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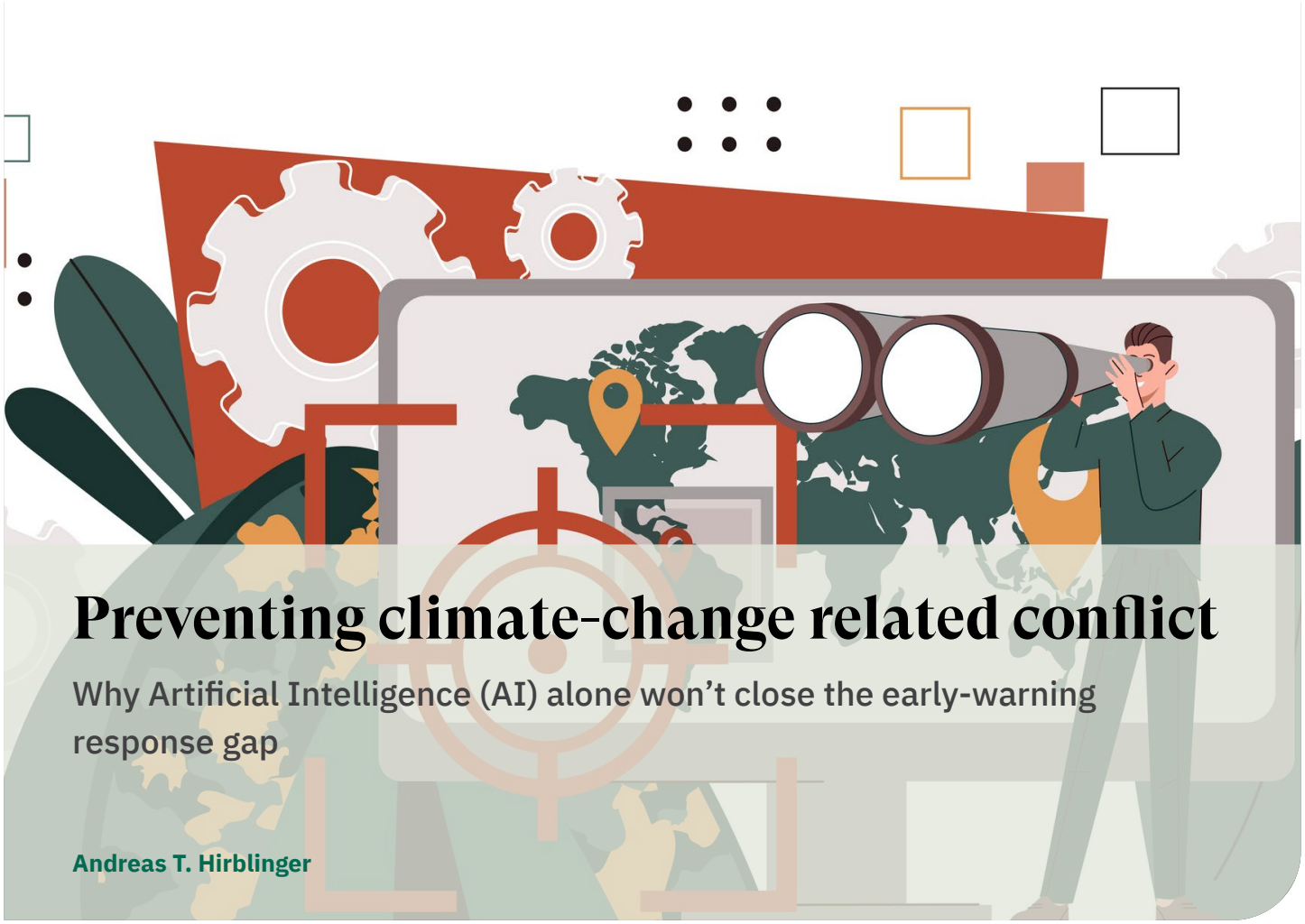

Preventing climate-change related conflict

Why Artificial Intelligence (AI) alone won't close the early-warning response gap

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Summary and recommendations

Artificial Intelligence (AI) brings new opportunities and challenges to international efforts to warn about and respond to climate change-related conflict. This policy brief discusses the benefits and risks of AI-enhanced Conflict Early Warning and Early Response (CEWER) systems for climate-induced conflict, demonstrating that the effectiveness of such systems depends on how well they can be aligned with context-specific approaches to data analysis.

