CGIAR FOCUS Climate Security

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TAILORING THE CLIMATE SECURITY OBSERVATORY TO LIVESTOCK-RELATED CONFLICTS

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Summary

The Climate Security Observatory (CSO) is a decision support tool helping policymakers and other practitioners to understand and respond to climate-related security risks. It currently covers broad aspects of the climate security nexus, describing overall relationships among the dimensions of climate, conflict and socioeconomic vulnerabilities over a multiannual timeframe, without in-depth analysis of specific components around e.g. livestock-related conflicts, migration aspects, or food systems.

This report is meant to guide future work that includes livestock systems into the CSO. To visualize agro-pastoral conflict and understand its causes, factors and exacerbators, the general CSO questions, analysis and used data sources need to be tailored to livestock systems. The report will therefore review current CSO analysis and give recommendations on how to include livestock systems and pastoral conflicts.

Main takeaways:

- Need to **identify audience and use-case**: discussions with future users will be necessary to understand data gaps and develop a actionable use-cases for a livestock adaptation of the CSO.
- Need to **identify specific questions** that can be answered specifically for the livestock context. E.g. Will we focus on the climate-conflict link or are we going to broaden the spectrum? How do land-use and conflict interact with each other? How can we visualize structural factors such as tenure insecurity and social cohesion?
- Develop an **alternative to the climate-conflict hotspot model**: Compare areas with high conflict or an upwards trend of conflict against land use changes and climatic indicators, and allow conflict data to be overlayed or filtered by the presence of livestock corridors/ concentration zones
- **Seasonal trends: Transhumant movements** are seasonal. Understanding climate shocks that affect pastoralists requires a focus on seasonal, rather than annual changes which is the focus of the current CSO.
- **Transhumance routes and seasonal concentrations:** Given the important role of transhumance in the ongoing discussion around agro-pastoral conflict, understanding and mapping these routes is a critical input. Since no public dataset exists of these routes, gathering them would require in-country research including interviews, data gathering from ministries and focus groups.
- **Identifying "livestock conflict"**: Need to decide what kind of conflict event to include in the analysis, which will require manual sorting of individual conflict events
- **Land cover/ land use changes:** This will be a critical component to any kind of visualization of the causes behind agro-pastoral conflicts. Incorporating these data would require an accuracy assessment, which can be performed with other satellite imagery or ground data.

Background and Context

The Climate Security Observatory

The CSO is a decision support tool helping policymakers and other practitioners to understand and respond to climate-related security risks.

The CSO uses a mixed method approach to give answers to four lead questions: Where are the most vulnerable areas to climate-related insecurities and risks? Who are the groups vulnerable to climate and security risks that should be targeted? How does climate exacerbate the causes of conflict? What needs to be done to break the vicious cycle between climate and conflict?

The first version of the CSO is developed under the Climate and Resilience initiative (also known as ClimBeR: Building Systemic Resilience Against Climate Variability and Extremes), which is implemented in Kenya, Senegal, Zambia, Philippines and Guatemala. Climate security is one of the four initiatives' focus areas. The main goal of this work package is to build production-system resilience through recognizing the relationships between climate, agriculture, security and peace. As such, it includes a broad range of links and drivers of the climate security nexus, without going into detail of pathways related to specific links/drivers (nutrition/food security, migration, agricultural production systems, natural resource management, migration etc.).

The CSO will also be linked to other OneCGIAR initiatives: The Livestock and Climate initiative (also known as LCSR, Livestock, Climate and System Resilience), to be implemented in Colombia, Guatemala, Senegal, Mali, Ethiopia, Kenya, Tanzania and Tunisia, and the Fragility, Conflict and Migration initiative, to be implemented in Burkina Faso, Ethiopia, Iraq, Mozambique, Niger, Nigeria, Pakistan, Somalia, Yemen (and potentially in Afghanistan, Bangladesh, El Salvador, Guatemala, Honduras, Jordan, Mali, Myanmar, Nepal, Palestine, Sri Lanka, Sudan, Syria, Zimbabwe). The CSO, i.e. its general lead questions, analytical framework and used data sources need to be tailored to speak to the specific objectives of these thematic initiatives.

