



PHOTO EU/ECHO/MARTIN KARIMI

# Where are the most vulnerable areas to climate induced insecurities and risks in **Kenya**?

## A spatial analysis

*Harold Achicanoy, Julian Ramirez-Villegas, Andres Mendez, Peter Läderach and Grazia Pacillo*

This factsheet gives answers on how climate exacerbates root causes of conflict in Kenya, using spatial hotspot analysis. The findings show that areas of high conflict and harsh climate interactions co-occurred with hotspots where socio-economic vulnerabilities (undernutrition, inequality, migration, low productivity) are present. This occurs in the following wards: Wajir East Township, Wagberi, Barwago, Bulla Mpya, and eastern Khorof.

This publication is part of a factsheet series reporting on the findings of the CGIAR FOCUS Climate Security Observatory work in Africa (Kenya, Mali, Nigeria, Senegal, Sudan, Uganda, Zimbabwe). The research is centered around 5 questions\*:

**1 How does climate exacerbate root causes of conflict?**

Impact pathways

[Kenya](#) [Mali](#) [Nigeria](#) [Senegal](#) [Sudan](#) [Uganda](#) [Zimbabwe](#)

Econometric analysis

[Kenya](#) [Mali](#) [Nigeria](#) [Senegal](#) [Sudan](#) [Uganda](#) [Zimbabwe](#)

Scopus analysis\*\*

**2 Where are the climate insecurities hotspots?**

Spatial analysis

[Kenya](#) [Mali](#) [Nigeria](#) [Senegal](#) [Sudan](#) [Uganda](#) [Zimbabwe](#)

**3 What is the underlying structure of the climate, conflict, and socio-economic system?**

Network analysis

[Kenya](#) [Mali](#) [Nigeria](#) [Senegal](#) [Sudan](#) [Uganda](#) [Zimbabwe](#)

**4 Are climate and security policies coherent and integrated?**

Policy coherence analysis

**5 Are policy makers aware of the climate security nexus?**

Social media analysis

[Kenya](#) [Mali](#) [Nigeria](#) [Senegal](#) [Sudan](#) [Uganda](#) [Zimbabwe](#)



Click on the links above to view the other Factsheets

\* Questions 1, 2, 3, 5 are analyzed at country level through a Climate Risk Lens (impact pathways, economic, spatial, network and social media analyses). The policy coherence and scopus analyses are at continental level.

\*\*Scopus is one of the largest curated abstract and citation databases, with a wide global and regional coverage of scientific journals, conference proceedings, and books. We used Scopus data for analyzing: (1) how global climate research addresses the dynamics between climate, socio-economic factors, and conflict, and (2) how the countries studied are represented in the database.

© 2021 CGIAR FOCUS Climate Security.

This is an open-access document distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

The views expressed in this document cannot be taken to reflect the official position of the CGIAR or its donor agencies. The designations employed and the presentation of material in this report do not imply the expression of any opinion on the part of CGIAR concerning the legal status of any country, territory, area, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The views expressed in this document cannot be taken to reflect the official position of the CGIAR or its donor agencies.

For more information please contact: [p.laderach@CGIAR.ORG](mailto:p.laderach@CGIAR.ORG)

## 1. OBJECTIVE AND RESEARCH QUESTIONS

The main objective of the spatial hotspots 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. The purpose of the spatial hotspots analysis is to provide answers to the following research question:

### ***Where are the hotspots of climate hazards, conflict, and socio-economic vulnerability?***

In response to this question, a traffic light code is created following three categories:

- **green color:** limited conflict - good climate,
- **yellow color:** moderate conflict - harsh climate, and
- **red color:** high conflict – harsh climate.

All other co-occurrences are colored in gray, for simplicity. The hotspots of climate insecurities correspond to the socio-economic vulnerabilities overlapping with the yellow and red categories of the traffic light code.

## 2. METHODS AND DATA

The hotspots analysis develops four steps: 1) determination of conflict clusters, 2) determination of climate clusters, 3) identification and mapping of conflict-climate interactions, and 4) identification of socio-economic vulnerabilities. The conflict and climate clusters are determined through pattern-based spatial cluster analysis using a regular grid of 30 km<sup>2</sup> of resolution. The labels for the resulting groups are defined by a conflict or climate gradient from descriptive statistics. The socio-economic vulnerability conditions are determined by extreme percentiles (10% or 90%, depending on the variable), based on the assumption that the most extreme conditions (in either tail of the probability distribution) are the most likely spots for urgent intervention. Finally, a simple traffic light code is used to identify the hotspots of climate-conflict and socio-economic vulnerability. 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, amongst others. Most of these data are directly available through Google Earth Engine.

