riverine flooding in 2020. The areas most affected were around the densely populated Yangtze river basin, where over 30 million experienced flooding costing in excess of $30 billion.[182]

Datong Town in the city of Tongling, a river port along the Yangtze River, during the 2020 China floods.
Creative Commons / WikiMedia

YEAR IN REVIEW: **CENTRAL AMERICA**

Central America is one of the world's most vulnerable regions to the impacts of climate change.[183] Five of the top ten countries in the Global Climate Risk Index most affected by climate change over the past two decades are in Central America or the Caribbean.[184] The unprecedented climate-induced humanitarian disasters in the final weeks of 2020 further underscored the fragile region's vulnerability.

In response to these hurricanes, the U.S. military quickly mobilized and deployed to support humanitarian and disaster relief efforts in Colombia, Honduras, Guatemala and Panama.[185] U.S. Southern Command Joint Task Force Bravo rescued more than 800 disaster victims and moved nearly 350,000 pounds of food, water, hygiene kits, and other life-saving assistance as well as over half a million pounds of relief supplies in support of the U.S. Agency for International Development (USAID)-led humanitarian response to the region.[186]

According to the National Hurricane Center, historically six out of an average of twelve tropical storms become hurricanes over the Atlantic Ocean during the annual hurricane season. In 2020, a record 30 named storms formed over the Atlantic. The number of extreme category 4 and 5 storms was also a record. The duration of hurricane seasons is also increasing; 2020 marked the first time two hurricanes formed in the Atlantic in November, past the peak of hurricane season. Hurricane Iota, the Atlantic's 30th and final named storm of 2020, was the latest Category 5 hurricane ever recorded.[187]

WIth increasing ocean and atmospheric temperatures, hurricanes such as Eta and Iota are generating higher wind speeds, precipitation rates, and are able to accelerate to higher intensities much faster.[188] Today a typical hurricane's intensity is 25% greater after its first full day after landfall than it was fifty years ago, threatening areas further inland for longer periods of time.[189] Over a third of the population of Central America was affected by last November's two hurricanes.[190]

The storms' impact on the region's struggling economies exacerbated untenable levels of joblessness. Deprivation of basic needs such as food and shelter caused by the storms' destruction incentivized already endemic corruption in the delivery of public services and made vulnerable populations even easier prey for criminal gangs' intimidation, extortion and recruitment. The human suffering from November's hurricanes contributed to just one of the many long-standing factors driving the most recent wave of migration from Central America to the United States.

Regional leaders have rallied around the devastation of the unprecedented storms to call on developed nations to increase long-term development support for Central American nations acutely affected by climate change. Guatemalan President Alejandro Giammattei delivered a message to developed countries to the North: "If we don't want crowds of Central Americans going to other countries in search of a better life, we have to build walls of prosperity in Central America. Because physical walls are not going to stop people's needs."[191]
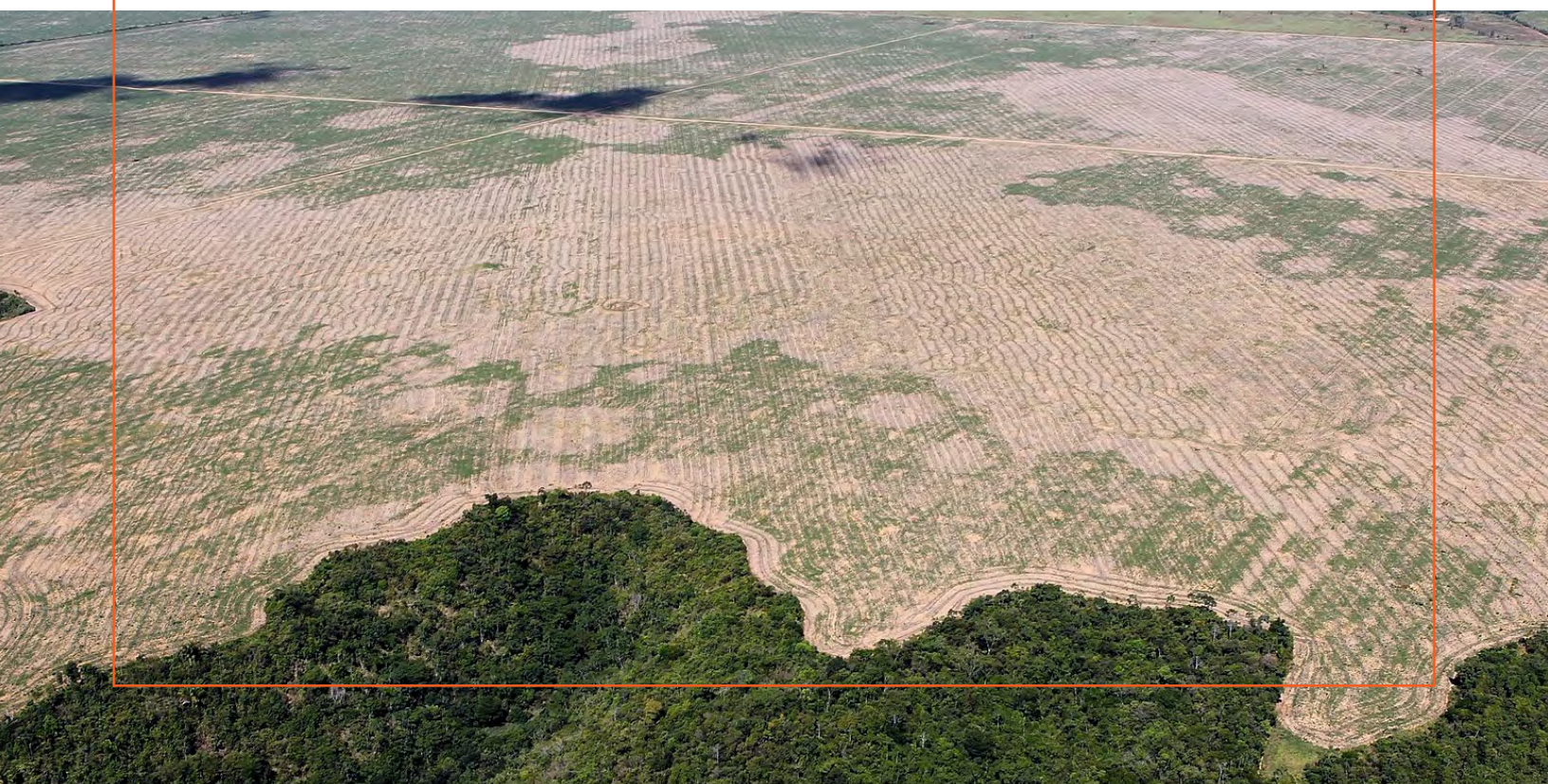
YEAR IN REVIEW: **BRAZIL**

In Brazil, the Jair Bolsonaro Administration escalated an assault on environmental and climate regulations, and disregarded climate action throughout 2020 and in the first quarter of 2021. The report "Climate and Security in Brazil" issued by the Expert Group of the IMCCS[192] in November 2020 anticipated Bolsonaro's intensifying drive in 2021 to strip environmental protections and dismantle Brazil's environmental regulatory agencies. This report also detailed the Bolsonaro regime's complicity in surging wildfires and illegal deforestation that reached its highest levels ever in 2020. Despite this, the Bolsonaro government's 2021 budget cuts funding for environmental protection and fire prevention by 27 percent, while funding Brazil's environment ministry at its lowest level in over twenty years, according to the Climate Observatory, a network of 56 NGOs.[193]

In early 2021, environmental and indigenous leaders raised awareness around environmental and health exploitation in the Brazilian Amazon, including by filing a suit against President Bolsonaro in the International Criminal Court.[194] The Climate Action Network (CAN) said in a January 2021 letter to the United Nations Framework Convention on Climate Change (UNFCCC), that the Brazilian Government's NDC submission in December 2020 was an unacceptable regression from previous commitments by the world's sixth largest emitter and "was decided without consultation, transparency or the participation of civil society, scientists and other stakeholders.[195] Meanwhile, international donors have suspended contributions to the Amazon due to the Brazilian's government's deforestation policies.

Climate security issues in Brazil warrant deeper research and solutions development than has been done to date, particularly regarding military and security strategies in the face of the changing climate, how to manage cross-border relations, and both the benefits and drawbacks of the Brazilian military using civilian technologies in combating deforestation and managing climate risks.

Deforestation in Gurupi Biological Reserve and the Caru and Alto Turiaçu Indigenous Lands, in Maranhão. July 2016. FELIPE WERNECK / ASCOM / IBAMA.

