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Cohort 4: Climate-related security risks and sustaining peace

Integrating climate change and conflict early warning: A project proposal

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Abstract

This paper presents an action plan for how to do climate change informed conflict early warning analysis at regional level. It argues that geospatial data and analysis are underestimated tools for better understanding how climate change, peace and security risks link. Given their design, the few existing conflict early warning and response systems often focus on the kinds of risks that emerge from human-to-human interactions. Similarly, climate change early warning systems typically focus unilaterally on data from the natural science sphere. The growing evidence showing that climate change interact with risks of conflict in significant ways calls for a merger of these different forms of early warning systems, by increasing the data signal from the natural sciences side of the equation when performing conflict early warning analysis. Modern GIS and remote sensing technology offer approaches that, if packaged properly, can provide new understanding of how the environment interacts with the human sphere in shaping conflict drivers. Taking departure in the regional level in Africa, the paper presents an approach to develop a historical climate change exposure map and overlaying it with climate and environment geodata, capturing static and land use and land cover change features (LULCC) at a granular geographical level. Geodata to be incorporated could include data on soil quality, erosion, freshwater storage and runoff, chronic aridity, flood events, forest cover, harvest potential, and deforestation rates. This map would be overlaid with meteorological forecasting maps, which in turn could be overlaid, with maps representing human mobility-, conflict- and security-related data. Using a relatively simple interface, conflict analysts could perform spatial analysis to detect early signs of drought or other rapid or slow-onset climate-related risks and examine how they interact with early signs of peace and security risks unfolding in a specific location. The paper argues that such an interdisciplinary and geographical approach to capturing risk could strengthen the quality of conflict early warning analysis if institutional capacities are strengthened at the same time. Increasing the relative natural science data signal in conflict early warning and investing in analytical capacity, could reveal new connections between climate change and conflict at a detailed geographical level and help identify climate – security risks, before they materialize. This would result in payoffs for decision makers working on climate change policy, conflict prevention and peacebuilding at both national, sub regional and regional levels. While the data is out there, innovative partnerships will be required among international and national organizations, donors, academia, and the private sector to operationalize an integrated climate-conflict early warning tool. The paper presents a simple road map towards a development program, that would create and operationalise such a tool.

Background

For well over 20 years,[1] lines of research have sought to uncover the relationship among climate change, peace and security factors. Efforts to document that link have intensified recently and agreement between scholars and practitioners appears to be growing that climate change does not cause conflict directly but, rather, exacerbates existing conflict dynamics.[2] With the mainstreaming of what is referred to as the climate change-security nexus, the issue has been included on the UN Security Council's agenda with increased frequency. To date, this has led to the institutionalization of a small, but agile, Climate Security Mechanism (CSM) within the UN. With scientific and grey literature growing rapidly, the development, climate change and peacebuilding communities of practice are becoming increasingly interested in determining what this new nexus would mean for policy and programming. This poses a key question: How do we move from assessing climate security risks to solving problems for the vulnerable populations exposed to these increasingly clear dynamics?

The different communities of practice appear to be taking small steps toward joint approaches. The peacebuilding community now acknowledges that "the effects of climate change and environmental degradation can compound other conflict drivers or even become security risks in their own right." [3] In terms of climate change adaptation, studies are examining how to integrate conflict prevention and peacebuilding approaches when preparing adaptation projects.[4] This is occurring as many forms of traditional livelihoods are becoming increasingly infeasible due to pressure from climate change that undermines incomes and increases vulnerability. This is expressed in a variety of ways, including through violence. The design of adaptation projects recognizes that building resilient societies that are adapted to climate change will increasingly require incorporating a structural approach to conflict prevention. The CSM aims to bring the two streams together through a range of knowledge sharing initiatives, while individual UN agencies are producing a growing number of geographically specific climate-security risk assessments, guidelines and tools to address climate change-related security risks.[5],[6],[7]

Rather than add to this rapidly growing knowledge production, this paper proposes an alternative way to bring the different communities of practice together by strengthening existing conflict early warning systems. It argues that conflict early warning analysis can be strengthened significantly by ranking socio-economic, political, environment and climate-related drivers of conflict equally, using map-based risk and analysis assessment tools. Starting from the AU CEWS, which already draws on a comprehensive list of societal, economic, political and governance indicators in its analysis, the paper develops a methodology for adding a set of indicators that monitor climate change and environmental data. CEWS is chosen as an example because it is one of the most sophisticated conflict early warning systems at the regional level. It thus offers an appropriate context in which to test the addition and integration of another set of sectoral indicators on climate change.

