



NATO Science for Peace and Security Series - C:
Environmental Security

National Security and Human Health Implications of Climate Change

Edited by
H.J.S. Fernando
Z.B. Klaić
J.L. McCulley



Springer



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National Security and Human Health Implications of Climate Change

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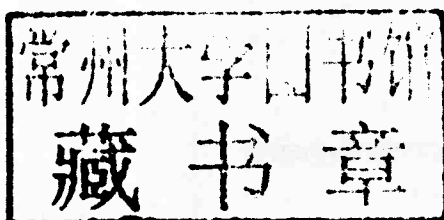
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Series C: Environmental Security

Preface

This NATO Advanced Research Workshop was aimed at examining *the relationship between Climate Change, Human Health and (Inter) National Security*. The subject is widely discussed internationally both at the military and at the civilian level. A plethora of movie fictions have illustrated a great variety of possible scenarios. The direct impact of climate change on health has been shown and accepted. The CO₂ levels are now the highest of the last 500,000 years, the global temperature is clearly on the rise, glaciers melt at the poles, but also at the continental level, and extreme events are on the rise. In our cities, we face a level of pollution that is increasingly relevant in the pathogenesis of human and animal diseases. It is time to very seriously evaluate these new or newly arisen threats, which are at levels higher than the “watch” or “guard” levels of the last century’s environmental conditions. Unless these threats are appropriately studied, carefully assessed and prevented, they can, at least in their more direct impacts, have devastating effects on our health, social organization and, thus, on our security.

The questions we should ask ourselves are therefore:

1. Which climatic changes can represent a threat to our security and why?
2. Which elements increase the effects of climate change on health?
3. Which actions we must undertake?

Political and military leaders of the major countries asked themselves the same questions. The UN Security Council decided to tackle the problem and even the U.S. Central Intelligence Agency decided to open a center devoted to “Climate Change and National Security.” For the next few decades the forecasted effects of climate change are primarily the extreme events: typhoons, floods, rising sea levels, reduction of polar ice, peaks of extreme heat, and conditions which favour the spreading of disease, such as malaria, dengue fever, schistosomiasis as well as increasing the risk of water-borne diseases.

These events, both at the national and international level can cause migrations of individuals or entire populations, but also situations favouring internal conflict and can create political instability and humanitarian disasters. Regional impacts of climate change include the following.

Africa: Increased political instability, reduced agricultural productivity, famines, civil wars, which favour terrorism: Darfur/Ethiopia. Eritrea, Somalia, Angola, Nigeria, Cameroon, Western Sahara are clear examples.

Asia: The forecast is for a warming of the Asia/Pacific region where hundreds of millions people are at risk because of the melting of the Tibetan glaciers.

Middle East: In this region water is crucial and the situation can be summarized by "ABUNDANT OIL, SCARCE WATER AND INTERNATIONAL CONFLICT"

The Western Hemisphere (US): The major risks for the American continent are cyclones, fires, whether naturally occurring or by arson, at times of huge dimension and duration, and tropical storms (Katrina, etc.) which pose a major challenge for the social infrastructures and the organization of the alarm and support systems.

The Western Hemisphere (EEC): Europe faces a warming phenomenon (unfortunately at this point we cannot speak of a trend) so that for some areas we speak now of desertification. Only in the last few decades have we witnessed the phenomena of coastal erosion, rivers overflowing, abnormal heat waves, and torrential rains responsible for landslides and snowslides. In 2003 a single heat wave alone has caused over 35,000 deaths. Unfortunately, not all countries have an efficient system of civil protection. While industrial countries may have effective social infrastructure to adapt to modified climatic conditions effectively, it is much lower in the less developed countries such as The Balkans, Moldova and the Caucasian regions.

What Can We Do?

Climatic changes at the international level must fit in to a global geo-political strategy, which must take into account existing resources and structures. We need programs of specific information targeted to policymakers like the scientific publication entitled: *Research on Environmental Management in a Coastal Industrial Area: new indicators and tools for air quality and river investigations* ISBN 9788860818997 performed by ENEA (MC. Mammarella et al) with the scientific support of American, European and Russian research groups leading at environmental level. It is imperative to devote resources to specific research, information, and training of civil and military personnel by a qualified international task force. It is important to develop equipment, strategies and preventive measures, creating infrastructures and networks, both national and international levels, which are capable of responding quickly and effectively in emergency situations. We should also support the weaker governments and help them to achieve the ability to implement all the preventive measures to face the effects of climatic changes on population. The climate change can be conquered, but quick action is needed.