### 3. RESULTS

- ▶ Conflict events across Kenya during 1997-2021 are widely distributed over the country (Figure 1.A). Three clusters were identified based on statistical analyses. High conflict areas are estimated in the Central, Nairobi, southern corridor of Rift Valley, Nyanza, and Western provinces, but also in the southeastern part of the country in the counties of Kwale, Mombasa, Kilifi and Lamu. The moderate conflict cluster covers most of the rest of the country. Riots, protests, battles, and violence against civilians are the main conflict events and produce a greater number of fatalities in both high and moderate conflict clusters.
- ▶ The interaction between conflict and climate clusters is presented through a traffic light color code (Figure 1.B). **The red color indicates the co-occurrence of high conflict and harsh climate conditions.** Here specifically, the negative climate conditions are determined by high variability in rainfalls, a high number of days with moisture stress, and high-water deficit. **The yellow color corresponds to the co-occurrence of moderate conflict and harsh climate conditions.** The location of high/moderate conflict but also harsh climate conditions covers the northern and **eastern part of Kenya covering most of the area of eastern Turkana, Marsabit, Mandera, Wajir, the central part of Isiolo, northern Garissa and Lamu.** All other combinations (which cover a substantial portion of the country) are colored in grey, for simplicity in the visualization.
- ▶ Figure 1.C shows the socio-economic hotspots (left) and they are overlaid by the conflict-climate interactions (right). The social vulnerabilities are determined by the resource and mobility impact pathway. In the map, the vulnerabilities are presented by the following categories: undernutrition (U), inequality (I), migration (M), low productivity (LP), and their co-occurrences. Despite the limited number of **high conflict and harsh climate interactions, they co-occurred with hotspots where all the socio-economic vulnerabilities are present. This occurs in the following wards: Wajir East Township, Wagberi, Barwago, Bulla Mpya, and east of Khorof. While hotspots of inequality and low production are present in: north of Uran, Sololo, and north of Obbu, Marsabit central, Sagante/Jaldesa and Karare.**
- ▶ There are a high number of hotspots determined by different combinations of **migration and inequality issues in the eastern part of Turkana and Marsabit, and low productivity in southern Nyanza, Rift Valley, and Central province.**
- ▶ The southeastern areas of Kenya are characterized by inequality, undernutrition, and migration hotspots.