YEAR IN REVIEW: **RUSSIA**

In 2020, regions across Russia experienced record temperatures.[196] The Siberian city of Verkhoyansk hit a temperature of 38 degrees Celsius on the Summer Solstice in June, a new record for the Arctic Circle.[197] The summer heat brought Siberian flash floods that displaced thousands of residents[198] and forest fires that consumed more than 100,000 km². Snow coverage was at a record low in 2020, and Arctic sea ice coverage shrank to its second-lowest extent in over 40 years.[199]

Russia's current 2030 emissions target is 25-30 percent below 1990 levels and has been deemed inconsistent with its individual responsibility for limiting global warming to 1.5°C.[200] In fact, Russia's "national action plan on climate" released in January called on the country to 'use the advantages' of warming and listed Arctic shipping and extended growing seasons among things that would shower 'additional benefits' on the nation."[201]

Such an approach, however, ignores climate change trajectories. Though Russia's largest cities and most important military bases are far less vulnerable to inundation from sea-level rise than those elsewhere, including in China and the United States, Russia is warming 2.5 times faster than the rest of the world.[202] Rapidly thawing permafrost not only threatens significant Russian infrastructure (i.e., networks of roads, bridges, factories and pipelines),[203] but also the release of enormous quantities of trapped greenhouse gases (including extreme climate forcers such as methane) which will have dramatic consequences on the atmosphere.[204]

Optimistic Russian leaders anticipate that longer growing seasons, resulting from increases in arable land in the northern latitudes, will provide them a "wedge to drive into global geopolitics."[205] However, an increased drought risk in Russia's southern "bread basket" regions will offset climate-related gains.[206] In June 2020, officials in Stravopol, one of Russia's major wheat regions, projected a remarkable 40 percent decline in the annual crop as a result of droughts.[207] This has further security implications: namely, Russia's role in global food chains, the impact to the national economy, and the warming impacts of cultivating these carbon-rich soils.

The threat to the Russian economy from climate change is dual-natured. As in other countries, extreme weather events (i.e., droughts, floods, wildfires, permafrost damage, and disease) and climate damage to buildings and infrastructure will have first-order effects. At the same time, Russia's overreliance on hydrocarbon production and mineral export could become a strategic vulnerability as the world shifts toward low-carbon sources of energy and carbon-neutrality.

However, it would appear that none of the preceding issues are sufficiently compelling to inspire Russian leaders to undertake constructive action to counter climate change. The predominant views are overly optimistic or classically protectionist. In fact, these environmental impacts may be viewed as an opportunity – from a destabilizing geostrategic perspective in which a certain level of chaos is acceptable if Russia is in a position to benefit, or at least incur relatively less harm than other nations (e.g., wheat price increases as a result of the 2010 drought and heat waves in 2010). Many Russian political leaders express concern about changes in the climate policies of major export markets, particularly the European Union.

ENABLING COLLECTIVE GLOBAL CLIMATE SECURITY ACTION

Authored by:

Captain Steve Brock, U.S. Navy (Ret)
Senior Advisor
The Center for Climate and Security, an institute of the Council on Strategic Risks

Sofia Kabbej
Research Fellow at the Climate, Energy and Security Program
The French Institute for International and Strategic Affairs (IRIS)

Tackling the climate security risks outlined in previous sections will require collective action on global governance through multilateral fora. In this section we identify key recommendations for the international community going forward; first, we recommend a range of climate security actions for the United Nations, and we discuss the imperative to update or develop international law in a variety of areas--including maritime activity and migration--with the new challenges posed by climate security.

DEEPENING UN ACTION ON CLIMATE SECURITY

The UN system has long led the global effort on negotiated reductions in national emissions. With key nations and other multilateral institutions unable or unwilling to act, the UN process has persevered in keeping negotiated climate action on the global agenda. With political will now building within its most powerful members, the UN-led international system must seize the initiative to address all aspects of climate change drawing on the core tenets of its founding principles: peace, security, sovereignty, and human rights. It must adapt and update treaties and protocols that govern the global commons and shared environmental resources.

There are important steps all UN member states can take within their regional blocks and in the General Assembly to advocate for climate security integration into UN institutions and processes. These longer-term actions will require sustained commitment and coalition- building to enact. Broad-based support will be especially critical in the UN General Assembly's Fifth Committee which has authority over budget and management issues. These steps include:

- The official integration of climate security considerations into each UN mission's semi-annual report to the Secretary General and the UNSC. Each Force Commander could also be tasked with including climate security considerations in their annual briefings.

- The establishment of multiple regional Climate Security Crisis Watch Centers which feed into a UN-wide Climate Security Crisis Watch Center. Such centers would have the triple benefits of: cultivating a shared data-driven community; giving regional organizations a role in the success of a global climate security data network; and connecting these organizations through their common mission.[208]

- With a UNSC or UN General Assembly (GA) climate and security mandate, the Secretary General could exercise his authority to appoint a Special Representative of the Secretary General for Climate Security as part of the Special Advisors, Representatives and Envoys construct. In the absence of a UN climate and security mandate, like-minded member states should encourage the Secretary General to appoint a Personal Representative for Climate Security.

- Further building out an institutional structure through the creation of an office for climate and security within the Department of Political and Peacebuilding Affairs at the Assistant Secretary General-level, a division for climate and security within the Department of Peace Operations, and a climate security unit within the Office of Coordination of Humanitarian Affairs.

- Any climate and security organizational entity established should work closely with the Secretary General's Special Advisor for Climate Action, currently dual-hatted as the Assistant Secretary General for the UN Climate Action Team.

Incorporating climate security successfully will require the same level of discipline and rigor as are afforded other critical security issues within the UN system, including full integration into training, education, situational assessments, planning and operations. Institutionalizing analysis and action on climate security risks and opportunities throughout the UN will help the organization meet its mission to maintain international peace and security.

Accelerating a Sea Change in Global Defense Sector Climate Mitigation

Emergent technological breakthroughs have the potential to address the largest and most intractable defense sector mitigation challenge, aviation and maritime fuels. For example, in February, Maersk, the world's largest container shipping company, surprised the world with the announcement that it would launch a carbon-neutral vessel by 2023, seven years ahead of schedule. Maersk stated all its new vessels will run on carbon-neutral fuels such as e-methanol or bio-methanol.[209] Member nations' navies and coast guards can and should play a significant role in reinforcing this breakthrough by creating demand for the maritime biofuels market to scale. As with the scaling of synthetic aviation fuels, the principal challenge will be creating sufficient market signals to spur production of commensurate stocks of carbon-neutral fuels. The transition to military grade maritime biofuels and synthetic aviation fuels must be done in an environmentally and socially sustainable way that does not take land out of food production, deplete natural carbon sinks such as forests or grasslands, or adversely distort markets in fragile agrarian economies prone to instability and conflict.

UPDATE, ADAPT AND DEVELOP INTERNATIONAL LAW

Current international agreements and cooperative bodies are largely mismatched to the global security risks posed by climate change. Here we highlight two areas in which urgent action is needed: the law of the sea and rules and norms governing geoengineering.

Law of the Sea

The UN Convention on the Law of the Sea (UNCLOS) and its three institutions (the International Tribunal for the Law of the Sea, the International Seabed Authority and the Commission on the Limits of the Continental Shelf) will need to be adapted to meet the unprecedented challenges of sea level rise on sovereignty claims and ocean resource rights. The status of legal maritime boundaries based on baseline territorial features is entirely uncertain if such features are submerged due to sea level rise or are declared uninhabitable under current legal definitions. The loss of sovereign terrestrial territory due to rising seas could have an enormous impact on national waters and the exclusive economic zones (EEZ) over which a coastal or island state has special rights (e.g., regarding the exploration and use of marine resources, including energy and mineral deposits).

Even the submergence of small outlying reefs and atolls in island nation archipelagoes may result in the loss of hundreds of thousands of square miles of a nation's EEZ. Developed nations with island-building expertise to include capital intensive dredging and construction capacities may offer these services to sparsely-populated, geographically-dispersed and increasingly geostrategically important island nations, perhaps in exchange for negotiated access to their EEZs.[210]

Similar EEZ baseline controversies have already arisen in the contested South and East China Seas - the stage for regular confrontations between navy, coast guard and fishing vessels, as well as the build-up of Chinese military assets (airstrips, port facilities, long-range sensor arrays) on constructed artificial islands. Maritime boundary disputes already highlight the boundaries of the rule of international law and the limitations of the International Court of Justice's ability to enforce rulings on the South China Sea.[211] This sets a dangerous global precedent for managing claims over highly contested territories that are likely to become more strategically significant in a climate-changed future, as fish stocks relocate and are depleted, countries pursue their energy security through sub-sea oil and gas exploitation, and global economic interdependencies continue to rely on sea lines of communication.

Building Global Governance for Geoengineering

Geoengineering, defined as technology relying on deliberate large-scale human intervention in the climate system with the aim to mitigate the increase of the average global temperature, is becoming central to the climate governance debate.

The two principal types of geoengineering technologies are: those designed to capture and store CO_2 to reduce the overall concentration in the atmosphere (i.e., Carbon Dioxide Removal or CDR-see Figure 1); and those designed to reflect sunlight back into space or to allow more heat to escape from the atmosphere (i.e., Solar Radiation Modification or SRM--see Figure 2). While hundreds of CDR and SRM projects are currently ongoing (see Figure 3), only a small number of CDR technologies are currently being considered for large-scale deployment.