- International partners should prioritise supporting locally embedded, participatory conflict early warning initiatives that carefully balance technical sophistication with local needs.
- National civil society organizations should increase their capacity to engage with AI systems and AI-generated information, to support the integration and uptake of AI-driven early warning systems among local communities.
- Research organisations and technology companies that build and supply AI-powered early warning systems should adopt human-centred design approaches.

The forecasting and prediction of climate change-related conflicts can benefit greatly from remote sensing technologies, such as satellite imagery, because many factors that increase the likelihood of conflict, such as droughts or environmental degradation, are directly observable and quantifiable. The large volumes of data obtained from remote sensing are also well-suited to AI-powered pattern recognition and predictive analytics. However, decision-makers in conflict-

affected contexts often lack direct access to these technologies and the expertise to use them. This can reduce the relevance of AI-generated early warning information for national and local-level decision-makers.

Climate change brings about slow, gradual changes in our planet's ecosystem and sudden weather events that lead to natural disasters, which can increase the likelihood of violence and armed conflict. Yet, the relationship between climate change and conflict is not linear or straightforward. Many additional factors play a role, including the capacities of societies and states to adapt to climate change. In fact, research focused specifically on detecting climate change-related armed violence demonstrates that climate factors alone do not cause armed violence.

The complexity of the relationship between climate change and armed violence means that large amounts of information must be processed to assess the likelihood of climate-related armed conflict, warn early of increased risks, and take early action. In recent years, several initiatives have begun building early warning systems that integrate climate-related predictors into their forecasting models or have even focused specifically on the early warning of conflict drivers related to climate change. These initiatives combine advanced Machine Learning techniques with large, heterogeneous datasets, including data collected using remote sensing technologies.

The impact of AI on the early-warning early-response gap

The increasing use of such sophisticated data-driven approaches has led to more accurate and nuanced early warning information. However, it could paradoxically reduce the chances for a timely response. Researchers have long pointed to the "gap" between early warning and early response. Whether data-driven approaches help or hinder closing this gap depends not only on their ability to help establish sufficient epistemic certainty about imminent conflict. It also requires that they can be used in ways that generate ontological and normative certainty for action, for instance, through routines and adaptive approaches that also take ethical concerns into account.

Importantly, a lack of such ontological and normative certainty is often the consequence of insufficient involvement by the stakeholders closest to the conflict context. Various factors can help explain this lack of "localisation" of early warning and response systems. For example, technically demanding systems are often designed and operated from outside the conflict contexts, and stakeholders based in contexts prone to climate-related violence often face challenges in using them, including a lack of (digital) literacy. Unsurprisingly, academic research has repeatedly pointed to the challenge of insufficient community capacity and ownership. This issue has been acknowledged by leading international actors, such as the United Nations Development Programme, which argues that early warning systems should reach "all people, including marginalised groups".

However, simply sharing early warning information with local stakeholders is unlikely to be sufficient for enabling an effective response. Many studies on conflict early warning highlight the need for participatory approaches to the design of early warning systems and to the collection and analysis of data. There are several reasons for this. Often, remotely collected data and machine-generated analysis are not accurate, fine-grained, or actionable enough, which renders them difficult to apply to highly specific contexts. Moreover, because the relationship between climate change and armed conflict is not law-like, human interpretation and analysis are needed to determine context-specific risks. Finally, early warning information is only actionable if it can be trusted – and this requires that local responders are familiar with the methods used to generate it.

There exist different types of applications that, to varying degrees and in different ways, use remote sensing data and AI for predictive analysis, ranging from general conflict forecasting systems such as VIEWS, to specialized initiatives focusing on climate change-related incidents. For example, the Water Peace and Security (WPS) Partnership developed a Global Early Warning Tool by training a random forest model to predict water-related risks of violent conflict up to one year in advance. The tool uses machine learning to analyse patterns linking violent conflict to more than 80 environmental, economic, and social variables across several world regions. Its training data include information spanning two decades, such as satellite-based precipitation and drought data, as well as socio-economic and demographic data.