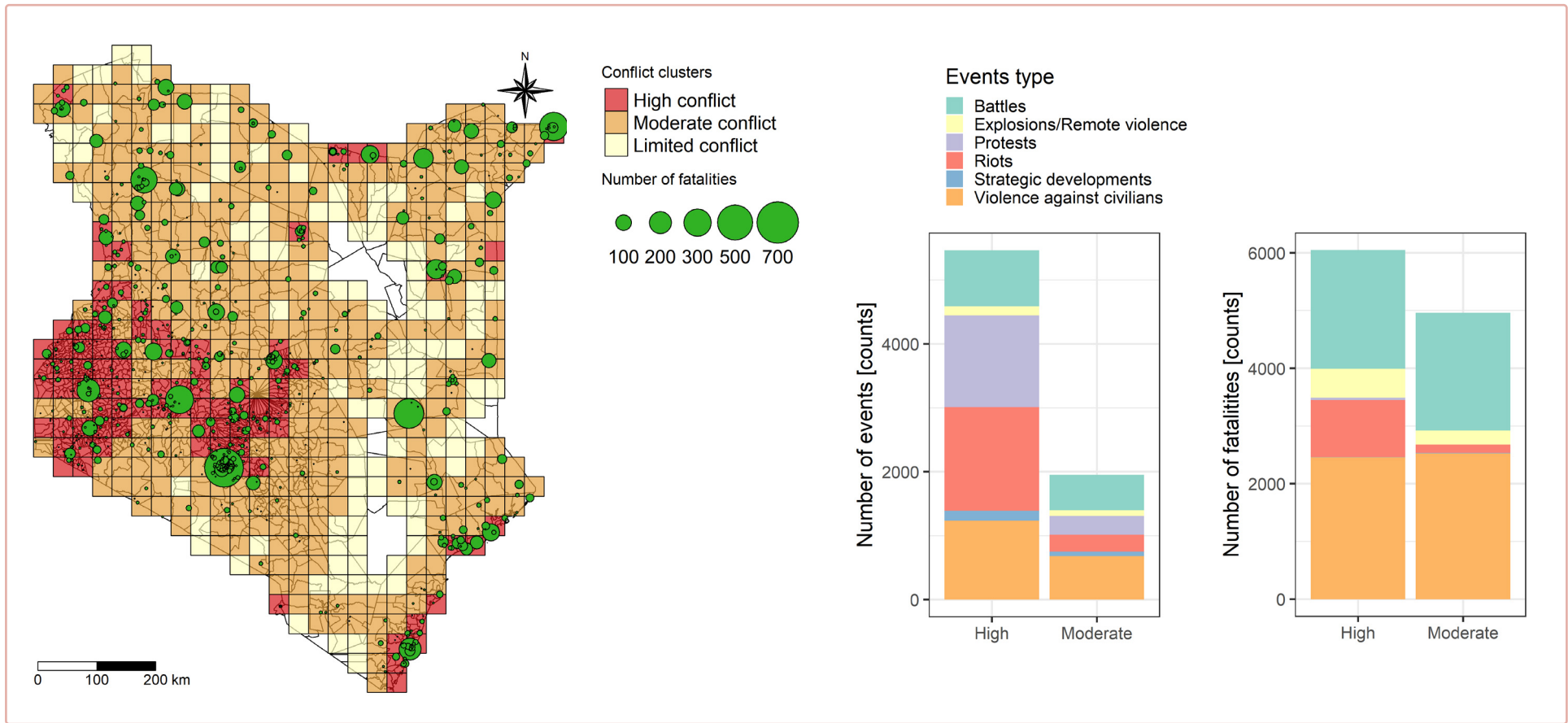
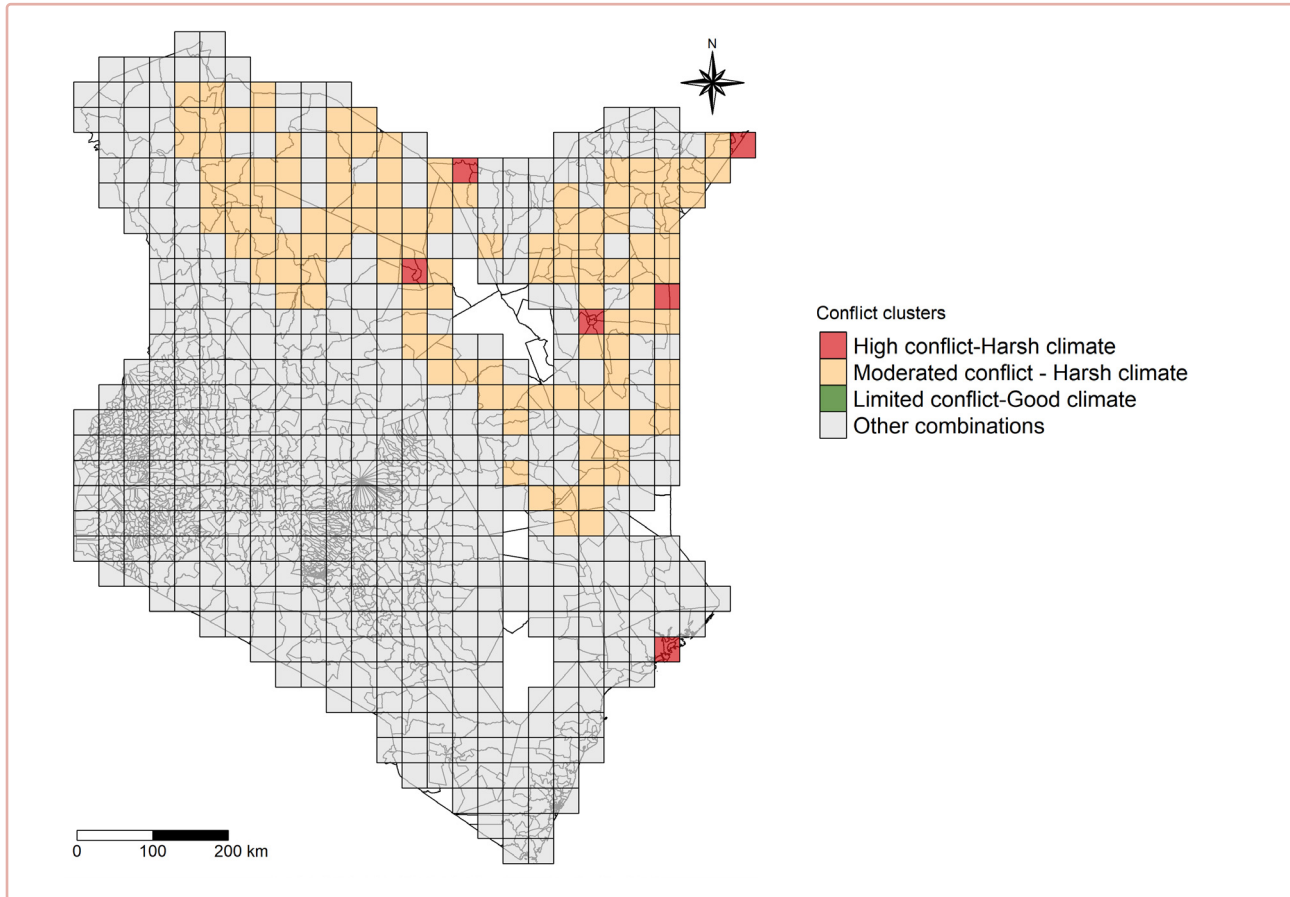
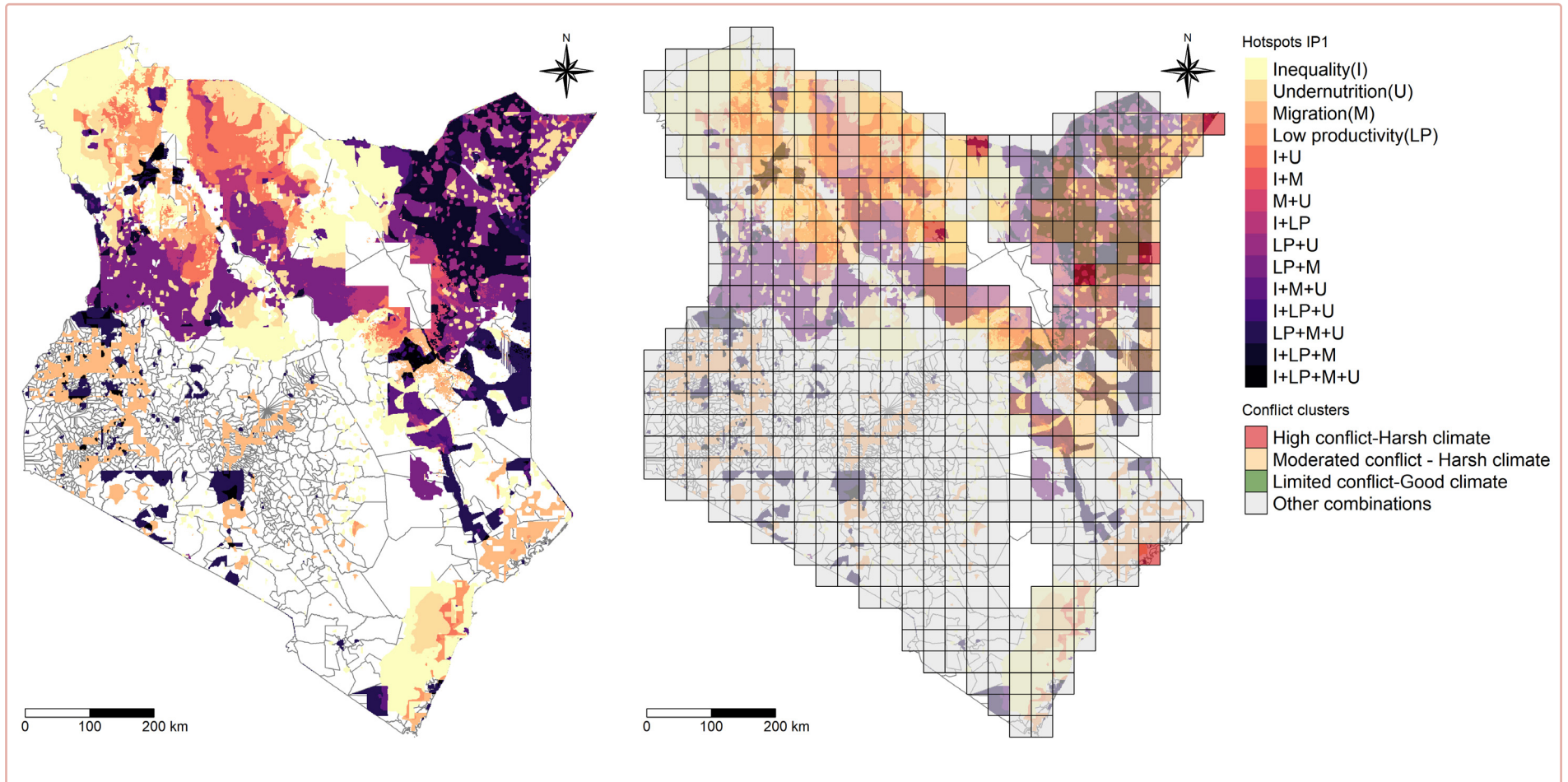


Figure 1.A. Conflict distribution: geographical location and distribution per type of conflict.



**Figure 1.B.** Conflict-climate interactions.



**Figure 1.C.** Spatial hotspots.



PHOTO © SMITH / CIAT

### **About CGIAR FOCUS Climate Security**

CGIAR aims to address gaps in knowledge about climate change and food security for peace and security policies and operations through a unique multidisciplinary approach. Our main objective is to align evidence from the realms of climate, land, and food systems science with peacebuilding efforts already underway that address conflict through evidence-based environmental, political, and socio-economic solutions.