Figure 1. Carbon Dioxide Removal Technologies. Source: Carnegie Climate Governance Initiative (C2G)
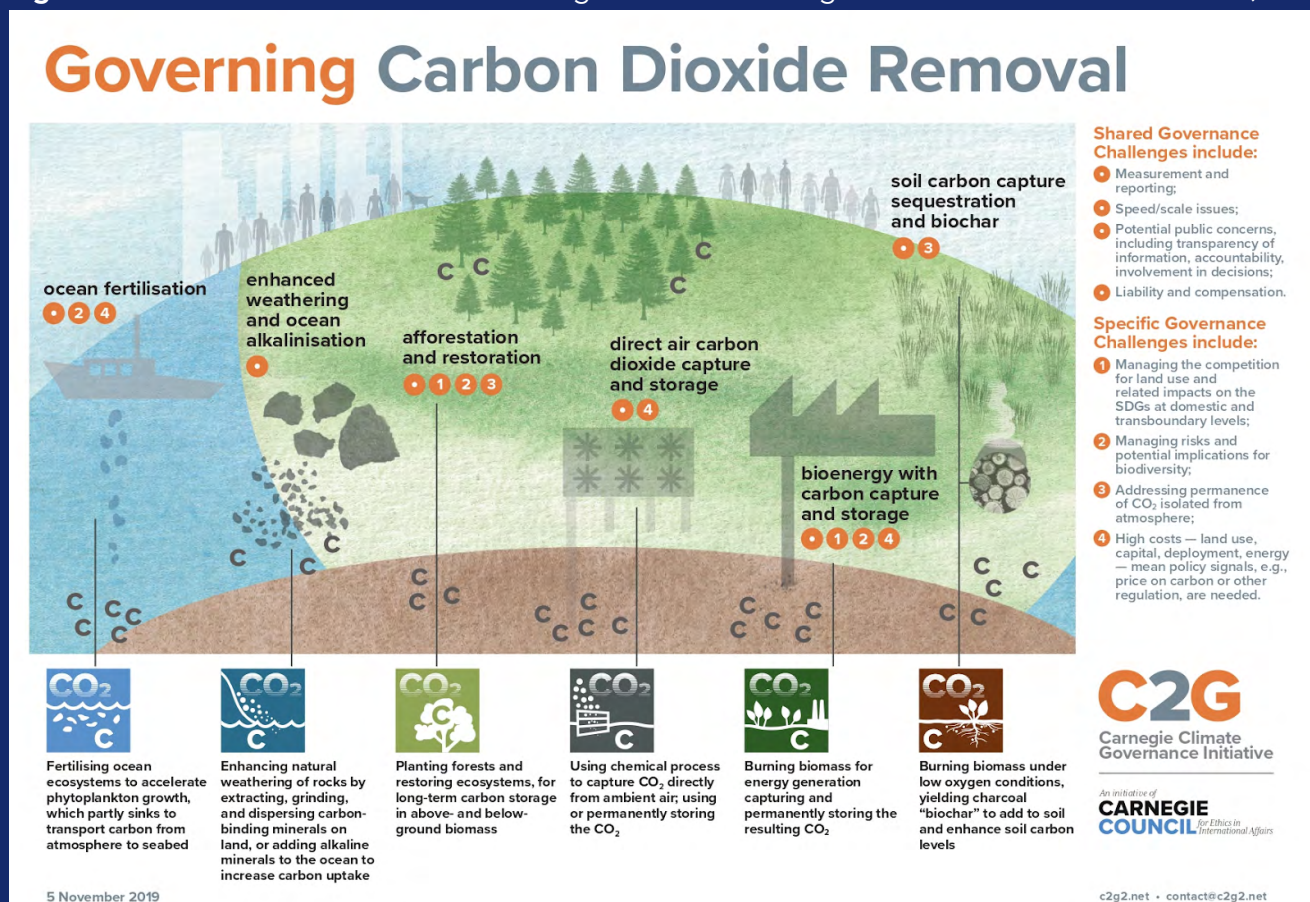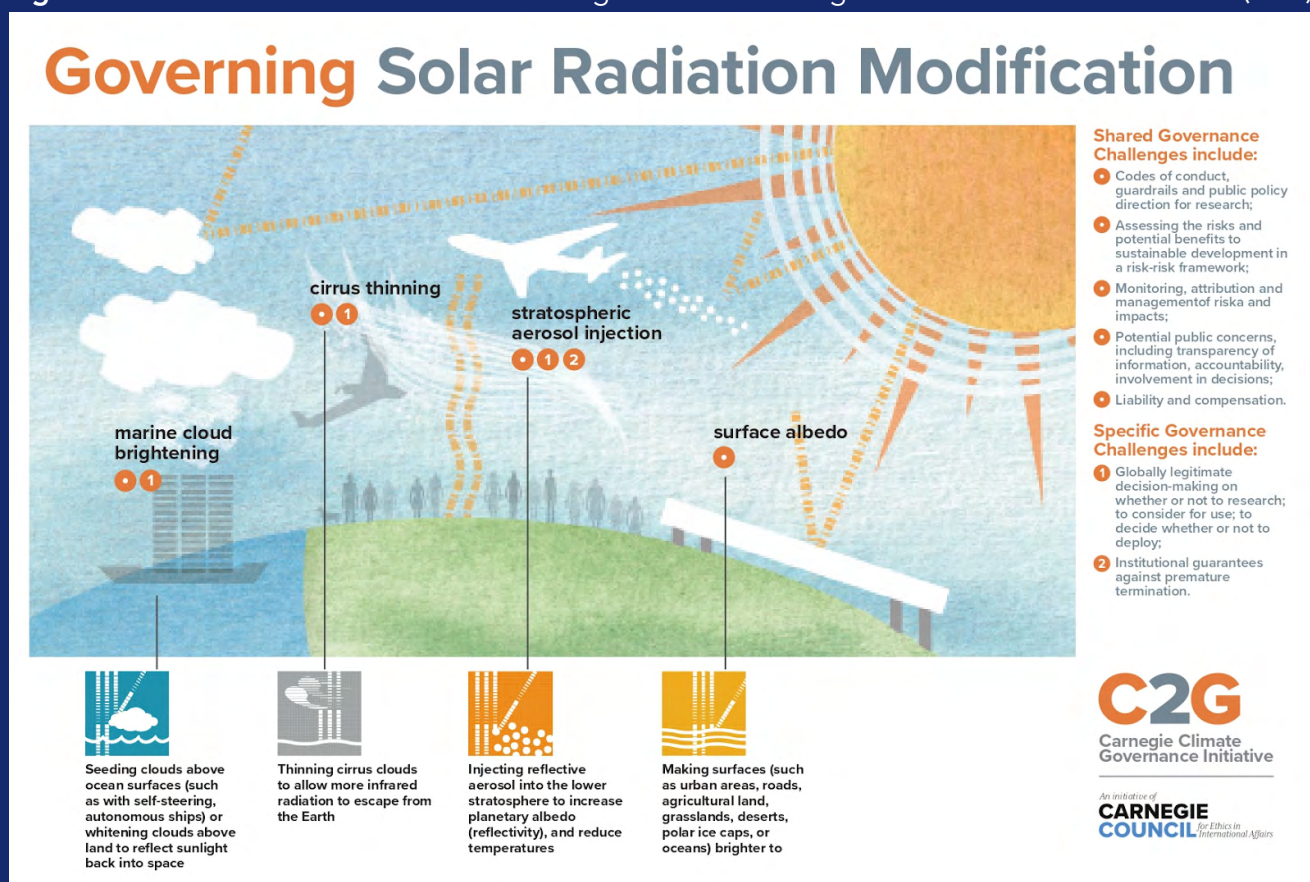

Figure 2. Solar Radiation Modification Technologies. Source: Carnegie Climate Governance Initiative (C2G).

Figure 3. Map of CDR and SRM Projects

Deliberate and large-scale intervention on the climate system can have negative impacts on the environment and the functioning of the Earth system, and may pose security risks. For example, modifying the chemical composition of the atmosphere could cause disruptions of the water cycle, droughts, or an intensification of extreme weather events,[212] while other interventions could accelerate biodiversity loss, increase land appropriation, and threaten food and water security. Many CDR technologies, for instance, rely on the use of land to store CO_2 and could constitute an additional pressure on natural resources as arable land becomes scarce. Concerns are also emerging about concealment as it would be complicated to determine the anthropic or natural origin of a meteorological event;[213] likewise, the prospect of unilateral but transparent deployment risks impacting other territories and potentially leading to armed conflict.[214] Finally, it is conceivable that a country might decide to use these technologies as an unconventional weapon.[215]

Geoengineering remains largely unexplored by international relations scholars, including those in security studies. Despite the many risks posed by these technologies, no governance framework surrounding the development or deployment phases currently exists. This is a role for which the UN is tailor-made. Given that it is entirely conceivable for a state or non-state actor to decide, unilaterally, to deploy such technologies to reduce global warming and its subsequent impacts for national security or economic interests, it is necessary to:

1. closely monitor and assess who would consider employment of such technologies and under what conditions; and,
2. work towards the establishment of multilateral governance mechanisms to regulate both the development and deployment of geoengineering technologies.

Attention should be given to the establishment of monitoring and governance mechanisms from the local to global levels - with an international framework to address issues such as responsibility, liability, accountability, cross-border environmental, social and economic impacts. With regard to SRM technologies, the most immediate challenge concerns research oversight and guidelines, as small-scale experiments are already underway. The establishment of codes of conduct, monitoring mechanisms and safeguard protocols is critical. Additionally, the establishment of early warning and surveillance frameworks could help nations differentiate between authorized and unauthorized geoengineered projects as well as between natural and man-made events.