President
European Medical Association
Bruxelles

Vincenzo Costigliola MD

Introduction: Climate Change, Human Health and National Security

Prime facie, the title of this volume appears as three timely topics, disconnected yet juxtaposed, but a closer look indicates that they are indeed interconnected through the fabric of *quality of life*. The latter is defined in terms of ensuring safe, healthy and equitable existence for every human, with access to adequate resources at present and in the future. As depicted in Fig. 1, however, climate change has threatened human health and security through numerous manifestations. To understand the tripartite interplay between human health, climate change and security of nations and citizens, a workshop was held in Dubrovnik, Croatia, during 28–30 April 2011, with sponsorship from the NATO Science for Peace and Security Program. Entitled ‘Climate Change, Human Health and National Security,’ the workshop was intended to facilitate discussions on each of the three themes, their interconnectedness and ensuing feedbacks. Thirty-two attendees from 17 countries were invited. The highlight was the multidisciplinary inclusiveness, where leading modelers, natural, political and social scientists, engineers, politicians, military experts, urban planners, industry analysts, epidemiologists and healthcare professionals parsed the topic on a common platform. The papers presented at the workshop are included in this volume.

Climate change impacts on humans are numerous, and at times can be pernicious, encompassing human comfort to food, energy and water shortages to armed conflicts. Human security implies freedom from the risk of loss of damage to attributes that are important for survival and well-being (Matthew et al. 2010). National security is the component of human security that deals with safety against armed conflicts and terrorism (hard security). As Kjeld Rasmussen* pointed out, while most discussions tend to be centered on hard security, soft security that deals with individuals is equally important in the current geopolitical atmosphere. Since the end of cold war, traditional definitions have been expanded to include additional threats such as social and political instability and ethnic rivalries. Because of the complexity of the problem and the formidable number of governing factors involved, addressing climate related issues requires a system approach, noted Julian Hunt*.

*quotations made during the meeting

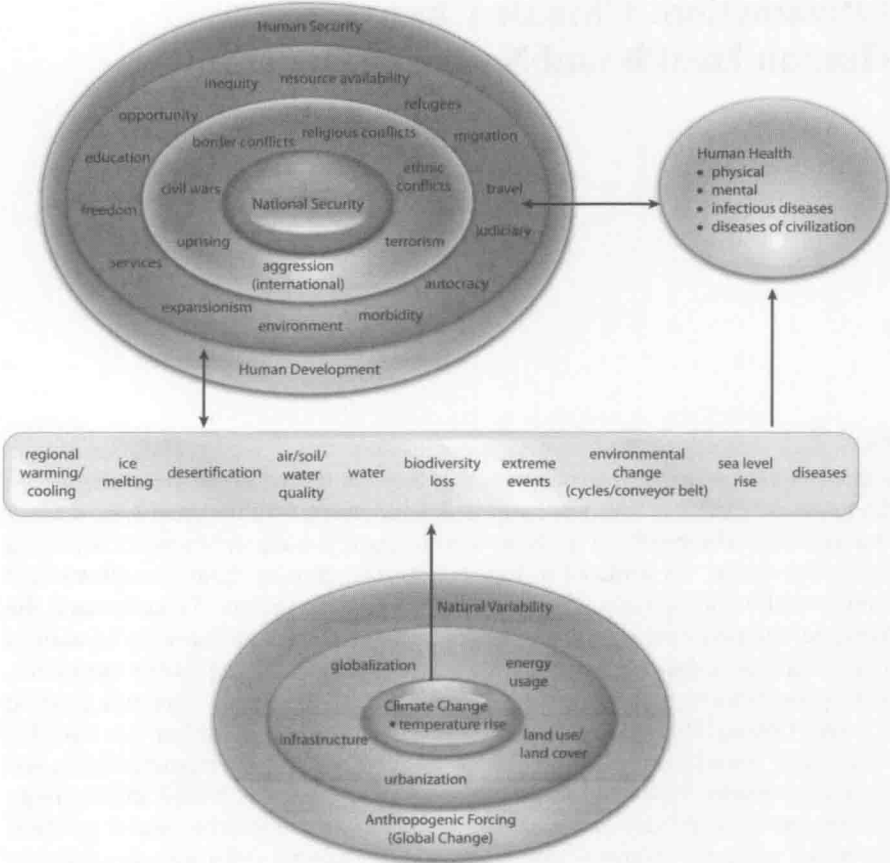


Fig. 1 Interplay between climate change, human health and national security

Through social reforms, ‘out of the box’ thinking and state-of-the-art technology utilization, it is possible to assess and fight off many negative impacts of climate change. “We need to convert conflict to cooperation,” noted Jacques Ganoulis*. “Introduce therapy as soon as symptoms come out,” added Vincenzo Costigliola*.