What is the state of continental level conflict early warning in Africa today?

The African Union Continental Conflict Early Warning System (CEWS) is a sophisticated system that has been developed over several years. It draws on a repository of 19 sets of indicators that collect data from a range of sectors. The data is harmonized and entered into a database, providing conflict prevention analysts with a range of options for conducting early warning analysis. The CEWS is a critical part of the African Union Peace and Security Architecture. Its analytical approach is based largely on a human security perspective, while operating in an environment where inter-state and "hard" security perspectives matter significantly. The CEWS monitors primarily socio-economic, demographic, food security, service provision, governance and political developments across Africa, tapping into an impressive amount of live and regularly updated data. CEWS harvests data on everything from police reports to election results and social media trends. It uses advanced machine learning techniques to collect and synthesize qualitative data, including news articles from key news outlets from across the continent in all the African Union official languages (Arabic, English, French, Portuguese, Spanish and Kiswahili). The African Union Commission headquarters in Addis Ababa

1 Scheffran et al., 2012. *Climate Change and Conflict*, Science, Vol 336, 18 May 2012.

2 Adger, W.N., et al., 2014; *Human security. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and, Sectoral Aspects. Contribution of Working Group II to the 5th Assessment Report of the IPCC*

3 UN Secretary-General's Peacebuilding Fund, 2020-2024 Strategy; https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap12_FINAL.pdf https://www.un.org/peacebuilding/sites/www.un.org.peacebuilding/files/documents/pbf_strategy_2020-2024_final.pdf

4 Adelphi, 2020. Linking Adaptation and Peacebuilding – Lessons Learned and the Way Forward; https://climate-security-expert-network.org/sites/climate-security-expert-network.com/files/documents/csen_research_paper_-_linking_adaptation_and_peacebuilding_lessons_learned_v3.pdf

5 UNEP, 2019. "Toolbox for addressing climate – fragility risks." https://postconflict.unep.ch/Climate_Change_and_Security/CFRA_Toolbox.pdf

6 Shoring up stability, addressing climate and fragility risks in Lake Chad region, https://reliefweb.int/sites/reliefweb.int/files/resources/Lake-Chad_Shoring-up-Stability.pdf

7 SIPRI series on climate related security risk assessments, including on Lake Chad, Somalia, Central Asia, Afghanistan https://www.sipri.org/research/peace-and-development/climate-change-and-risk/expert-working-group-climate-related-security-risks

includes a situation room, staffed around the clock; a state-of-the-art facility for doing conflict early warning analysis. Multiple screens provide analysts access to live-monitored data from the different sets of indicators, which automatically collect data from across the continent. Analysts review and synthesize the data in frequent reports to decision makers. Of the varied data that CEWS collects, just one of the 19 sets of indicators addresses environmental factors, primarily natural resource-related ones. With evidence of the interlinkages between traditional conflict drivers and climate change increasing rapidly, the AU, like other regional institutions, is examining how to strengthen the data signal from climate change and environment-related factors. The challenge is how to do that in practice – what to measure, and how to use and interpret the quantities of geodata together with the existing data feed, which includes mainly narrative socio-economic and conflict-related data. In fact, this would represent a major methodological undertaking. It would require solid technical legwork and analysis and tests of different models. The value proposition below presents the case for a greater focus on climate change factors when conducting conflict early warning analysis and examines how to do so.