APPENDIX 1:
CLIMATE SECURITY RISKS PERCEPTION SURVEY METHODOLOGY

The 2021 Climate Security Risk Perception Survey was administered from February-March 2021, and was methodologically consistent with the Climate Security Risk Perception Survey administered in 2019-2020,[216] apart from the expansion of the categories of climate security phenomena. The survey participants included 57 global leaders and experts in the fields of defense and intelligence, climate and ecosystem change, and national security.

Experts were asked for their judgement on the severity of climate-related national security risks in three time periods: today (2021), ten years from now (2031), and twenty years from now (2031). Respondents ranked each risk on a scale of severity for each time period: low, moderate, high, and catastrophic risk.

Respondents were then asked to consider the compound impacts of climate security risks, and to select five pairs of climate security categories that, over the span of the next twenty years, will pose the highest risks to security. These results allow for a novel picture of which categories of risks are most interconnected, and which could have the greatest impact on society.

For the purposes of this survey, "climate security" phenomena were defined as "climate change-exacerbated events that affect global security, including the security environment, security institutions or security infrastructure." The survey did not assess opportunities for mitigating these risks, or ask for information on how to adapt to or build resilience to them. Those policy decisions will ultimately be in the hands of leaders and policymakers who read the results, and hopefully the subject of future research.

Climate security phenomena were broken into ten categories with the following descriptions accompanying them. These categories of climate security phenomena represent an expansion and refinement of those surveyed in the World Climate and Security Report 2020, and are crafted to sync with the variables of our Climate Security Risk Methodology effort, found later in this report. While each phenomenon is likely to have many more security and societal impacts than those described, their potential impacts are shortened for length and readability.

WATER SECURITY

- **Climate change-driven sea level rise:** Risks of sea level rise, and subsequent groundwater salinization, storm surges, and flooding, impacting coastal water security and contributing to social and political unrest.

- **Climate change-driven precipitation changes:** Risk of increased instances of drought or extreme precipitation to otherwise invariable rainfall patterns leading to compromised availability of freshwater and diminished water security, impacting social, political, or economic outcomes.

- **Climate change-driven disasters disrupt sanitation systems:** Risk of more frequent and more intense natural disasters disrupting or diminishing provision of freshwater for sanitation purposes, impacting health and social security, particularly in populated areas.

FOOD SECURITY

- **Severe weather-driven disruptions to agriculture:** Risk of increased frequency and intensity of extreme weather events contributing to the devastation of critical harvests, affecting the price and availability of essential food staples.

- **Local food insecurities disrupt national, regional, and global food markets:** Risk of sudden price spikes in essential food staples disrupting economic and supply chain systems, leading to economic and social unrest.

HEALTH SECURITY

- **Climate change-driven expansion of infectious diseases:** Risk of the expansion of disease vectors due to warmer temperatures, biodiversity loss, and extreme precipitation, leading to mass sickness and death.

- **Climate change-driven extreme heat:** Risk of dangerous and unsurvivable heat and humidity, leading to increased death due to heat and compromised bodily functions.

- **Climate change-driven overwhelming of healthcare institutions:** Risk of more severe and frequent disasters place chronic stress and burdens on healthcare infrastructure and first responders; increase prevalence of non-communicable diseases; and disrupt access to healthcare, leading to increased death and social unrest.

ECOSYSTEM SECURITY

- **Increased tempo and scale of natural disasters due to climate change:** Risk of increase in frequency and intensity of natural disasters, including simultaneous disasters or disasters in rapid succession, that significantly strain response capacity and increase the likelihood of social and political unrest.

- **Climate change-driven critical biodiversity loss:** Risk of climate-driven mass biodiversity depletion, migration, and extinction, contributing to critical ecosystem loss that undermines food, freshwater, and land systems that are essential for human security, and increasing competition over these resources.

- **Climate change-driven oceanic disruptions:** Risk of the warming and acidification of oceans leading to mass species depletion, migration, and extinction, contributing to critical ecosystem loss that undermines marine systems that are essential for human security, and increasing competition over these resources.

ECONOMIC SECURITY

- **Severe weather-driven disruptions to national, regional, and global economic security:** Risk of increase in severe weather impacts on food, water and energy systems disrupting national, regional, and global economic security.

- **Climate change risks drive revaluation of assets:** Risk of climate change mitigation and adaptation policies leading to revaluation of assets, which could create stranded assets, supply chain disruptions, sovereign debt defaults, unemployment, and economic insecurity.

- **Climate change-driven disruptions increase economic and social inequality:** Risk of climate disasters and disruptions having harsher impacts on communities already marginalized by race, gender, or class; pushing larger shares of the population into unemployment and poverty, and further exacerbating the disparities between rich and poor communities.

INFRASTRUCTURAL SECURITY

- **Extreme weather and sea level rise eroding critical civilian infrastructure:** Risk of climate change-driven security disruptions eroding critical civilian infrastructure including: energy infrastructure; communications infrastructure; transportation infrastructure; manufacturing infrastructure; emergency services infrastructure; financial centers; agriculture infrastructure; healthcare infrastructure; information technology infrastructure; and water infrastructure.

- **Changes in climate disrupting critical waterways and transportation routes:** Risk of climate change-driven ocean warming and acidification changing patterns of freshwater and marine transportation, affecting both commerce and international security (e.g. fish stock migration, melting ice sheets, etc.).

NATIONAL SECURITY

- **Recurring climate change-driven stresses to highly populated areas and marginalized communities:** Risk of increase in climate change-driven stresses to highly populated/critical areas (e.g. megacities, financial/political centers) such as sea level rise, flooding, drought and extreme heat; with impacts hitting marginalized communities hardest.

- **Increase in forced displacement and involuntary migration, exacerbated by climate change:** Risk of expanding uninhabitable areas due to extreme weather, rising temperatures and sea-level rise, including existential threats to islands or coastal regions, which increases forced displacement or involuntary migration of peoples both within nations and internationally.

- **Climate change impacting governance and increasing instability and conflict within nations:** Risk of increasing social, economic, and political instability and conflict within nations due to climate change stress exacerbating political polarization, corruption, legislative gridlock, or weakening civil liberties.

MILITARY SECURITY

- **Climate change threats to critical military infrastructure:** Risk of increase in the frequency and intensity of extreme weather events and sea level rise threatening critical military infrastructure and contributing to the weakening readiness of military forces for both humanitarian and security operations.

- **Climate change-exacerbated degradation of capabilities of key military alliances:** Risk of climate change-exacerbated security disruptions contributing to the degradation of capabilities of key military alliances and possible erosion of their missions, legitimacy and viability.

- **Military overreliance and mission failures due to cascading climate-exacerbated threats and disasters:** Risk of increased military deployment in civilian settings and increased military mission failures due to cascading climate change-exacerbated natural disasters and security disruptions.

INTERNATIONAL SECURITY

- **Climate change increasing the likelihood of tensions or conflict between nations:** Risk of climate change disruptions to food, water, and energy systems increasing the likelihood of tensions or conflict between nations over resources.

- **Climate change-exacerbated stresses to existing peace and security agreements, treaties, and institutions:** Risk of climate change-driven disruptions to food, water, and energy security driving the deterioration of the missions, capabilities, and legitimacy of: peace and security agreements and treaties (e.g. water-sharing agreements, cease-fires, security treaties, defense pacts, nuclear security agreements, etc); and security institutions (e.g. the UN Security Council, regional security institutions, etc.).

- **Shifts in alliances and balance of power due to climate change disruptions to security:** Risk of shifts in alliances and balance of power due to climate change-exacerbated disruptions to the geostrategic landscape.

- **Increased isolationism at the regional and international scale due to climate change-exacerbated disruptions:** Risk of isolationism at the national, regional, and international scale due to climate change-exacerbated security disruptions, driving nations to withdraw from regional and international security institutions and increasing intra-group tensions.

NOVEL SECURITY RISKS

- **Unilateral geoengineering actions intended to reverse climate change:** Risk of unilateral geoengineering actions by nations and non-state actors, designed to reverse climate change, causing unpredictable disruptions to the global climate with uncertain security consequences.

- **Misuse of climate change-related technologies and data:** Risk of technologies and data developed to address climate change leading to increased population monitoring, securitization, or further marginalization of already disadvantaged communities (e.g. energy use monitoring, privatization of weather data, etc.).

- **Cascading climate change-driven disasters and tipping points:** Risk of increased secondary surprises stemming from climate change disasters that may have unknown and serious implications for security, including the irreversible crossing of critical atmosphere, cryospheric, and ecosystem thresholds.

- **Unanticipated risks:** Risk of unanticipated and abrupt climate discontinuities that may have unknown and serious implications for security.

ENDNOTES

1   "The World Climate and Security Report 2020." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020.

2   "The World Climate and Security Report 2020." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Louise van Schaik (Clingendael), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020.

3   This year's survey is based on the original survey design created by Caitlin Werrell and Francesco Femia in "The World Climate and Security Report 2020," published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020; pp 102-117. Accessible at: www.imccs.org/report2020

4   The assessment excludes events like earthquakes, tsunamis, glacier lake outburst floods, and volcanic activity, which are natural, geologically- occurring phenomena. The future occurrence of the latter type of natural events is not directly determined by climate change, although their incidence might be aggravated to some degree by global rising temperatures and sea level rise, or through triggering and cascading effects of other hazards.