Societal and ecosystem impacts of climate change are pervasive. Vector borne diseases will appear or reappear, and vectors will expand their poleward operating range as the temperature increases (Alebić-Juretić, Tourre, Paz)[†]. High temperatures may increase heat-stress related illnesses such as heat strokes and dehydration, which may increase the mortality rate (Peretz[†]). Weather variability is expected to produce high pressure regions conducive for heat waves and air pollution episodes (Kambezidis[†]), and teleconnections between different regions may cause climatic interdependences (Herceg Bulić[†]). According to Anne-Lise Beaulant*, “several

[†] see the paper of this author in this volume

yearly episodes of the ilk of [the] Paris-2003 heat wave are possible toward the year 2100" (Barriopedro et al. 2011).

Resource shortages due to climate change, especially the reduction of water and food supply, may spark conflict for resources. Extreme events triggered by climate variability such as intense hurricanes, heat waves and desertification may lead to human catastrophes, thus impacting human security. Those affected will aggressively search for means of adaptation and/or resettlement, leading to mass migration. Uncontrolled influx of migrants (climate refugees) sparks conflict between nations, in addition to intra-nation social and economic segregation. "Climate change is a threat multiplier," argued Marcus King*. Feeling the sense of injustice is an acute cause of uprising, added Lukas Rüttinger*. Governments may have to divert significant energies and resources, which could have been otherwise used for productive means, to help those afflicted and to quell uprisings. Of those, the most affected are the poor and vulnerable as well as smaller nations and islands, stoking issues of equity and justice, and hence political and social instabilities (Radović†). "For Pacific states, climate change is our main security concern," pointed out Nancy Lewis*.

In addition to indirect influence, climate change may directly affect the military enterprise, for example, through physical damage to military installations caused by extreme events, opening of sea-lanes due to ice melting, health impacts on warfighters caused by vector born diseases and poor air quality, and political instability of nations that house military assets. Conversely, military machinery can help ameliorate climate impacts on humans by providing physical, material and psychological humanitarian assistance, including mass evacuations, food distribution and emergency medical services. "It will be necessary to assess the current assets, their vulnerabilities as well as future requirements," contended Marcus King*. For example, fewer ice breakers and more hospital ships will be required in the future due to ice melting and increased disease and humanitarian assistance needs. Sound socio-economic analyses as well as cutting-edge resilience and risk assessment models can help conducting such assessments.

Urban areas are the centers of greenhouse gas emissions, and indications are that they will bear the brunt of climate change given their concentrated populations and intense on-going land use changes. Climate change may exacerbate the urban heat island and may cause a marked decrease of the diurnal temperature range in urban areas, thus affecting both human and ecosystem health. "[The] atmospheric boundary layer in which ecosystems are immersed is most sensitive to climate change," pointed out Sergej Zilitinkevich*. Changes to it will have consequences in pollution distribution, and hence to human health (Jeričević, Klaić, Fernando).† Also affected will be wind patterns and speeds, which will impact civil infrastructure and wind energy availability (Kozmar‡).

"Tipping" between climatic states is another issue of interest. While the IPCC 4th Assessment Report discounts the possibility of strong nonlinearities (or catastrophic shifts), regime shifts are possible over regional and local (urban) scales, driven by positive feedbacks amongst processes (Rasmussen, Fernando).† The workshop attendees call for physical understanding of phenomena and mechanisms of local climatic tipping, which is imperative in preparing for local climate variability.

The attendees also commented on the lukewarm response of regional and local governments to climate change challenges. "Global climate strongly interacts with local climate – some for good and some for bad," said Robert Bornstein*. Governments tend to work with 4–5 year time scales, and hence pay lesser attention to 10-year averages. Obviously local climate adaptation should not rely on IPCC predictions, as local responses can be markedly different. Sea Breeze, land use change, rainfall redistribution – all influence the local climate. New models, measurement tools and information technologies are necessary for rapid dissemination of climate and environmental risk information to stakeholders (Baklanov, Mammarella, Costigliola).[†]