Adapting the CSO to livestock-related conflict

This strategic report focuses on guiding future work that includes livestock systems into the CSO. To visualize agro-pastoral conflict and understand its causes, factors and exacerbators, the general CSO questions, analysis and used data sources need to be tailored to livestock systems. The report will therefore:

- Review current CSO tools and analysis and give recommendations on how to include livestock systems and pastoral conflicts
- Recommend relevant audiences, partners, approaches, research gaps, data sets and analysis
- Guide the development of analysis and approaches proposed in report: Suggest ways and provide guidance on what spatial techniques to use for livestock systems and pastoral conflicts; Identify livestock systems and pastoral conflicts -related predictors/proxies for quantitative methods (econometric and network analysis)

Background on agro-pastoral conflict

Agro-pastoral conflicts (or Farmer-Herder conflicts) have received heightened attention in recent years, particularly in East and West Africa. These conflicts are often built upon land-use tensions or competition for natural resources between sedentary farming and mobile pastoralist communities. Transhumance (the seasonal migration of herds) plays a key role in these conflicts as land use conflicts often play out when the land use balance between transhumance and sedentary farming collapses.

The mobile nature of transhumance makes these conflicts (and their root causes) complicated to map within the "hotspot"-centric framework of the spatial analysis of the CSO. Herd movements are fluid by nature, changing from one season to the next based on a host of factors (pasture, water, customary access rights, market demands among others). Likewise, non-climatic factors often play the key role in the propagation of these conflicts.

Current CSO analyses and needed adaptation to livestock systems

This chapter of the report details the CSO's current methods. At the end of each section detailing a method, a brief explanation of if/how the method can be adapted to the context of livestock and agro-pastoral conflict is given. Each section is divided by the category of questions the methods are meant to answer: How, Where, Who, and What?

CSO current analysis component[1]	Adaptation to livestock and agro-pastoral conflict
Context analysis Contextual factors determine how sensitive a nation or region is to hazards related to climate security. Following indices or measures are used to give contextual insights: Climate context: ND-GAIN index, Projected increases in temperatures by 2050; Conflict/political/institutional context: Global Peace Index, Governance Index; Socio-economic vulnerability context: Gini index, Global Gender Gap Index, Agricultural dependence (value added as % GDP), Employment in agriculture (% of total employment), Acute food insecurity rate, Population growth (% of total), Unemployment rate, Poverty headcount ratio (% of population), Internally Displaced Persons	Contextual layers for livestock should be determined with potential users, but may include the following: land cover, livestock and human population estimates and climatic data such as NDVI and rainfall.
HOW - Climate Security Pathway Analysis Using a data-driven literature review and content analysis, in addition to expert and first-hand information from the field, we first construct a conceptual model of how climate acts as a threat multiplier. With a particular emphasis on food, land, and water systems, this so-called Climate	Any CSPA that looks at agro-pastoral conflict will also need to be country specific and locally-informed. Agro-pastoral conflicts are interwoven with locally-specific issues such as land-use, discrimination, tenure security, and existing conflicts. The agro-pastoral conflict pathway in Mali (which involves broader