5   *The Hague* Centre for Strategic Studies, "Climate Security Assessment: A Methodology and Assessment of the Nexus between Climate Hazards and Security of Nations and Regions,."
        https://hcss.nl/report/climate security-assessment-methodology-and-assessment-nexus-between-climate-hazards-and

6   Sherri Goodman and Tom Middendorp, Foreword in "The World Climate and Security Report 2020." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS),   Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Louise van Schaik (Clingendael), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020. Pg 4

7   Jörg Birkmann, "Measuring Vulnerability to Promote Disaster-Resilient Societies: Conceptual Frameworks and Definitions," in *Measuring Vulnerability to Natural Hazards: Towards Disaster Resilient Societies* (Tokyo: UNU-Press, 2006), 18; Intergovernmental Panel on Climate Change, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (New York: Cambridge University Press, 2012), 69–73.

8   *The Hague* Centre for Strategic Studies, "Climate Security Assessment: A Methodology and Assessment of the Nexus between Climate Hazards and Security of Nations and Regions.".
        https://hcss.nl/report/climate security-assessment-methodology-and-assessment-nexus-between-climate-hazards-and

9   United Nations Department of Economic and Social Affairs, "The 17 Goals," United Nations Department of Economic and Social Affairs, 2020.

10   For more detail on each country's risk, please visit:

11   The scores for these countries might deviate somewhat from the actual situation, such as in the case of China and the United States. Limitations to the model (data availability, the relative weight of indicators, responsiveness of the indicators) are explained in more detail in the report "Climate Security Assessment: A Methodology and Assessment of the Nexus between Climate Hazards and Security of Nations and Regions," page 48. Some of these limitations can be addressed in future versions of this risk assessment methodology. Others will – to some extent – always be present in risk assessment models of this scope.

12   See among others: Brauch, H.G. and Scheffran, J. 2012. 'Introduction: Climate Change, Human Security and Violent Conflict in the Anthropocene', in: Climate Change, Human Security and Violent Conflict, by Scheffran, J. et al., Berlin Heidelberg: Springer, 3-40.; Barnett, J. 2016. 'Environmental Security', in: Contemporary Security Studies, ed. Collins, A., Oxford University Press, 2016, 229-246.

13   Tobias von Lossow, Anouk Schrijver, Maxime van der Kroon and Louise van Schaik, 2020, Climate Security Interventions: Good and Best Practices, Clingendael and Planetary Security Initiative Report.

14   *Ibid*.

15   A longer list of practices can be found on the website of the Planetary Security Initiative.

16   United Nations and World Bank. 2018. Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict. Washington, DC: World Bank. doi:10.1596/978-1-4648-1162-3. License: Creative Commons Attribution.

17   Allansson, M., Melander, E., & Themnér, L. 2017. Organized violence, 1989–2016. Journal of Peace Research, 54(4), 574-587

18   L. Van Schaik and R. Dinnissen, 2014. Terra Incognita: Land degradation as underestimated threat amplifier. Clingendael Report for the Netherlands Environmental Assessment.

19   For example: Katie Peters et al., 2020, Climate Change Conflict and Fragility. Overseas Development Institute.

20   United Nations and World Bank. 2018. Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict.; Rustad, S. A. (2016). Socioeconomic inequalities and attitudes toward violence: a test with new survey data in the Niger Delta. International Interactions, 42(1), 106-139; Hillesund, S., Bahgat, K., Barrett, G., Dupuy, K., Gates, S., Nygård, H. M., ... & Østby, G. (2018). Horizontal inequality and armed conflict: a comprehensive literature review. Canadian Journal of Development Studies/ Revue canadienne d'études du développement, 39(4), 463-480.

21   United Nations and World Bank. 2018. Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict

22   Bakker, R., Hill Jr, D. W., & Moore, W. H. (2016). How much terror? Dissidents, governments, institutions, and the cross-national study of terror attacks. Journal of Peace Research, 53(5), 711-726.; Piazza, J. A. (2017). Repression and terrorism: A cross-national empirical analysis of types of repression and domestic terrorism. Terrorism and Political Violence, 29(1), 102-118.

23   United Nations and World Bank. 2018. Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict

24   *Ibid.*

25   Florian Krampe, 2019. Climate Change, Peacebuilding and Sustaining Peace. *Stockholm International Peace Research Institute.*

26   Laura Parker, 2017. Who's Still Fighting Climate Change? The US Military. National Geographic, accessed 1 December 2020 https://www.nationalgeographic.com/news/2017/02/pentagon-fights-climate-change-sea-level-rise-defense-department-military/

27   Marc Kodack, "Wildfires in the U.S. and Their Effects on Security," The Center for Climate and Security, September 15, 2020 https://climateandsecurity.org/2020/09/wildfires-in-the-u-s-and-their-effects-on-security/

28   Cf. www.planetarysecurityinitiative.org

29   For a more comprehensive list of practices, see: Tobias von Lossow, Anouk Schrijver, Maxime van der Kroon and Louise van Schaik, 2020, Climate Security Interventions: Good and Best Practices, Clingendael and Planetary Security Initiative Report and the interactive map at: https://www.planetarysecurityinitiative.org/climate-security-practices

30   Danielle Dam-de Jong, 2019. "Building a sustainable peace: How peace processes shape and are shaped by the international legal framework for the governance of natural resources". Leiden University.

31   See Best Practices Policy Brief, Clingendael 2020

32   For example, greening efforts by the UN: L. Maertens, and M. Shoshan, 2018. "Greening Peacekeeping: The Environmental Impact of UN Peace Operations", International Peace Institute, New York.

33   See for example, Stuart Parkison and Linsey Cottrell, "Under the Radar: The Carbon Footprint of Europe's Military Sectors," Conflict and Environment Observatory, February 2021, https://ceobs.org/the-eu-military-sectors-carbon-footprint/

34   Louise van Schaik, Dick Zandzee, Tobias von Lossow et al. 2020. "Ready for Take-Off? Military Responses to Climate Change". *Clingendael Report*, p 66.

35   Ministère des Armées. 2020. *Defence Key Figures*. https://www.defense.gouv.fr/content/download/592948/10040253/file/Chiffres%20cl%C3%A9s%20de%20la%20D%C3%A9fense%20-%202020%20-%20UK.pdf (accessed November 2020)

36   Ministère des Armées. 2020. *Defence Key Figures*.

37   European Defence Agency, Energy and Environment (EnE) Programme. Accessed October 2020, from https://www.eda.europa.eu/what-we-do/activities/activities-search/energy-and-environment-programme

38   European Commission. 2019. Communication from The Commission: *The European Green Deal*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:640:FIN (accessed October 2020).

39   Million A. Tadesse, Bekele A. Shiferaw and Olaf Erenstein, 2015. Weather index insurance for managing drought risk in smallholder agriculture: lessons and policy implications for sub-Saharan Africa; Amarnath, G., et al., 2019. "Insurance as an agricultural disaster risk management tool: evidence and lessons learned from South Asia. Colombo, Sri Lanka." *International Water Management Institute (IWMI), CGIAR Research Program on Water, Land and Ecosystems (WLE)* (WLE Briefing Series No. 27). (https://wle.cgiar.org/insurance-agricultural-disaster-risk-management-tool-evidence-and-lessons-learned-south-asia)

40   Amarnath, G., et al., 2019. 'Insurance as an agricultural disaster risk management tool: evidence and lessons learned from South Asia. Colombo, Sri Lanka.' International Water Management Institute (IWMI), CGIAR Research Program on Water, Land and Ecosystems (WLE) (WLE Briefing Series No. 27). (https://wle.cgiar.org/insurance-agricultural-disaster-risk-management-tool-evidence-and-lessons-learned-south-asia)

41   Greatrex H., et al., 2015. *Scaling up index insurance for smallholder farmers: Recent evidence and insights.* CCAFS Report No. 14 Copenhagen: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

42   See https://old.ecopeaceme.org/projects/community-involvement/ EcoPeace Middle East, 'Community Involvement'.

43   Karolina Eklöw and Florian Kampe, 2019. Climate-related Security Risks and Peacebuilding in Somalia. Stockholm International Peace Research Institute. https://www.sipri.org/publications/2019/sipri-policy-papers/climate-related-security-risks-and-peacebuilding-somalia

44   United Nations Assistance Mission in Somalia. "UN Opens Regional Drought Operations Cooperation Centre in Baidoa", 19 March 2017. https://unsom.unmissions.org/un-opens-regional-drought-operations-coordination-centre-baidoa (accessed November 2020).

45   Report of the Drought Operations and Coordination Centre (DOCC) Field Mission to Galkaacyo: Situation Overview, Key Findings and Follow-Up Action Points for the Relocation of 17,000 Internally Displaced Persons (IDPs). 24-26 April 2018 https://www.sheltercluster.org/sites/default/files/docs/som_20180620_docc_mission_to_galkaacyo.pdf

46   Interview with Christophe Hodder, UN environmental advisor to Somalia, 10 September 2020 https://unsom.unmissions.org/interview-un-environmental-advisor-somalia-christophe-hodder

47   *Ibid.*

48   Karolina Eklöw and Florian Kampe, 2019. Climate-related Security Risks and Peacebuilding in Somalia. Stockholm International Peace Research Institute.
https://www.sipri.org/publications/2019/sipri-policy-papers/climate-related-security-risks-and-peacebuilding-somalia

49   "The World Climate and Security Report 2020." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Louise van Schaik (Clingendael), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020. P. 91.