The initial version of the tool claimed to predict

conflicts with ten or more casualties with an accuracy of 86 per cent. This sounds like a great success at first. In practice, however, considerable challenges can arise when such information is intended to inform conflict-preventative and mitigative responses. Among them is the tendency to calibrate systems in such a manner that they overpredict conflict risk. However, false positives could have a range of negative effects, including misallocation and waste of preventative capacities. Moreover, ML-models only produce correlations between certain climate-related variables, such as access to drinking water, and conflict, and crucially, it does not explain why. This makes the human interpretation and further analysis of ML-generated forecasts necessary. Where sufficient human capacity and expertise to interpret AI-generated results and determine the right action are lacking, AI-enhancements could make local responses harder or slower.

The challenge of trustworthy and actionable data

Outputs from early warning systems that employ ML, such as Random Forest algorithms, can also struggle to gain the trust of decision-makers because they are "black box" models. Although their methods can be explained reasonably well, the inference path cannot be fully reconstructed. This makes them less appropriate for high-stakes decision-making under uncertainty. Moreover, they may also struggle to contribute value to decision-making and adaptation processes because they ultimately contain very little information. They provide a quantitative estimate of the likelihood that a conflict will break out or persist, without providing additional explanations grounded in the context of the conflict in question.

An overreliance on AI-generated predictions also risks obscuring the social and political aspects of knowledge creation. When AI models replace human analysis, they may limit opportunities for collaborative reflection. AI-driven approaches tend to reduce information processing to the production of reliable quantifications. They cannot replace iterative human reflection and adaptive approaches, which are often essential for dealing with complex problems and uncertainty.

Remote sensing and AI arguably currently contribute very little actionable data for local-level conflict prevention and mitigation efforts. This has much to do with the fact that sufficient, reliable sub-national-level data for training ML models are often lacking – a problem that is common for conflict-affected and resource-deprived contexts. In consequence, likelihood estimates are often generated only for the national level and lack the information needed to launch targeted responses in specific areas.

For example, to generate insights into potential water-based conflicts in Lake Turkana, Kenya, the WPS project developed a dashboard that visualises various data, such as ACLED data on past conflict events, precipitation and soil moisture. The dashboard also integrates locally collected data, such as about the status of water points. This suggests that despite considerable advances in remote sensing and AI-enhanced predictive analytics, local expertise currently remains crucial for collecting, curating and analysing relevant early warning data.

Linking predictive AI and participatory approaches

AI and remote sensing are increasingly used in early warning and response efforts because they provide more and better information that cannot otherwise be obtained. At the same time, stakeholders and decision-makers in vulnerable contexts often lack direct access to remote data and predictive technologies. Connecting early warning systems to participatory response mechanisms involving these actors is important because such systems identify risks that can often be addressed only through collective action that involves affected communities.

Preventive responses have an impact on conflict-affected communities because they influence their safety, well-being, economic opportunities, and power relations. Early warning information also reflects the values, reasoning, and biases embedded in the AI model. For instance, environmental indicators such as precipitation or soil moisture may be seemingly neutral criteria for assessing water availability, but they may fail to account for other drivers of climate change-related conflict over water, such as government decisions to build dams or promote large-scale agricultural projects.

This suggests that accurate and actionable early warning information is necessary but not sufficient for an effective response. What is required is AI-enhanced approaches that are sufficiently

localised. This involves more than effectively translating and explaining early warning data. It also requires a participatory approach to designing and operating early warning systems from the outset. There are many options to ensure that early warning and early response systems remain inclusive and participatory. Early warning information can be provided to relevant stakeholders through traditional media, social media, or mobile apps. AI enables new interactive methods, such as chatbots embedded in messaging services, to deliver location-specific, user-adapted weather forecasts.

However, providing early warning data is a necessary step – but won't, in itself, be sufficient. Collective action also requires collective methods for analysing and discussing the data and for developing joint responses. Providing stakeholders with access to the raw data and models, along with explanations of how predictions were made, can help strengthen trust in remote information by enabling interpretation and scrutiny against other available information. Even better would be to integrate beneficiaries into the design loop, which can increase the trustworthiness of early warning systems by making them more accurate, reliable and acceptable to local end users.

Outlook

We will likely see future investments in AI-driven initiatives to strengthen early warning and response to climate-related armed conflict and violence. However, in the near future, low-tech approaches to early warning may remain the better option for enabling participatory responses in resource-deprived contexts. Where AI is employed to enhance early warning, human involvement will remain essential to ensure that early warning systems enable timely and effective responses.

Further reading

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