Interdisciplinary, multi-scale and collaborative approaches are imperative in handling critical trans-boundary issues of climate change (NAS 2005). The workshop attendees identified possible ways to break communication barriers within multidisciplinary audiences, foster harmony within climate science enterprise and turn climate woes into opportunities. They noted that "water can be a powerful source to foster peace," since nations are unwilling to deprive others of accessing water resources lest grave humanitarian crises arise (Rüttinger[†]). "Water issues cannot be looked at in isolation; food, water and energy are all interrelated, and all underpin ecosystem services," noted Roger Falconer*. Many countries, especially those in Middle East, Africa and Asia, will be impacted by the changes to hydrological cycle (Elsaheed, Oroud),[†] but special attention should be paid to local water resources, the climatic response of which is largely unknown. "We know that we don't know about [it]," remarked Jacques Ganoulis*. Accounting for water is not a straight jacket issue, as 'virtual water' (used in the production of goods or services) needs reckoning, Roger Falconer* added. Extreme rainfall over narrow land areas as well as shifting of rain over to oceans may leave some catchment areas devoid of rain (Alpert[†]).

How sensitively the earth system responds to climate mitigation strategies depends on the resilience of large water bodies, such as oceans and inland seas, to environmental change (Zavialov[†]). Even if there is no further release of anthropogenic CO₂ to the atmosphere, because of the slow response of oceans, climate warming will continue to occur over the twenty-first century albeit at a slower pace, increasing by several tenths of a degree over the century (Royal Society 2010). About half of the CO₂ released since the industrial revolution has been absorbed by the oceans, which has been a source of ocean acidification and coral bleaching. A change of CO₂ injection permeates to the ocean very slowly, and hence greenhouse gas mitigation strategies only sluggishly come into effect.

Ecosystems response to climate change can be diverse, and include loss of biodiversity and indigenous species as well as arrival of invasive species (Bashmakova, Vardanian).[†] Landscape planning, ecosystem health and air quality are effective platforms for climate mitigation and adaptation discourse at the local level. For example, management of parks, deltas, rivers and wetlands require melding of social, political, economic and ecological teams. Residents pay attention to ecosystems, air pollution, visibility and aesthetics, and are eager to see that local governments ensure a healthy environment sooner than later, said Adnan Kaplan*. In this context, naturally, climate change becomes a part of the consideration.

A bane for the progress of climate science is the paucity of data. Only some 1,400 data stations are being used for global averaged temperature, and some of them have now become urban over time, introducing biases. Change of flow patterns can also introduce unrepresentative trends. “Sound physics-based protocols must be developed for data processing and rejection, rather than relying on preconceived trends,” noted Robert Bornstein*. Satellites are stepping up to the challenge of global temperature monitoring and provide extensive spatial coverage. More representative data stations are needed, with frequent evaluation of their suitability for climate research. Data should be transparent and easily available, with metadata, to all researchers. “Governments and international organizations such as WMO, WHO and the UN ought to develop data exchange, reposting and cataloging plans” proposed Julian Hunt*. Voluntary data also can be used after proper quality control procedures.

The workshop was a resounding success in bringing scientists with a myriad of different backgrounds together to communicate on how climate change can trigger health and security concerns. The seeds of the conference were germinated by Dr. Vincenzo Costigliola, former Medical Chief of NATO and the President of the European Medical Association. The workshop could not come to light without painstaking contributions of many colleagues, co-workers and students. Jennifer McCulley, Arizona State University, acted as the conference coordinator, Stipo Sentic, Scott Coppersmith, Melissa Unruh and Marie Villarreal, University of Notre Dame, helped with fine tuning of logistics and maintaining the website and Sahan Fernando, Gonzaga University, helped in preparing this ARW volume. Both University of Notre Dame and Faculty of Science, University of Zagreb, provided generous support in numerous ways, including financial contributions, for which we wish to express sincere gratitude. The enthusiastic participation of conference attendees and their willingness to exchange information made the conference a memorable event that is bound to spark future workshops of this ilk. We are grateful to the NATO for financial support through grant # EAP.ARW.984000.

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Chapter 1

National Security and Human Health Implications of Climate Change

Marcus DuBois King

Abstract The first section of the paper presents key findings from the 2007 report, *National Security and the Threat of Climate Change* by the CNA Corporation, including that projected climate change: (1) Poses a serious threat to U.S. National Security; (2) Acts as a threat multiplier for instability in some of the most volatile regions in the world and; (3) Adds tensions even in stable regions of the world. In the second section I summarize work conducted by myself and Dr. Ralph Espach at CNA that identifies exactly which countries are most relevant to the CNA Military Advisory Board's original findings. By compiling data from a variety of sources, we identify the states most exposed to the impacts of climate change both in the short and long term. The next section introduces estimates of the resilience of these countries, and combines our evaluation of country exposure and expected resilience to create a 3-tiered ranking of countries most vulnerable to political and/or humanitarian crises as a result of climate impacts.