50   *Ibid.*

51   Steve Brock and Deb Loomis. Climate 21 Memo for Department of Defense. P. 12. https://climate21.org/documents/C21_Defense.pdf

52   Louise van Schaik et al. 2020. "Fears for Militarization of Climate Change: Should we be concerned?", Clingendael Alert.

53   Such policies are elaborated by national governments, or supported by international organizations, such as the FAO as it is the case with the project "towards climate change adaptation in sub-Saharan Africa", with pilots in Ethiopia, Kenya and the United Republic of Tanzania.

54   "The Great Green Wall." Great Green Wall. https://www.greatgreenwall.org/about-great-green-wall

55   Carlowicz, Michael, 16 Dec. 2019, "Drought threatens millions in Southern Africa", *NASA Earth Observatory*.

56   World Food Program, April 2020, *Southern Africa: Seasonal Overview and Drought Hotspot Analysis (2019/2020)*, Johannesburg Regional Bureau.

57   Carlowicz, Michael, 16 Dec. 2019, "Drought threatens millions in Southern Africa", *NASA Earth Observatory*.

58   Relief Web, 2020, "Southern Africa: Drought – 2018-2020", Disaster description.

59   Carlowicz, Michael, 16 Dec. 2019, "Drought threatens millions in Southern Africa", *NASA Earth Observatory*.

60   *Ibid.*

61   Gebremeskel Haile Gebremedhin, Qiuhong Tang, Seyed-Mohammad Hosseini-Moghari, et al., 2020, "Projected Impacts of Climate Change on Drought Patterns Over East Africa", Earth' *Future*, 8 (7)

62   *Ibid.*

63   *Ibid.*

64   Nicholson, E. Sharon, 2017, "Climate and climatic variability of rainfall over eastern Africa", *Rev. Geophys.*, 55, pp. 590– 635.

65   Wainwright M.Caroline, Marsham John H, Keane Richard J., P. Rowell David, Finney Declan L., Black Emily & P. Allan Richard, September 2019, "'Eastern African Paradox' rainfall decline due to shorter not less intense Long Rains", *npj Climate and Atmospheric Science*, 2 (34).

66   FEWS net, 13 August 2020, "Forecast below-average rainfall in late 2020 and early 2021 likely to drive high food assistance needs", East Africa Food Security Alert.

67   RCP stands for Representative Concentration Pathways. Four RCPs produced from Integrated Assessment Models are used in the Fifth IPCC Assessment as a basis for the climate predictions and projections. RCP2.6 is the pathway where radiative forcing peaks at approximately 3 W m^{-2} before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100); RCP4.5 and RCP6.0 are two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 4.5 W m^{-2} and 6.0 W m^{-2} after 2100 (the corresponding ECPs assuming constant concentrations after 2150); RCP8.5 is the high pathway for which radiative forcing reaches greater than 8.5 W m^{-2} by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250).

68   *Ibid.* p.19-20.

69   The occurrence of floods can partly be explained by the degraded quality of soils, notably due to changes in droughts patterns and human activities. During heavy rainfall periods, such as during long rains, soils degraded by droughts can't absorb precipitation. Moreover, environmental degradations, such as deforestation, contribute to the perturbation of natural cycles (such as those of soils and water), reinforcing the vulnerability of the region to climate change.

70   OCHA, November 2019, "Regional Floods Snapshot", *Eastern Africa Region*.

71   OCHA, May 2020, "Floods and locust outbreak snapshot", *Eastern Africa Region*.

72   Al Jazeera, 9 May 2020, "East African countries count losses after devastating floods".

73   FEWS NET, 10 October 2020, "June to September 2020 rains marked by extensive flooding and historically high water levels", *East Africa Seasonal Monitor.*

74   Save the children, 15 May 2020, "Covid-19 risks in east Africa heighten as severe floods displace nearly half a million people". News & stories.

75   Geoengineer, 16 May 2020, "East Africa devastated by floods and landslides".

76   FEWS NET, 10 October 2020, "June to September 2020 rains marked by extensive flooding and historically high-water levels", *East Africa Seasonal Monitor.*

77   Andualem Kassegn and Ebrahim Endris, 2021, "Review on socio-economic impacts of 'Triple Threats' of COVID-19, desert locusts, and floods in East Africa: Evidence from Ethiopia", Cogent Social Sciences, 7:1

78   Gitau Bernard,15 October 2020, "Rising Lake Naivasha water levels eight dead", People Daily.

79   Jackson Njehia, 4 September 2020, "Kenyans fear 'ecological disaster' if two swollen lakes merge", Reuters.

80   NASA, 7 September 2020, "Rising Waters on Kenya's Great Rift Valley Lakes", *Earth Observatory.*

81   Al Jazeera, 9 May 2020, "East African countries count losses after devastating floods".

82   FEWS NET, 13 August 2020, "Forecast below-average rainfall in late 2020 and early 2021 likely to drive high food assistance needs". Alert.

83   *Ibid.*

84   *Ibid.*

85   African Economic Research Consortium, 2020, "The impact of Covid-19 on food security in Africa".

86   IUCN, 2020, *Invasive alien species and climate change*, Issues brief.

87   OCHA, 25 January 2020, "East Africa's Locust infestation".

88   Siliezar Juan, 30 June 2020, "East Africa facing massive swarms of locusts", *The Harvard Gazette*.

89   Salih, A.A.M., Baraibar, M., Mwangi, K.K. et al., 2020, "Climate change and locust outbreak in East Africa", *Nat. Clim. Chang*,10, p.584–585.

90   OCHA, 25 January 2020, "East Africa's Locust crisis in numbers".

91   World Bank, 01 July 2020, "The Locust Crisis: The World Bank's Response", *Factsheet*

92   Winks Rachel, 20 October 2020, "A plague during a pandemic: how to increase resilience against the desert locust outbreak", *Invasive Blog.*

93   FAO, 19 October 2020, Desert Locust situation update, *Locust Watch, Desert Locust*.

94   Chana et al., 2019,"Prospects and challenges of fish for food security in Africa", *Global Food Security*, 20, pp.17–25.

95   FAO, 2018, *Impacts of climate change on fisheries and aquaculture*

96   Fisheries provide 50% of the Mozambique population's protein intake and tuna represents Maldives' single most important export commodity, while 30% of Seychelles' GDP relies on industrial fisheries.

97   This refers to the added masses of all fish species in an area, regardless of their species, genus, class or development phase.

98   Cheung, W. W. L., Jones, M. C., et al., 2016, "Structural uncertainty in projecting global fisheries catches under climate change", *Ecological Modelling*, 325, pp.57-66.

99   Belhabib, D., Cheung, W. W. L., et al., 2020, "Catching industrial fishing incursions into inshore waters of Africa from space". *Fish and Fisheries.* 21, 379– 392.

100   The French Institute for International & Strategic Affairs, 2020, "Changements climatiques et ressources halieutiques dans le golfe de Guinée : tendances, conséquences régionales et tensions associées", *NOTE D'ANALYSE N°5.*

101   France 24, 29 January 2018, " Au Sénégal, la mort d'un pêcheur entraîne la destruction de boutiques mauritaniennes."

102   The French Institute for International & Strategic Affairs, 2020, "Changements climatiques et ressources halieutiques dans le golfe de Guinée : tendances, conséquences régionales et tensions associées", *NOTE D'ANALYSE N°5.*

103   De Sy, V., Herold, M, et al., 2019, "Tropical deforestation drivers and associated carbon emission factors derived from remote sensing data", *Environment Research Letters.* 14 (9).

104   Demand for timber from foreign countries, especially China who would import 75% of Africas' timber export.

105   In September 2015, several Eastern Africa countries signed the Zanzibar Declaration on Illegal Trade in Timber and other Forest Products to address the illegal timber trade in the region. Some points are still in discussion regarding the implementation and coordination of member states (For more information: TRAFFIC, 11 April 2017, "Eastern African nations launch Steering Committee for Zanzibar Declaration on Illegal Trade in Timber and other Forest Products").

106   The East African, 21 May 2014, "Africa losing $17bn to logging annually.

107   Cavanagh, C. Joseph *et al.*, 2015, "Securitizing REDD+? Problematizing the emerging illegal timber trade and forest carbon interface in East Africa", *Geoforum*, 60, p.72-82.

108   *Ibid.*

109   REDD+ programs in Africa may have neglected the potential negative economic and social impacts of such initiatives, especially towards forest-dependent communities.

110   "The Great Green Wall." Great Green Wall. https://www.greatgreenwall.org/about-great-green-wall

111   Takouleu, Jean Marie, 5 février 2021, « Madagascar : la Banque Mondiale alloue 50 millions de dollars pour la lutte contre la déforestation », Afrik 21.

112   Cavanagh, C. Joseph *et al.*, 2015, "Securitizing REDD+? Problematizing the emerging illegal timber trade and forest carbon interface in East Africa", *Geoforum*, 60, p.72-82.

113   Duffy Rosaleen, Dickinson Hannah, Joanny Laure, 13 July 2017", The Militarisation of Conservation in Africa may be doing more harm than good".

114   *Ibid.*

115   UNOWAS, 09 January 2020, "Briefing of the Special Representative for West Africa and the Sahel to the Security Council: Despite positive political developments, the region continues to witness a devastating surge in terrorist attacks".