Value proposition

Significantly increasing the relative importance given to climate change when performing conflict early warning analysis would provide decision makers in regional institutions with peace and security response mandates a more comprehensive picture of root causes vis-à- vis systemic risks that contribute to conflict. Introducing a set of climate change indicators would require revisiting existing sets and calibrating the relative data signal from different thematic sets in order to capture low-probability, high-impact risks. The COVID-19 pandemic illustrates the importance of capturing such risks. A pandemic had been considered a low-probability risk previously, but it has now materialized, with extreme impacts worldwide. Early warning signs could have saved many lives.

To understand how climate and the environment interact with society in conflict-prone regions requires better-quality and more intuitive tools that can present climate change-related data clearly and as intuitively as traditional conflict measures. Adopting a comprehensive climate change early warning toolset to complement conflict early warning systems would strengthen the precision of both short- and long-term early warning analysis and improve the quality of early response. As documented in a recent CSM scan of the UN system's work on climate security, existing early warning systems address different thematic areas and geographies. However, the need to link early warning analysis to early action and response remains a recurring issue. A map-based early warning tool that present risks from the different realms, using geographic information systems (GIS), could help move beyond this issue by presenting a range of easily digestible maps, useful in preparing detailed analysis for concrete decision-making.

Methodology

The key requirements of a climate-conflict early warning system will be operability, data compatibility, effectiveness in performing analysis, a forward-looking approach and its ability to effectively communicate its findings to beneficiaries. In addition, it will have to consider a relevant spectrum of indicators from both the human and environmental sphere. While the focus of this paper is on the environmental sphere, it is important to also reflect a bit on what would be required by data from the societal sphere.

Societal data to consider

To get to a spatial analysis tool that can identify emerging climate related security risks in a given geography and also assist in deriving actions to mitigate such risks, it is key that adequate attention is given to what political, social, economic and gender related data needs to be fed in to the tool and in what way. This is not the primary concern of this paper, but it is worth noting that it will be key to capture the right kinds of societal data, to identify the relevant conflict drivers that might be exacerbated by climate change and environmental triggers. Such data would have to be spatial in nature to be compatible with the environment and climate data and span a range of areas that in combination would describe a society's vulnerabilities to conflict. It could include data on land ownership and access, natural resources and their management, inequality, employment and livelihoods, demographics and housing, public health access, migration and displacement, remittance, ODA and financial flows, crime and violence as well as proxies for democratic governance, access to justice, protection of human rights and services available to vulnerable groups and refugees, fairness of elections, and accountability of duty bearers towards right holders. As mentioned above, the AU CEWS has one interesting though complex methodology to capture conflict risk drivers in close to real time, while others focus at a more static but more granular level than the state, including USAID[8], who presents a

8 USAID, 2018. The Intersection of Global Fragility and Climate Risks; https://pdf.usaid.gov/pdf_docs/PA00TBFH.pdf

simpler geospatial fragility index. The approach adopted by the Global Land Programme combines innovative research methods to the study of "Land Systems Change", combining natural science-based study of land use and land cover change with analysis of human decision-making at various geographical levels and how this together contributes to alteration of land systems, as well as ultimately climate change.

A comprehensive approach to a climate – conflict early warning system would need to give adequate attention to the growing evidence that gender, climate change and security are tightly connected. Women and girls are not only disproportionately affected when climate related security risk materialise but are also key to mitigate these risks at all geographical levels. A recent report by UNDP, DPPA, UNEP and UN Women lay out the intricate connection between gender, climate change and peace and security and points towards a policy and programmatic response[9]. In a program that aims to develop a climate – conflict early warning system, it would be natural to partner with established programmes, such as the Joint Programme on Women, Natural Resources and Peace between UNDP, UNEP and DPPA,[10] when developing the societal fragility indicators. That would also contribute to deliver on the wider demand from the UN Security Council for "better analysis and concrete, immediate actions to address the linkages between climate change and conflict from a gender perspective".[11] As documented through different projects, there is solid evidence that women and girls play a key role in conflict prevention and peacebuilding initiatives in relation to natural resource management.[12]