Security Pathway Analysis maps out prospective Climate Security pathways by detailing the intricate relationships between climate, conflict, and current vulnerabilities.	conflict [12], foreign fighters [3] and land-use regimes that are several centuries old[4]) would be inapplicable to neighboring Senegal (where agro-pastoral conflicts have rarely been violent since the early 1990s[5][6]). Cross-border analysis should also be looked at, i.e. for various border regions, e.g. Senegal River Valley, Lipatako-Gourma Zone, Southern border between Burkina Faso+ Ghana, Benin a specific CSPA can be developed.
HOW - Network Analysis We analyze driver relations of the Climate Security Nexus using network analysis to get a global view on the underlying structure of the climate, conflict, and socio-economic system. The variables, represented by the nodes, are categorized as climate variables, conflict variables, and socio-economic risk variables, including indicators related to inequality, low productivity, migration, resources scarcity and malnutrition. The edges between nodes, represent the partial correlation coefficients. The most important drivers identified in this step are used for the hotspot mapping (where).	Input variables for the different climate security dimensions (i.e. climate, conflict, socioeconomic vulnerabilities) need to be adapted to represent relevant indicators for livestock systems, such as land cover, livestock population estimates, climatic data such as NDVI and rainfall, transhumance routes and seasonal concentrations, etc. (see more under Potential data sources). The input variables should be determined based on a theoretical knowledge, i.e. the CSPA and expert consultations.
HOW – Econometric Analysis We use econometric models to further quantify part of the Climate Security Nexus. We focus on testing whether and how climate variability and conflict risk are indirectly correlated through highly localized food and nutrition insecurity dynamics. We apply a causal mediation model to understand the mechanisms of direct and indirect effects of climate variability on conflict risk.	As for the network analysis, Input variables for the different climate security dimensions need to be adapted to represent relevant indicators for livestock systems. However, the tenuous link between climate and agro-pastoral conflict will make repeating the econometric analysis difficult. Furthermore, many of the data required (see more under Potential data sources) are not necessarily uniformly available.

[1] UNOWAS (2018), Pastoralism and Security in West Africa, https://unowas.unmissions.org/sites/default/files/rapport_pastoralisme_eng-april_2019_-_online.pdf

[2] International Crisis Group (2021) Mali: Enabling Dialogue with the Jihadist Coalition JNIM https://www.crisisgroup.org/africa/sahel/mali/mali-enabling-dialogue-jihadist-coalition-jnim

[3] Long War Journal (2012) Foreign Jihadists continue to pour into Mali,https://www.longwarjournal.org/archives/2012/10/foreign_jihadists_continue_to.php

[4]Benjaminsen and Ba (2021) Fulani-Dogon Killings in Mali: Farmer-Herder Conflicts as Insurgency and Counterinsurgency, https://www.tandfonline.com/doi/full/10.1080/19392206.2021.1925035

[5] PASTRES (2022) ,Pastoralism against land grabbing: decolonizing development narratives for a just socio-ecological transition, https://pastres.org/2022/05/20/pastoralism-against-land-grabbing-decolonizing-development-narratives-for-a-just-socio-ecological-transition/

[6] The most well known instance of agro-pastoral violence was the Senegal-Mauritania Border War of 1989-1991 https://en.wikipedia.org/wiki/Mauritania%E2%80%93Senegal_Border_War

HOW - Social Learning Approaches The aim is to understand the everyday experiences of members of affected communities on how climate change and human insecurity impact local contexts, using a rapid assessment through a qualitative mixed-methods approach combining direct observation, participatory group sessions and semi-structured interviews. Approaches used include: Transect walk, historical timeline mapping, seasonal calendars, problem and solution trees.	Inclusion of field knowledge and participatory approaches are also important for livestock systems, especially for data that otherwise are nearly impossible to obtain. Potential approaches include participatory GIS to map livestock, see for information on examples in section "Potential Data Sources".
WHERE – Spatial Analysis The spatial analysis consists of four stages: 1) determination of conflict clusters, 2) determination of climate clusters, 3) identification and mapping of conflict-climate interactions, and 4) identification and mapping of the most relevant socio-economic vulnerabilities. Both climate and conflict clusters are run on a regular grid of ~20km2 resolution, and are based on either agroclimatic or conflict-related indices as input. For the hotspot mapping, the extreme percentiles (10% or 90%, depending on the variable) for the top 10 most relevant variables according to the previously performed network analysis are identified.	Adapting the Spatial Analysis component will be necessary, if somewhat complicated. Areas experiencing agro-pastoral conflicts typically have very mobile transhumant livestock. Transhumance, which is often central to the conflicts, is by nature a fluid concept and can be difficult to make spatially explicit. This is further detailed in the Way Forward section of this report.
WHO Community profiles are provided for different combinations of climate, conflict and hotspots. Used variables include: Population density, Nightlights, Estimated Net Migration Recent, Years of education male and female, Difference of years of education, Piped water, Sanitation facilities, Stunting, wasting and underweight prevalence, Relative and absolute wealth index, Food Insecurity, Livelihood type/Zone, Dependency Ratio.	The same data can be used for an agro-pastoral context. Populations affected by both agro-pastoral conflicts fall across a wide variety of rural livelihoods including farmers, pastoralists, fishing communities or a mix of all.
WHAT - Social media analysis Content analysis techniques enable the identification of trends in political agendas and actors, over time and across geographies. Through Twitter's API, publicly available social media content from national level policymakers (central government, ministries of agriculture, natural resources, and the environment, as well as national security bodies) are collected and analyzed on a weekly basis.	To adapt the social media analysis, it is important to understand what we are trying to analyze. Possibilities would be a sentiment analysis of agro-pastoral conflicts, or the perceptions of key actors engaged in these issues.However, social media analysis will be difficult to adapt to the context of livestock and agro-pastoral conflicts. It remains to be determined how many actors involved in these conflicts are active on twitter (herding