116   Kwaja, M.A. Chris and Smith Katie, 2020, *Transnational Dimensions of Conflict between Farmers and Herders in the Western Sahel and Lake Chad Basin*, 1st ed.,Washington DC: Search for Common Ground, p.11.

117   *Ibid.* p.8.

118   *Ibid.*

119   *Ibid.* p.11.

120   IMCCS, 2020, The World Climate Security Report, p.18-20.

121   *Ibid.*

122   SNV, January 2018, "Meating West Africa's mega cities".

123   *Ibid.* p.9.

124   *Ibid.* p.14.

125   Venllturo Madeline & Dick Shannon, 19 March 2020, "How Arms Proliferation Is Driving Herder-Farmer Conflict in the Sahel", World Politics Review.

126   Boko Haram, al-Qaeda, Islamic State of West Africa Province [ISWAP], Islamic State in the Greater Sahara [ISGS]) in Chad, Cameroon, Burkina Faso, Mali, Niger, and Nigeria.

127   Kwaja, M.A. Chris and Smith Katie, 2020, *Transnational Dimensions of Conflict between Farmers and Herders in the Western Sahel and Lake Chad Basin*, 1st ed.,Washington DC: Search for Common Ground, p.12.

128   *Ibid*, p.12-13.

129   *Ibid*, p.13.

130   Road blockers are armed gangs generally located on roads in sub-Saharan Africa, who attack drivers and people.

131   Africa News, Février 2021, « Tchad : au moins 35 morts dans des violences entre éleveurs et cultivateurs ».

132   De Coning Cedric & Krampe Florian, April 2020, Multilateral cooperation in the area of climate-related security and development risks in Africa, NUPI Report 4/2020, Norwegian Institute of International Affairs, p.36.

133   *Ibid.*

134   Hammer Craig, Ricketts Leslie & Hanglem Niharika, 16 July 2020, "Monitoring the impact of COVID-19 and climate change on pastoral populations in the Sahel", World Bank Blogs.

135   *Ibid.*

136   Nnabugwu Treasure, 5 March 2020, "EA scientists develop a device to fight locust swarms in the region", Ventures.

137   "durabilité" in French.

138   The MEFA has elaborated a new Strategy called" Prevention, resilience and sustainable peace (2018-2022) - A comprehensive Approach to the Fragilization of States and Societies", which is the main framework for the French 3D approach. The AFD has declined this strategy by publishing its own strategy" Vulnerabilities to crisis and resilience 2017-2021".

139   French Development Agency, February 2020, "La France au Sahel, l'approche 3D".

140   Ministry for Armed forces, 10 March 2020, « BARKHANE : Sécurité et aide à la population : la force, pleinement impliquée dans la stratégie 3D « diplomatie, défense, développement ».

141   *Ibid.*

142   *Ibid.*

143   European External Action Service, 2020. Climate Change and Defence Roadmap (EEAS (2020) 1251), Brussels, November, https://data.consilium.europa.eu/doc/document/ST-12741-2020-INIT/en/pdf (Accessed March 2021)

144   Rob Mayeda. "Climate in Crisis: Could Arctic Sea Ice Reach an All-Time Low in 2021?" *NBC Bay Area.* February 16, 2021. https://www.nbcbayarea.com/news/local/climate-in-crisis/climate-in-crisis-could-arctic-sea-ice-reach-an-all-time-low-in-2021/2469215/

145   Staalesen, A. 2021. 'New Russian fighter jets on standby in upgraded Arctic air base', *The Barents Observer*, 8 February, Security section.

146   Brzozowski, A. 2020. 'With geopolitics in mind, EU opens consultation on future Arctic strategy', *EURACTIV*, 23 July, Arctic Agenda section.

147   Raphaeli, N. 2020. 'Water Crisis In Iraq: The Growing Danger Of Desertification', *MEMRI* [online], July, https://www.memri.org/reports/water-crisis-iraq-growing-danger-desertification-0 (Accessed March 2021).

148   van Schaik, L et al. 2020. 'Ready for take-off? Military responses to climate change', The Hague, *Clingendael Report,* https://www.clingendael.org/sites/default/files/2020-03/Report_Military_Responses_to_Climate_Change_March_2020.pdf (Accessed March 2021).

149   *EU boosts humanitarian aid budget for 2021 as needs rise*, European Commission, Brussels, https://ec.europa.eu/echo/news/eu-boosts-humanitarian-aid-budget-2021-needs-rise_en (Accessed March 2021).

150   Paz, S. 2019. 'Effects of climate change on vector-borne diseases: an updated focus on West-Nile virus in humans', *Emerging Topics in Life Sciences*, May, 3(2), pp. 143-152.

151   *Weekly updates: 2020 West Nile virus transmission season,* European Centre for Disease Prevention and Control, Solna, https://www.ecdc.europa.eu/en/west-nile-fever/surveillance-and-disease-data/disease-data-ecdc (Accessed March 2021).

152   *Warming Europe invites dangerous mosquitos,* The Copernicus Programme, Paris, https://climate.copernicus.eu/warming-europe-invites-dangerous-mosquitos (Accessed March 2021).

153   Janjevic, D. 2018. 'Nord Stream 2 gas pipeline – What is the controversy about?, DW News, 14 July, English news section.

154   European Commission, 2021. *Building a Climate-Resilient Future - A new EU Strategy on Adaptation to Climate Change*, Brussels, February, https://reliefweb.int/sites/reliefweb.int/files/resources/Building_a_Climate-Resilient_Future_-_A_new_EU_Strategy_on_Adaptation_to_Climate_Change.pdf (Accessed March 2021).

155   Guy, Kate at al. "A Security Threat Assessment of Global Climate Change: How Likely Warming Scenarios Indicate a Catastrophic Security Future." Product of the National Security, Military, and Intelligence Panel on Climate Change. Edited by Femia, Francesco and Werrell, Caitlin. The Center for Climate and Security, an institute of the Council on Strategic Risks. Washington, DC. February 2020.

156   European Council Conclusions of 11 and 12 December 2020.

157   European External Action Service, 2020, pp. 5-6.

158   European External Action Service, 2020, pp. 7-9.

159   European External Action Service, 2020, pp. 10-11.

160   Co-chaired by Germany and Nauru

161   European Parliament, 2021. *A new neighbourhood, development and international cooperation instrument – Global Europe*, Brussels, March, https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/628251/EPRS_BRI(2018)628251_EN.pdf (Accessed March 2021).

162   Council of the European Union, 2021. *Council conclusions on Climate and Energy Diplomacy - Delivering on the external dimension of the European Green Deal* (5263/21), Brussels, January, https://www.consilium.europa.eu/media/48057/st05263-en21.pdf (Accessed March 2021).

163   *Climate and energy diplomacy: EU highlights key role of external policy in delivering European Green Deal,* EU Neighbours East, Brussels, https://www.euneighbours.eu/en/east/stay-informed/news/climate-and-energy-diplomacy-eu-highlights-key-role-external-policy#:~:text=On%2025%20January,%20The%20Council%20of%20the%20European,and%20resilience%20of%20the%20EU%20and%20its%20partners (Accessed March 2021).

164   European External Action Service, 2020, p. 3.

165   Council of the European Union, 2021, p. 3.

166   Parkinson, S. & Cottrell, L. 2021. *Under the Radar: The Carbon Footprint of Europe's Military Sectors.* Brussels, The Left group in the European Parliament - GUE/NGL.

167   European Union Institute for Security Studies (2021), Climate change, defence and crisis management: from reflection to action, Event report.

168   van Schaik, L. & Hofhuis, P. 2021. 'Transatlantic Cooperation on Climate Change: Beyond the Beauty Contest', Washington D.C., *Wilson Center*, February, https://www.wilsoncenter.org/article/transatlantic-cooperation-climate-change-beyond-beauty-contest (Accessed March 2021).

169   Fetzek, S. & van Schaik, L. 2018. 'Europe's Responsibility to Prepare: Managing climate security risks in a changing world', Washington D.C., *The Center for Climate & Security*, June, https://www.clingendael.org/sites/default/files/2018-06/Report_Europe_Responsibility_to_prepare.pdf (Accessed March 2021).

170   Hofhuis, P. 2020. 'The European Commission on the brink of a green recovery Will it be able to deliver?', the Hague, *Clingendael Institute*, July, https://www.clingendael.org/sites/default/files/2020-07/Policy_Brief_Green_Deal_and_Coronacrisis_juli_2020.pdf (Accessed March 2021).

171   Hofhuis, 2020, p. 2.

172   European External Action Service, 2020. Climate Change and Defence Roadmap (EEAS (2020) 1251), Brussels, November, https://data.consilium.europa.eu/doc/document/ST-12741-2020-INIT/en/pdf (Accessed March 2021)

173   European External Action Service, 2017. Defending Europe: The European Defence Fund, Brussels, June, https://eeas.europa.eu/sites/default/files/defence_fund_factsheet_0_0.pdf (Accessed March 2021).