Climate and environment data to consider

The main argument of this paper is about how to capture key climate change related and environment data, relevant for identifying peace and security risks and act upon them. In the following, it is argued that to get to a set of dynamic climate change indicators for a spatial climate – conflict early warning system, one would need to approach the task of indicator development, through three different temporal "lenses":

1. **A long-term historical lens that reviews climate events as far back as possible (for instance, up to five decades, the period for which we have satellite data);**

A historical heat map of climate events in Africa, comprised of a mosaic of historical climate change exposure data. It would be static in nature, showcasing only an aggregation of historical climate change events per location, in as high resolution as possible. Each pixel, representing a location in Africa, would be assigned a climate change exposure value, which could be overlaid with spatial analysis. This would constitute a base map for geospatial analysis. An additional map layer could present historical exposure to conflict, with data such as historical armed conflicts or different forms of insecurity;

2. **A short-term historical lens looking in further detail at recent patterns of climate and environmental change (five – 10-year horizon);**

A recent historical lens, which would involve an Africa-wide surveillance system designed to capture significant environmental changes in land cover and land use over five to 10 years. This lens would use primarily Landsat satellite and remote sensing data to track key environmental changes that are determined to matter most for human security. A team of experts would have to determine and define the most relevant factors in further detail but, based on an initial concept, it could include measures of changes in surface water reservoir, runoff, soil moisture, land erosion and the Normalized Difference Vegetation Index (NDVI). The latter can be used to estimate the quantity of biomass of a given land cover and, as such, constitutes an important proxy for measuring forest cover or land productivity, identifying crops or estimating the timing of slow-onset drought or the onset of planting season;

3. **A future-oriented forecasting lens**

The future-oriented lens would draw on regional climate change models and meteorological data for the short, medium and long term to present a range of trajectories and that could be overlaid with data from 1 and 2.

By combining the static and dynamic map layers, a conflict early warning analyst with basic GIS skills would be able to identify potential hotspots of fast- or slow-onset climate change or environmentally-induced crisis. Conversely, the analyst would be able to identify the environmental impacts of an ongoing crisis. Maps produced based on the three types of data presented above could be convincing and effective communication tools in themselves. However, the analytical depth and relevance increase, from a conflict perspective,

9 UNDP, DPPA, UN Women, UNEP, Gender, Climate and Security, 6/2020 https://dppa.un.org/sites/default/files/gender_climate_and_security_report.pdf

10 https://www.unenvironment.org/explore-topics/disasters-conflicts/what-we-do/recovery/women-natural-resources-and-peace

11 UN Security Council, 'Women and peace and security', Report of the Secretary-General, S/2019/800, 9 Oct. 2019 https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/s_2019_800.pdf

12 Women and Natural Resources, Unlocking the peacebuilding potential, https://postconflict.unep.ch/publications/UNEP_UN-Women_PBSO_UNDP_gender_NRM_peacebuilding_report.pdf

when overlaid with the socio-economic and conflict data drawn from the 19 sets of indicators that the CEWS already collects. The existing CEWS, combined with the above-mentioned three-component climate change and environment, would provide solid conflict early warning analysis, while simultaneously providing a visual map tool relevant for effective decision-making.

Static and dynamic data

To forecast future risk prevalence with confidence, a first step would be to consider historical data in order to identify and model trends. However, climate change may modify existing relationships that have historically been used successfully to make forecasts.[13] As a result of this special feature of climate change, it differs from standard forecasting parameters. In any case, the first step in creating a climate change-informed CEWS would be to assess and limit the amount and types of data that the system would draw on, thereby maintaining the ability to perform well-informed and rapid conflict prevention analysis. In other words, which data are "need to include" and which would be "nice to include"? When selecting data sources, it is of course critical to maintain an explicit list of the assumptions being made in order to limit false predictions later. Adding too many data layers from the natural sciences would increase the complexity and cost of the task; neither characteristic is congruent with an agile CEWS and a rapid decision-making structure. Shortlisting data sources requires adequate advice from the climate change-security community of practice, as well as, importantly, natural scientists and the geodata community. Together, they would be able to identify key datasets that would add the most value given the purpose of performing conflict early warning analysis. Selecting data and methodologies involves an ethical dimension, as many assumptions are made at each step. Each assumption made during the design phase contributes to the overall framework of potential analysis, thus ultimately defining the potential range of responses.

