[*DEVELOPMENT OF A METHODOLOGICAL FRAMEWORK FOR ENHANCING THE RESILEICE OF MILITARY INFRASTRUCTURE AGAINST CLIMATE CHANGE IMPACTS/ CASE STUDY: 116COMBAT WING, ARAXOS, AHAIA, GREECE*]

Col (HAF-Eng) Ilias Manolis, Msc, Head of Hellenic Minsistry's of National Defence Department of Infrastructure and Environmental Protection, +306983507768, iliasmanolis@hotmail.com
Dr. Ataanasios Sfetsos, Research Director, Environmental Research Laboratory Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety National Centre for Scientific Research "Demokritos", +302106503403, ts@ipta.demokritos.gr
Professor Christos Makropoulos, MEng, DIC, MSc, PhD, FRGS, FHEA, Editor in Chief, Urban Water Journal Professor of Water Management and Hydroinformatics, School of Civil ngineering, National Technical University of Athens +30 210 772 2886 , cmakro@mail.ntua.gr
Antonis Skouloudis , Assistant Professor, Department of Environmen University of the Aegean, +30 22510 36277, skouloudis@aegean.gr

Overview

Mitigating climate change impacts and enhancing the resilience capacity of military infrastructure is essential for the Armed Forces, first, to ensure a high level of both readiness and sustainability transitions and, second, to contribute to each EU Member-State's (MS) specific energy and climate goals, as these are defined within the National Energy and Climate Plans (NECPs). Furthermore, improving the efficiency of defence infrastructure could save human and finance resources, which national defence directorates can allocate and/or invest in other essential needs respectively.

While there are several actions and ongoing initiatives at both national and EU level to achieve such aforementioned goals, efforts are unsystematic and occasionally duplicated or overlapped. It is also evident that a Member-State itself cannot always ensure the effective implementation of the climate change legislative provisions to military infrastructure, due to a number of potential obstacles (organizational lack of awareness, motivation and commitment; lack of knowledge and expertise; budget constraints and limited access to funding; asset defeciencies and lack of energy consumption data; etc.)

In view of the above, specific challenges and necessities emerge which define the overarching scope of this research endeavor and pertain to the following elements that constitute the main objectives of the study:

- To identify critical hazards associated to climate change impacts which are interacting with major defence infrastructure assets (buildings, either individual or in the form of compounds/clusters, utility networks, waste management procedures, transport processes, logistics, etc) and ultimately pose potential setbacks to the effective execution of operational capabilities.
- To quantitatively assess vulnerability points that such hazards create, in terms of frequency, severity and/or magnitude of the affected areas, as well as related costs.
- To identify and evaluate existing resilience factors in order gauge the level that fundamental elements military infrastructure can anticipate, absorb, cope, recover and eventually adapt to linear and non-linear climate challenges (with specific focus on impacts that hamper the operational capabilities of the test case – Air Base-such as excessive rain fall, flooding incidents, high air humidity, wind storms, low cloud coverage, heat waves, etc).
- To propose policy interventions, accompanied with financial estimations of plans needed in order to mitigate climate risks, in the prospect of achieving climate neutrality and adaptive capacity of defence infrastructures.

Methods

In order to achieve the aforementioned aim and objectives, the study will follow the key research steps outlined below:

1. Problem statement, literature review on similar initiatives in the civilian sector, academic research studies and funded projects, presentation of the pilot case military infrastructures (116 Combat Wing, list of related to infrastructure assets-buildings, utility networks, transportation-logistics-communication/navigation means and equipment, relevant data such as energy and fuels consumption, etc).
2. Climatic hazards' identification and specific risk assessment accompanied by suitable Key Performance Indicators (KPIs) definition (i.e. vulnerability analysis, carbon footprint estimations, associated costs and assessment of the impact on operational performance).

3. Development of a Resilience Assessment Matrix (based on capacities of the Combat Wing related to potential quantification of anticipation, absorption, coping, recovery and adaptation of its activities)
4. Preparation of a list of proposed interventions, which aim at enhancing adaptation and mitigation procedures with the ultimate goal to achieve carbon neutrality, using the characterization of risks evaluation and defined resilience factors (step 3).

The steps presented above, are expected to be followed in an ad-hoc process, meaning that for each step the analysis and research associated is going to be summarized into a relevant scientific publications ('papers"). These papers are intended to be made available to the public, keeping in mind that some pieces of information are going to be kept confidential, according to the internal (military) information disclosure rules.

Results

The results of the study will help defence, as well as related scientific community factors, among other things, to :

- Generate new knowledge and validated data on the direct and indirect impacts of climate change on the defence infrastructure, and in particular air force, as well as on their exposure and vulnerability. Focus will be on Greek air base (116Combat Wing).
- Propose, and validate, a comprehensive climate risk reduction and resilience concept that will entail trade-offs in terms of climate neutrality and environmental sustainability, something that is not well understood.
- Implement this integrative process : climate neutrality, climate resilience / risk reduction, sustainable development and mission criticality using a systems based approach. Presently defence sector risk assessments tend to focus on individual hazards, structures and regions and also often fail to address future changes in climate-related hazards.
- Pursue the establishment of recommendations of adaptive planning (e.g. contingency and business continuity) and management specific to each defence installations.

Conclusions

In recent years, climate impacts and resource scarcity have been viewed through the prism of international security which has led to the emergence of the research field "climate security", i.e. the analysis of how climate change affects conflict and political stability (Boas and Rothe 2016). The issue has been discussed in the UN Security Council (2011), the EU and NATO recognize climate change as threat to international security (EC 2021).
Climate change and exacerbated climate extremes can negatively affect military installations, military assets, supplies and operations and are a growing concern to European Union (da Costa 2021) defence sector. A multi range of impacts is anticipated that may include a) direct physical impacts on installations, infrastructure (air fields, naval bases,…) and utilities (e.g., roads, bridges, energy, water), b) military capability and mission operations / deployment in climate harsh conditions, and c) through potential increase causing increased tensions, country instability and conflict escalation. The defence sector may also incur higher running costs for maintenance, repair or replacement of infrastructures and equipment and face increased health and safety risks from climate change (e.g. personnel exposed on heat waves).
The outcome of the PhD dissettation will assist in the wider effotts and the objectives sought by relevant defence and scientific stakeholders to assess both in qualitative and quantitave terms the aforementioned impacts and propose a generic framework of solutions, which is going to be customized for the pilot case of 116CW.

References

- Boas, Ingrid, and Delf Rothe. 2016. "From Conflict to Resilience? Explaining Recent Changes in Climate Security Discourse and Practice." Environmental Politics 25 (4): 613–32. https://doi.org/10.1080/09644016.2016.1160479.
- DOD (2019a). Report on Effects of a Changing Climate to the Department of Defense. United States Department of Defense, Washington, DC. https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT-2019.pdf
- European Commission. 2021. "Forging a Climate-Resilient Europe - the New EU Strategy on Adaptation to Climate Change. COM(2021) 82 Final." European Commission
- North Atlantic Treaty Organization (2021). NATO is responding to new challenges posed by climate change https://www.nato.int/docu/review/articles/2021/04/01/nato-is-responding-to-new-challenges-posed-by-climate-change/index.html
- Tavares da Costa, R. and Krausmann, E., Impacts of Natural Hazards and Climate Change on EU Security and Defence, EUR 30839 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-41947-1, doi:10.2760/244397, JRC126315.
- UNFCC 2018 annual reporting