174   CAL FIRE. "2020 Incident Archive." *State of California.* https://www.fire.ca.gov/incidents/2020/

175   The Report on the Effects of a Changing Climate on the Department of Defense. 2019

176   Dan Lamothe. "Amid 'apocalyptic' fire conditions, the California National Guard prepares for a long fight". The Washington Post (September 24, 2020) https://www.washingtonpost.com/national-security/2020/09/24/after-daring-rescue-apocalyptic-wildfire-conditions-military-prepares-long-fight/

177   Megan Eckstein, Gidget Fuentes. "Marines, Sailors Join National Guard to Fight California Wildfires". (September 22, 2020). United States Naval Institute News https://news.usni.org/2020/09/22/marines-sailors-join-national-guard-to-fight-california-wildfires

178   Arlette Saenz and Donald Judd. "Biden's pledge to storm-battered Texans: 'We're in it for the long haul'". CNN. (February 26, 2021) https://www.kten.com/story/43417891/biden-surveys-weather-harm-encourages-virus-shots-in-texas

179   Leah Wieczorek. "How Is Asia Responding to the Global Climate Challenge?" *South pole.* December 15, 2020. https://www.southpole.com/blog/asia-climate-action

180   Ted Nordhaus, Seaver Wang. "China Breaks Decades of Climate Gridlock." Foreign Policy (January 11, 2021). https://foreignpolicy.com/2021/01/11/china-climate-diplomacy-decarbonize-net-zero-separate-and-differentiated/

181   Andreas Unterstaller. "Will Climate Change Derail the Asian Century?" The Diplomat (February 26, 2020) https://thediplomat.com/2020/02/will-climate-change-derail-the-asian-century/

182   Kat Kramer and Joe Ware. "Counting the Cost 2020: A Year of Climate Breakdown." *Christian Aid.* December 2020.

183   "The World Climate and Security Report 2020." Product of the *Expert Group of the International Military Council on Climate and Security.* Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Louise van Schaik (Clingendael), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020. P. 88.

184   David Eckstein, Marie-Lena Hutfils, and Maik Winges. "Global Climate Risk Index 2019: Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017." *Germanwatch.* December 2018.

185   "Disaster Relief in Central America." *U.S. Southern Command.* December 3, 2020. https://www.southcom.mil/Media/Special-Coverage/Disaster-Relief-in-Central-America/

186   Jose Ruiz. "SOUTHCOM Commander Visits, Thanks Troops Who Supported Relief Effort In Aftermath of Hurricanes Eta, Iota." *U.S. Southern Command.* December 11, 2020. https://www.southcom.mil/News/PressReleases/Article/2445089/southcom-commander-visits-thanks-troops-who-supported-relief-effort-in-aftermat/

187   National Hurricane Center and Central Pacific Hurricane Center. "NHC Active Tropical Cyclones." *National Oceanic and Atmospheric Administration.* https://www.nhc.noaa.gov/cyclones/

188   "Hurricanes and Climate Change." *Center for Climate and Energy Solutions.* https://www.c2es.org/content/hurricanes-and-climate-change/

189   Lin Li and Pinaki Chakraborty. "Slower decay of landfalling hurricanes in a warming world." *Nature*. Nov. 2020, DOI: 10.1038/s41586-020-2867-7

190   "Hurricane Eta and Hurricane Iota: Why You Should Care." *Solidaridad*. November 17, 2020. https://www.solidaridadnetwork.org/news/hurricane-eta-and-hurricane-iota-why-you-should-care/

191   Ciara Nugent. "Central American Leaders Demand Climate Aid as a Record Storm Season Batters the Region." *TIME*. November 18, 2020. https://time.com/5913006/hurricane-iota-climate-aid/

192   "Climate and Security in Brazil." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Oliver-Leighton Barrett (CCS), Andrea Rezzonico (CCS), Vanessa Pinney (CCS), Francesco Femia (CCS). Edited by Francesco Femia. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. November 2020.

193   Jan Rocha. "Bolsanaro's Brazil is becoming a Climate Pariah," 1 Feb 2021, https://climatenewsnetwork.net/bolsonaros-brazil-is-becoming-a-climate-pariah/

194   Gabriel Toueg. "Former Brazilian ministers seek Europe's help with COVID crisis." *Anadolu Agency*. January 28, 2021. https://www.aa.com.tr/en/americas/former-brazilian-ministers-seek-europe-s-help-with-covid-crisis/2125423#

195   "Letter to UNFCCC Executive Secretary: Brazil's Nationally Determined Contribution." *Climate Action Network International.* January 25, 2021. http://Letter-to-UNFCCC-Exec-Sec-Brazil-NDC_TE.pdf

196   Angelina Davydova, "Siberia Swelters in the Age of Climate Change." *The Moscow Times.* July 8, 2020. https://www.themoscowtimes.com/2020/07/08/siberia-swelters-in-the-age-of-climate-change-a70809

197   "Reported New Record Temperature of 38°C North of Arctic Circle." *World Meteorological Organization*. June 23, 2020. https://public.wmo.int/en/media/news/reported-new-record-temperature-of-38%C2%B0c-north-of-arctic-circle

198   "Over 400 People Injured by East Siberia Floods." *TASS*. July 6, 2019. https://tass.com/emergencies/1067371

199   Cyrus Newlin, Cyrus and Conley, Heather, "Climate Change Will Reshape Russia", *Commentary*, CSIS, 13 January 2021, https://www.csis.org/analysis/climate-change-will-reshape-russia.

200   https://climateactiontracker.org/countries/russian-federation/.

201   Lustgarten, Abrahm, "How Russia Wins the Climate Crisis", *New York Times*, 16 December 2020, https://www.nytimes.com/interactive/2020/12/16/magazine/russia-climate-migration-crisis.html.

202   Cyrus Newlin, Cyrus and Conley, Heather, "Climate Change Will Reshape Russia", *Commentary*, CSIS, 13 January 2021, https://www.csis.org/analysis/climate-change-will-reshape-russia.

203   A recent storage tank collapse sent 21,000 tons of diesel into the Ambarnaya river and surrounding subsoil; see: Cyrus Newlin, Cyrus and Conley, Heather, "Climate Change Will Reshape Russia", *Commentary*, CSIS, 13 January 2021, https://www.csis.org/analysis/climate-change-will-reshape-russia.

204   Levin, Kelly and Ezra Northrop. "Four Things to Know About the IPCC Special Report on the Ocean and Cryosphere." World Resources Institute. September 25, 2019. https://www.wri.org/blog/2019/09/4-things-know- about-ipcc-special-report-ocean-and-cryosphere.

205   Lustgarten, Abrahm, "How Russia Wins the Climate Crisis", *New York Times*, 16 December 2020, https://www.nytimes.com/interactive/2020/12/16/magazine/russia-climate-migration-crisis.html.

206   Cyrus Newlin, Cyrus and Conley, Heather, "Climate Change Will Reshape Russia", *Commentary*, CSIS, 13 January 2021, https://www.csis.org/analysis/climate-change-will-reshape-russia.

207   Polina Devitt. "Russia's Leading Grain Producing Region Sees 2020 Crop Down 40% - INTERFAX." *Reuters*. June 5, 2020. https://www.agriculture.com/markets/newswire/russias-leading-grain-producing-region-sees-2020-crop-down-40-interfax

208   Werrell, C.; Femia, F.; Goodman, G; Fetzek, S."A Responsibility To Prepare: Governing in an Age of Unprecedented Risk and Unprecedented Foresight," *The Center for Climate and Security*, August 7, 2017

209   Anmar Frangoul. "Maersk Says It Will Launch a Carbon Neutral Vessel by 2023, Seven Years Ahead of Schedule." *CNBC*. February 17, 2021. https://www.cnbc.com/2021/02/17/maersk-says-it-will-launch-a-carbon-neutral-vessel-by-2023.html

210   Cleo Pascal, 'China forcing a shift in strategic map', Sunday Guardian Live, February 23 2019, https://www.sundayguardianlive.com/news/china-forcing-shift-strategic-map.

211   Permanent Court of Arbitration, The South China Sea Arbitration (The Republic of Philippines v. The People's Republic of China), 2016, https://pca-cpa.org/en/cases/7/.

212   Clive Hamilton. (2013). "Les apprentis sorciers du climat". Anthropocène seuil.

213   Clive Hamilton. (2019). "Could geoengineering cause a climate war". Science Focus.

214   Darius Nassiry et al. (2017). "Implications of geoengineering in developing countries". *Odi*. Working paper 524.

215   Seymour M.Hersh, 3 July 1972, "Rainmaking is used as a weapon by U.S". *The New York Times*.

216   "The World Climate and Security Report 2020." Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Bastien Alex (IRIS), Oliver-Leighton Barrett (CCS), Francesco Femia (CCS), Shiloh Fetzek (CCS), Sherri Goodman (CCS), Deborah Loomis (CCS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Louise van Schaik (Clingendael), Julia Tasse (IRIS), Caitlin Werrell (CCS). Edited by Francesco Femia & Caitlin Werrell. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. Feb 2020.

MCCS
EXPERT GROUP

THE CENTER FOR
CLIMATE AND
SECURITY

COUNCIL ON
STRATEGIC
RISKS

Clingendael
Netherlands Institute of International Relations

Planetary Security
INITIATIVE

The Hague
Centre for
Strategic
Studies

iRiS
INSTITUT DE RELATIONS
INTERNATIONALES
ET STRATÉGIQUES

THE WORLD CLIMATE AND
SECURITY REPORT 2021

A Product of the Expert Group of the
INTERNATIONAL MILITARY COUNCIL ON CLIMATE AND SECURITY

JUNE 2021