Creating a climate change exposure map

A heatmap is a data visualization technique that shows the magnitude of a phenomenon as colour on a map. It indicates the exposure of a given location, based on the historical climate change events to which it has been exposed. To assess the exposure of a given location to climate change, we must first define the most critical features of climate vulnerability. When such a base map is established, a range of dynamic flux data and forecasting data can be overlaid on it. USAID created such a static climate change exposure map. In its comprehensive 2018 study, the agency presents a useful methodology combining historical geodata from a range of different climate events and climate hazards, based largely on UNEP GRID data.[14] The study includes 40 years of data on cyclones, flood events, wildfire events, rainfall anomalies, areas with chronic aridity, and low-elevation coastal zones susceptible to storm surges and future sea level rise. Assuming that this is an adequate list of climate change hazards and that the selected hazards are equally important over time, the historical climate exposure of each location can be determined by aggregating the number of climate events for each location/map pixel. The approach is simple, but useful for creating a heat map of historical climate change vulnerability. The map can then be overlaid with a variety of more recent climate change data, socio-economic data, and forward-looking forecasting climate change and conflict scenarios. While the methodology and weighting across hazards can be refined and adjusted to the specific reality of Africa and its subregions, the overall approach is useful as a starting point.

The USAID study also presents a methodology for deriving a societal fragility map which, overlaid with the climate exposure map, creates a proxy snapshot of historical climate-conflict exposure. For the establishment of a static base-map of climate – conflict fragility, the USAID methodology can suffice. But once we move to the next – dynamic – step of doing forecasting of climate – conflict events, using geospatial data, both societal and climate change elements must be considered at an increasing level of detail. As discussed further in the next section, the approach to establishing a societal fragility index is not detailed enough in the USAID approach to capture dynamics at community level, including in relation to political, economic, social power and gender dynamics. And, by its very nature, climate change is geographically dynamic and self-reinforcing under some physical conditions. This can be exacerbated by human-induced land use and land cover change. Temporal changes must thus be considered. This is the key reason to also use dynamic, or time-sensitive, data. The next step is hence to collect dynamic recent historical climate and environment data, as well as forecasting data, while at the other hand develop an approach to collect societal data on key parameters.

13 UNDP, 2018. Five Approaches to Build Functional Early Warning Systems. https://www.eurasia.undp.org/content/rbec/en/home/library/environment_energy/five-approaches-to-build-functional-early-warning-systems.html

14 USAID, 2018. The Intersection of Global Fragility and Climate Risks; https://pdf.usaid.gov/pdf_docs/PA00TBFH.pdf

Dynamic, recent historical climate and environment data

These data, including topographic and remote sensing data that is available in increasingly precise form, can be collected via satellite or airplane. A range of African countries are using remote sensing technology for a variety of purposes, including harvest forecasting and flood assessments. In addition, tools and methodologies have been developed to predict the size and net worth of harvests, predict floods, determine yields and crops, or even calculate GDP for some poor countries with limited data collection resources. Remote sensing is also being used increasingly for environmental governance purposes, such as monitoring illegal deforestation or informal urban sprawl. Some tools combine static and dynamic data to produce environmental change maps for different purposes and abundant, quality data is increasingly available at diminishing costs. Tools that use recent climate change and environment data include UNOSAT's flood portal and UNEP's GRID, which includes tools such as the Map X and the World Environment Situation Room. UNOSAT operates a range of interactive maps to support humanitarian operations and the UN Global Pulse uses innovative AI technologies to conduct new forms of geodata analysis across multiple sectors.