	associations, ministries of livestock, police and security actors). When they are, they tend to tweet in a variety of languages that would complicate this analysis. If we take for example the case of Mali, Twitter counts a total of 56,000 active and inactive users for the whole country, which is relatively insignificant. Tweets, especially those related to ongoing conflicts, are often done in Arabic, French, Tamasheq and Bambara. Given how agro-pastoral conflicts have taken on an ethnic dimension in Mali, ethnic labels ("Fulani"/"Fulbe", "Tuareg", etc) would need to be included among key words to analyze. If this is done, there is a risks of the analysis being overloaded with irrelevant information, but if it omits ethnic keywords, it likewise risks missing large parts of the discourse on agro-pastoral conflicts. this analysis would need to be repeated for every country, requiring a significant investment of time and resources.
WHAT - Policy coherence analysis Building peace and conflict responsiveness into climate policies requires a multi-sectoral, integrated strategy in which several policy domains cooperate in a coherent way toward a single, overarching goal at the same time. The method incorporates qualitative directed content analysis with an empirical scoring/ranking system.	
WHAT - Stakeholder workshops Workshops are organized to bring together experts and practitioners working across the humanitarian, development and peace sectors to discuss how relevant climate and conflict connections are manifesting across the country, identify and map key stakeholders, as well as co-develop policy and programmatic recommendations towards integrating climate security considerations in climate action strategies.	Stakeholder engagement will be crucial for livestock conflicts as well. The most crucial part is to make sure to reach out to the right audience, also see section "Identifying audience and use-case".

[1] Different analysis components contribute to the four lead questions: HOW does climate worsen the root causes of conflict? WHERE are the most vulnerable areas to climate-related insecurities and risks? Who are the groups vulnerable to climate and security risks that should be targeted? What needs to be done to break the vicious cycle between climate and conflict? Datasets currently used in the CSO can be found in the Annex.

The Way forward

As it stands, the CSO needs significant adaptations for understanding agro-pastoral conflicts and for providing decision support for policy makers and researchers.

Identifying audience and use-case

We are in need of a strong use-case. Currently, we lack an identified user-base who can provide actionable use-cases for a livestock adaptation of the CSO. More discussions with future users will be necessary, especially those who might be working at the nexus of conflict and pastoralism. Potential discussion participants should include:

- Individual academics, first and foremost with colleagues from ILRI
- Regional bodies (e.g. for West Africa, CILSS, AGHRYMET)
- Ministries of livestock- especially those focused on land-use
- Donors and HQ-level operators
- Peace-building orgs: E.g. Search for Common Ground
- Conflict-focused think-tanks: Timbuktu Institute, Clingandael
- Pastoralist associations: Reseau Billatal Maroobe, etc
- Humanitarian actors focusing on livestock: Action Contre la Faim, Vétérinaires sans Frontières, ICRC

We need to understand from these users what the data gaps are and whether and how a platform such as ours can offer a useful solution for them.

