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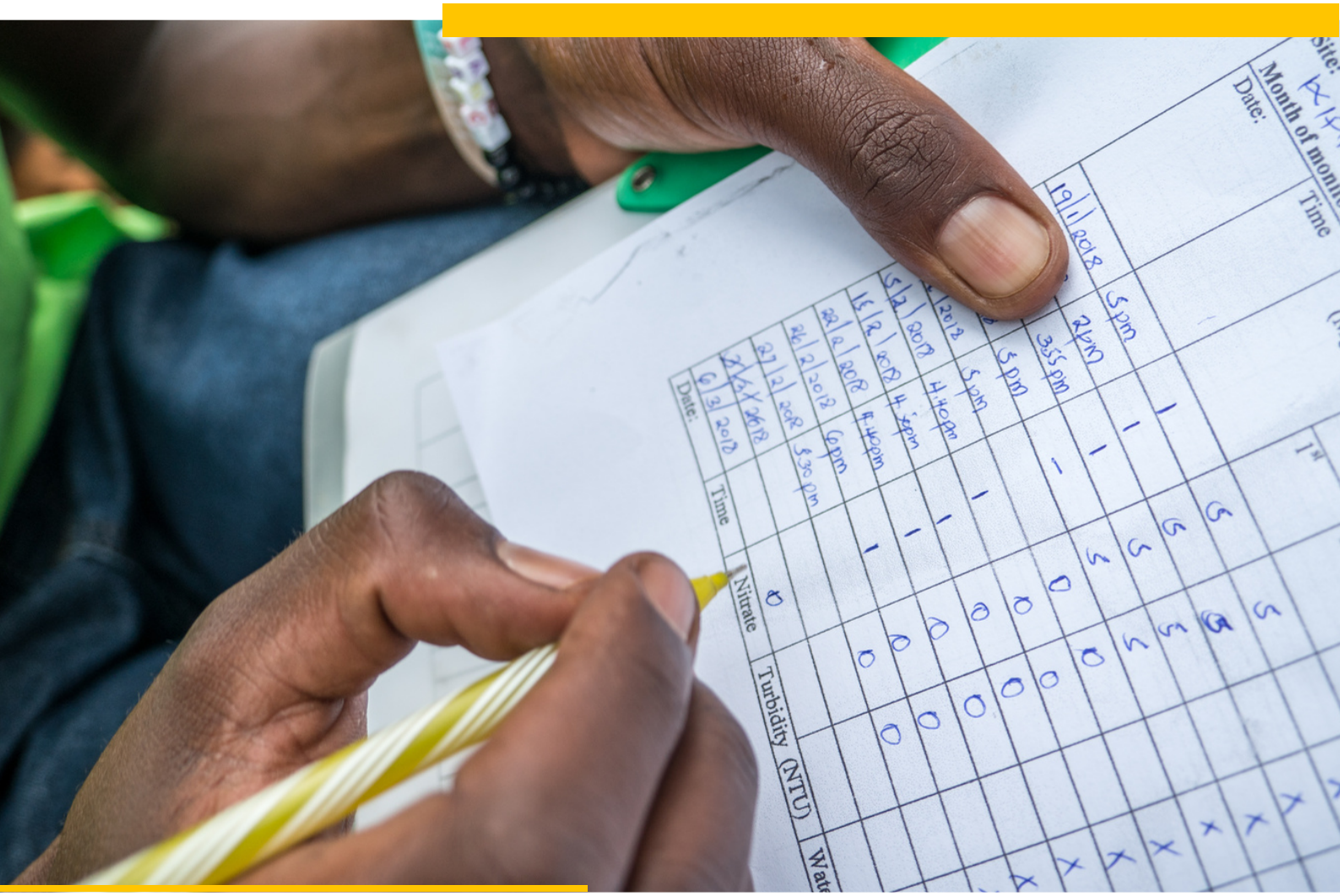
SPATIAL ANALYSIS

CGIAR Climate security observatory



METHODS PAPERS SERIES

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PURPOSE

The main objective of the spatial analysis is to map the climate-conflict nexus, and identify the geographic co-occurrence of specific combinations of conflict, climate conditions, and socio-economic vulnerabilities.

RESEARCH QUESTIONS

Spatial analysis seeks to answer the WHERE and WHO questions within the Climate Security Observatory, that is, WHERE are the most vulnerable areas to climate induced insecurities and risks and WHO are the vulnerable groups to climate induced insecurities and risks? This helps in targeting and location prioritization of interventions or programs.

In response to this question, the co-occurrence of different conflict intensities and climate conditions is mapped to illustrate areas where conflict and harsh climate conditions co-occur alongside information on socio-economic vulnerabilities which depict attributes of vulnerable groups.

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METHODS & DATA

Spatial analysis enables rapid detection and descriptive analysis of places and communities at risk from climate, security, and socioeconomic impacts. Significant climate and socioeconomic variables are selected using Network Analysis approach in Craparo et al. (2023). The framework consists of four stages: 1) determination of climate clusters, 2) determination of conflict clusters, 3) identification and mapping of conflict-climate co-occurence, and 4) identification and mapping of the most relevant socio-economic vulnerabilities per climate security pathways driven by network analysis procedure.

A pattern-based spatial cluster approach (Nowosad, 2021) is used to determine climate clusters utilizing a regular grid (megapixels) of ~20 km2 resolution and agroclimatic indices as input. The conflict clusters are determined through the execution of a hierarchical clustering method combined with a Principal Component Analysis (PCA). The conflict data, obtained from Armed Conflict Location & Event Data Project (ACLED), is grouped into three categorical conflict clusters (high, moderate, and limited) using unsupervised machine learning (ML). The ML algorithm spatially and temporally clusters all reported events within a mega-pixel. Labels for the resulting megapixel clusters are defined by a conflict or climate gradient from a PCA identifying the most relevant variables that explain the established differences.

Profiles of vulnerable groups in areas with different co-occurring climate-conflict intensities is determined using extreme tails of socio-economic data distribution. This is done by computing extreme percentiles (10% or 90%, depending on the variable) for the top 10 most relevant variables identified via the network analysis. For instance, 10th percentile for piped water access as an indicator of inequality or 90th percentile for stunting and wasting as an indicator of undernutrition. Finally, they are aggregated by socio-economic categories (inequality, low productivity, migration, and natural resources scarcity).

Data sources: Conflict data are from ACLED; climate data are from CHIRPS, TerraClimate, and AgERA5; and socio-economic variables are from the Institute for Health Metrics and Evaluation (IHME), Facebook's wealth maps, Malaria Atlas Project, MODIS, NASA SEDAC at the Center for International Earth Science Information Network, Earth Observation Group, Payne Institute for Public Policy, Colorado School of Mines, EnvirometriX Ltd, amongst others. Most of these data are directly available through Google Earth Engine platform.

REFERENCES

Nowosad, J. (2021). Motif: an open-source R tool for pattern-based spatial analysis. Landscape Ecology, 36(1), 29-43

Craparo, A.C.W; Basel, A.M. and Minoarivelo, H.O. Network Analysis. Climate Security Observatory Methods papers series (2023)

Suggested citation

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