Combining and connecting existing products could be a direct way to integrate climate change into conflict early warning practice, rather than inventing something totally new. UNDP's country-by-country Crisis Risk Dashboard and the newly launched Water, Peace and Security partnership are examples of tools that focus on environmental and climate change data and combine them, to some extent, with conflict-related and other data. The partnership draws on a number of geospatial analytical methods to improve understanding of the linkages among conflict, security and water data on maps. As The Guardian noted earlier this year, this kind of analysis is a rapidly growing and promising field.[15] Other initiatives include the WMO Climate Risk and Early Warning Systems (CREWS), UNEP's Climwarn, and the FAO-sponsored World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture.

However, most of them target primarily the community and country level and are based mainly on meteorological data. In the Horn of Africa region, IGAD's Climate Prediction and Application Centre (ICPAC) applies an alternative methodology for subregional analysis, along with capacity development opportunities for member states, prediction products and services.

Road map towards developing an integrated climate-conflict early warning system

If there is interest from the right mix of stakeholders, a climate – conflict early warning tool as presented in this paper, could operate on a stand-alone basis or as a plug-in to existing early warning system, such as that of the AUC. In any case, it would involve a number of considerations in the project design phase and the participation of a range of experts. The following should be considered in further detail:

- the exact purpose of the system;
- the approach that would provide best value for money (initial investment and running costs);
- the amount of time required to deliver and the number and type of human resources;
- needs in terms of testing, operationalizing and running the system;
- user-friendliness, data management practices, data warehouse partners, knowledge partners; and,
- donor partners, project governance structure and ownership among different institutions.

The two overall approaches to developing an integrated climate-sensitive CEWS are a two-year pilot project and an ambitious five-year programme.

Option 1: Two-year pilot project

A limited model would at a minimum require a two-year pilot project to produce a GIS-based prototype heat map with some analytic functionalities. An interactive map would be developed jointly with key regional and subregional partners to be used for climate-security early warning analysis and decision-making. At the end of the project, key lessons will be drawn to further refine the map tool so that it can be integrated into becoming a continental climate – conflict early warning system. Such a project could be led by the UNDP Resilience Hub in Nairobi, which hosts a unique mix of technical capacity in performing disaster risk reduction and climate change adaptation programming and policy analysis, as well as governance and peacebuilding project design and country support. The Hub would closely partner with relevant UN partners, including UNEP and the Climate Security Mechanism (UNDP, UNEP and DPPA), and an external knowledge partner or a network of critical partners. Working together, partners would build a common understanding of the potential offered by adding climate change data to conflict early warning. The benefit of this model, if successful, is that it would be relatively inexpensive

15 https://www.theguardian.com/global-development/2020/jan/08/water-wars-early-warning-tool-uses-climate-data-to-predict-conflict-hotspots

and fast to set up and then get to scale. The risk is that climate – conflict early warning analysis is too complex for a pilot project. Designing a prototype, where the database is hosted externally and only open source data are used as inputs, would still require significant time, with potentially limited payoff. Second, without dedicated longer-term skilled staff or organizational credibility, the project could be short lived, as institutional uptake might be limited, compared to a large roll-out.

Option 2: Five-year full-scale programme

A more comprehensive model would involve a five-year, fully-fledged programme that could involve the same partners as noted above (UNDP Resilience Hub in Nairobi, UNEP, CSM, regional and sub-regional partners, national governments, knowledge and funding partner(s)). In addition, institutional partners from other regions could serve as peers following the development closely, or the programme could be rolled out simultaneously on more than one continent. The objective of a five-year programme would be to build a comprehensive climate change early warning system that is fully integrated and mainstreamed within existing conflict early warning systems and capable of sustaining and developing itself beyond the programme period. Such a programme could be a flagship initiative for the climate-security community of practice in Africa and beyond. It could potentially explore the full scale of opportunities that big data, artificial intelligence and forecasting offer in a relatively data-scarce environment. The programme could be led by a core Programme Management Unit of approximately 8 to 10 full-time key experts with core competencies in biogeosphere interaction, land use and land cover change, remote sensing, database management, conflict prevention and peacebuilding and in forecasting, qualitative and quantitative data analysis. In addition, a pool of short-term experts with specific skillsets could be added to advise on specific issues as they arise, possibly beyond the analytic dimension, to include expertise on how best to respond to the findings. The pool of short-term experts would cover different areas; such as disaster risk reduction and recovery, transboundary water management, REDD+, environmental impact assessment, extractive industries, and food security assessments. The key expert team would sit physically together in a programme unit in the hosting institution and be able to draw on the short-term expert pool, which would represent the interdisciplinary community of practice, potentially drawn from a wide consortium of knowledge partners from academia, international organizations, donor agencies, the government and the private sector.