What specifically are the issues we want to address?

Once use-cases are identified, we can begin to look at specific questions that can be answered specifically for the livestock context:

- What do we want to show? Do we want to map the growth and change of agro-pastoral conflict?
    - If so, how will we define these conflicts?
- Will we focus on the climate-conflict link or are we going to broaden the spectrum?
    - Is the climate-conflict link possible to visualize?
    - Given the complicated, non-linear interactions between climate change and agro-pastoral conflict, how can this be done?
    - If it cannot be done, what other relationships should we look at?
- How do land-use and conflict interact with each other?
- How can we visualize structural factors such as tenure insecurity and social cohesion?
- Which areas are experiencing a growth in agro-pastoral conflict?
    - What (if any) other environmental factors are these areas experiencing?

Limiting the countries

Of the 11 CSO countries, at least 4 should be excluded because of a lack of any kind of agro-pastoral conflict.

CSO Countries	Transhumance	Agro-Pastoral conflict
ETHIOPIA	Yes	Yes
GUATEMALA	No	No
KENYA	Yes	Yes
MALI	Yes	Yes
NIGERIA	Yes	Yes
PHILIPPINES	No	No
SENEGAL	Yes	Yes but no widespread violence
SUDAN	Yes	Yes
UGANDA	Yes	Historically yes
ZAMBIA	No	No
ZIMBABWE	No	No

Alternative to the climate-conflict hotspot model

If we work on the assumption that climate shocks change transhumant movements which then instigate conflict intensification, then the hotspot methodology does not work. Because the livestock (and therefore the conflict) is displaced from the climate shock, conflict events will not be occurring in the same places as the climate shocks.

Further, research tends to point to structural factors, such as tenure insecurity, discrimination and land use changes as the main factor behind agro-pastoral conflicts where climate is seen as an exacerbating factor.

As a result, a model that insinuates a linear or correlative relationship between climate shocks and livestock-related conflict is unlikely to be successful. That said, the hotspot model might be applied to other factors. Likewise, it may be possible to show how climate change exacerbates conflict, without making it a central factor.

Seasonal trends

Transhumant movements are seasonal, whereas the current CSO analyses are calculated on an annual basis. Understanding climate shocks that affect pastoralists requires a focus on seasonal, rather than annual changes.

Identifying “livestock conflict”

Narrowing down our definition of “livestock conflict” will be complicated but necessary. If the data source is an open platform, such as ACLED, we will need to decide what kind of conflict event to include in our analysis: Would the analysis be only limited to violence occurring over land use disputes (for instance, violent confrontations between herders and farmers during grazing)? Or would the analysis also include events less directly related such as:

- Attacks by jihadist groups on park rangers or forestry service officers widely perceived as retaliation for their extortion of pastoralists (Burkina Faso 2022, Mali 2018)
- Attacks on civilians in conflicts related to land-use conflicts (Ogossagou Massacre 2019)

The distinction of these conflicts will necessarily be based on contextual understanding, so an automated approach will not be possible. More than likely, this will require manual sorting of thousands of individual conflict events. Local knowledge and significant investment in time will be necessary to select "pastoral-related" conflict events from public data.

Potential Data Sources

Transhumance routes and seasonal concentrations:. Given the important role of transhumance in the ongoing discussion around agro-pastoral conflict, understanding and mapping these routes is a critical input. Unfortunately, no public dataset exists of these routes. In many countries, some GIS data on these routes exists from previous projects. Such data could be gathered and completed by participatory GIS (Fig. 1). Gathering this data would require in-country research including interviews, data gathering from ministries and focus groups.

Photo 1. Débat et définition des points de référence sur la carte.