Keywords Climate change • Stability • Resilience • Exposure

1.1 Introduction

This paper will build upon the findings of the CNA Military Advisory Board (CNA MAB) study, *National Security and the Threat of Climate Change* published in 2007 and subsequent research our group has performed on climate change and state

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stability. The CNA MAB is an elite group of retired three-and four-star flag and general officers from the U.S. Army, Navy, Air Force and Marine Corps that studies pressing energy and environmental issues of the day to assess their impact on America's national security.

The mention of this CNA study in the website material providing justification for this conference is a testament to its continued relevance. It is therefore worth reviewing key findings of the study in some detail.

1.2 Findings of the CNA MAB

Finding 1: Projected climate change poses a serious threat to America's national security

The CNA MAB found that potential threats to U.S. national security require careful study and prudent planning—to counter and mitigate potential detrimental outcomes. Based on the evidence presented, the CNA MAB concluded that it is appropriate to focus on the serious consequences to our national security that likely stem from unmitigated climate change. In already-weakened states, extreme weather events, drought, flooding, sea level rise, retreating glaciers, and the rapid spread of life-threatening diseases will themselves have likely effects. The effects may include increased migrations, further weakened and failed states, expanded ungoverned spaces, exacerbated underlying conditions that terrorist groups seek to exploit, and increased internal conflicts. In developed countries, these conditions threaten to disrupt economic trade and introduce new security challenges, such as increased spread of infectious disease and increased immigration.

Overall, the study found that climate change has the potential to disrupt our way of life and force changes in how we keep ourselves safe and secure by adding a new hostile and stressing factors into the national and international security environment.

Finding 2: Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world

The CNA MAB found that many governments in Asia, Africa, and the Middle East are already on edge in terms of their ability to provide basic needs: food, water, shelter and stability. Projected climate change will exacerbate the problems in these regions and likely add to the problems of effective governance. Unlike most conventional security threats that involve a single entity acting in specific ways at different points in time, climate change has the potential to result in multiple chronic conditions, occurring globally within the same time frame. Economic and environmental conditions in these already fragile areas will further erode as food production declines, diseases increase, clean water becomes increasingly scarce, and populations migrate in search of resources. Weakened and failing governments, with an already thin margin for survival, foster the conditions for internal conflict, extremism, and movement toward increased authoritarianism and radical ideologies. The U.S. or its allies may be drawn more frequently into these situations to help to provide relief, rescue, and logistics, or to stabilize conditions before conflicts arise.

Because climate change also has the potential to create natural and humanitarian disasters on a large scale its consequences will likely foster political instability where societal demands exceed the capacity of governments to cope. As a result, the U.S. or its allies may also be called upon to undertake stability and reconstruction efforts once a conflict has begun.

Finding 3: Projected climate change will add to tensions even in stable regions of the world

The CNA MAB report found that developed nations, including the U.S. and Europe, may experience increases in immigration and refugees as drought increases and food production declines in Africa and Latin America. Pandemic disease caused by the spread of vectors and extreme weather events and natural disasters may lead to increased domestic missions for US military personnel—lowering troop availability for other missions and putting further stress on its already stretched military, including National Guard and Reserve forces [1].

1.3 Analysis of Global Climate Change and State Stability

In 2008, CNA took a deeper, more analytical look to determine which parts of the world the second and third conclusions of the CNA MAB study best applied to. The question in this further research undertaken by myself and Dr. Ralph Espach was to determine exactly which states (strong or weak) were most exposed to the impacts of climate change and what sort of resilience these countries might have? [1] This research was undertaken at the request of the U.S. National Intelligence Council (NIC), a center for midterm and long-term strategic thinking within the U.S. Intelligence Community. The NIC asked CNA to examine countries that could become unstable from climate change in the near (2020–2025) and long (2040–2045) terms. Specifically, we were asked to:

- Identify those countries that are most exposed to climate impacts (water scarcity, agricultural degradation, sea level rise, and extreme weather events) both in the short term and the long term;
- Assess these countries' resilience to the impacts of climate change; and
- Discuss the implications of these findings for the security interests of the United States.

CNA was not asked to conduct any original data collection for this study, but instead to base our analysis on existing research from reputable sources [2].

1.3.1 Methodology

We derived a list of the countries most exposed to climate impacts in the short term (2020–2025) based on the historical record of frequency and intensity of droughts,