A fully-fledged programme would require an inclusive management structure and a programme management unit (PMU), strategically positioned in a strategically selected host institution. Once the programme is operating successfully, it could be expanded geographically to other regions or, even operate globally. At the outset, however, Africa does enjoy the advantage of already having a fully-fledged continental conflict early warning system in place, integrated in the AU Peace and Security Architecture. Thus, it is an ideal ecosystem for exploring the interplay among new climate-change related indicators and those that have been created for other areas. This is unlike most other regions, which would have to build the CEWS from the ground up.

Opportunities and new partnerships

1. **As the links among climate change, peace and security, particularly across Africa, become increasingly evident, many stakeholders are showing a genuine interest in further strengthening regional and subregional conflict early warning systems.**

2. **Wider innovation for the sustainable development ecosystem of practice is developing rapidly, with effective new forecasting methodologies and technologies launched at increasing speed. Data analysis capability is increasing and university departments across a range of fields—from international relations to natural geography—are using machine learning to harvest and analyse a variety of geodata. The quality, variety and granularity of remote sensing data has been improving rapidly in recent years, opening new avenues for spatiotemporal analysis.**

3. **The study of climate-related security risks is expanding across a number of disciplines, including in African academic institutions. At the same time, the African technical consultancy sector is becoming increasingly competitive internationally, also in terms of conducting spatial analysis. Earlier capacity gaps in GIS and remote sensing analysis should thus be less of a concern to government and donor institutions than previously.**

4. **Governments and regional organisations across Africa have already made progress in developing a range of early warning systems, emphasizing different aspects of the human-environment interface. Combining the lessons learned can allow for R&D shortcuts and avoiding previous mistakes could give a such a programme a head start.**

5. **Free and inexpensive GIS-based tools, methodologies and projects exist online. They could be relevant to the climate change-informed conflict early warning system and should be fully analysed to build on what already exists.**

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UNDP Oslo Governance Centre

The Oslo Governance Centre (OGC) is one of six UNDP Global Policy Centres, established in 2002. It works closely with its New York based Headquarters and other relevant UN and UNDP units strengthening the overall analytical and learning ability in the area of Governance and Peacebuilding. It supports policy development and applied research with an overarching focus on democratic governance and peacebuilding in crisis, conflict and transitional contexts.

www.undp.org/oslocentre

Joint UNDP-DPPA Programme on Building National Capacities for Conflict Prevention

Since 2004, the United Nations Development Programme and the UN Department of Political and Peacebuilding Affairs (DPPA) have partnered to strengthen support to the UN’s work in building national capacities for conflict prevention. Often times, such support is extended through the deployment of Peace and Development Advisors (or PDAs), a growing cadre of UN staff who support Resident Coordinators and UN Country Teams adapt and respond to complex political situations and to develop and implement strategic conflict prevention initiatives and programmes.

https://peaceinfrastructures.org/

Folke Bernadotte Academy

The Folke Bernadotte Academy (FBA) is the Swedish government agency for peace, security and development. As part of Sweden’s international development aid, FBA promotes peace in conflict-affected countries by offering training, advice and conducts research in order to strengthen peacebuilding and statebuilding; as well as grant funds to civil society organizations working with peace and security. The agency is named after Count Folke Bernadotte, UN’s first peace mediator.

https://fba.se/en/