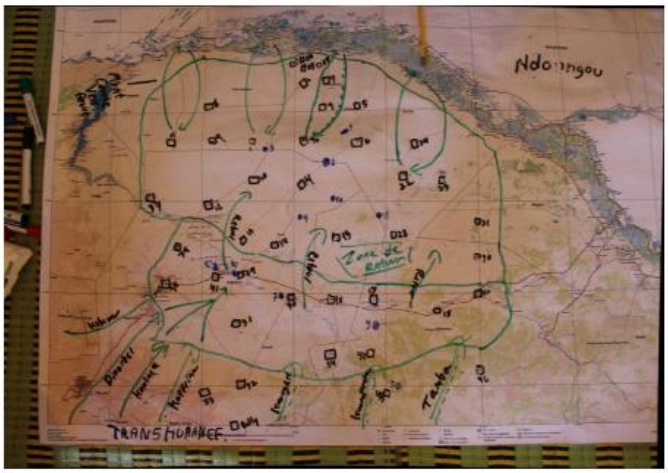

Photo 2. Résultat du débat, carte des mouvements et zones de concentration typiques pour le Ndoungou.

Fig. 1. Example of Participatory GIS to map livestock movements in Senegal

Livestock populations: FAO's Gridded Livestock of the World (already in CSO data dictionary) can provide a rough estimate of livestock density. The accuracy of this data is difficult to assess but it so far appears to be the only one of its kind. For many countries, we are unlikely to find livestock census data that would provide this kind of granularity.

Land cover/ land use changes: This will be a critical component to any kind of visualization of the causes behind agro-pastoral conflicts. Several public datasets exist, however few are accurate in African Drylands. Several datasets should be explored for their suitability including:

- ESA CCI (100m and 300m resolution) 1993-2018
- Google Dynamic World (10m resolution)- 2016- present
- WorldCover (10m)- 2020 - 2021

Incorporating these data would require an accuracy assessment, which can be performed with other satellite imagery or ground data. It should be noted that this would not be an easy exercise and would require a significant investment of time.

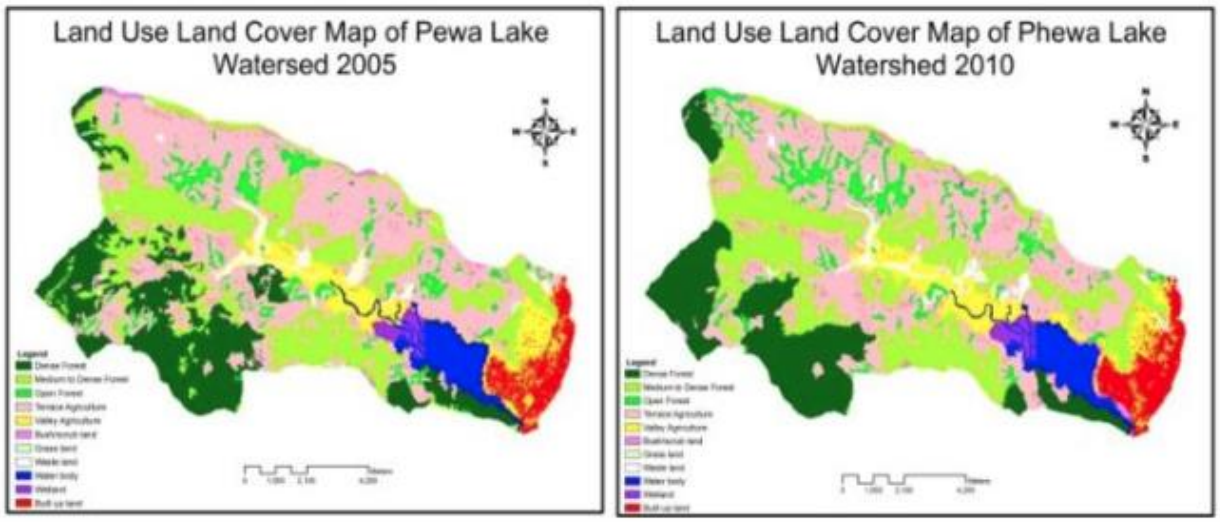

Fig. 2. Example for land use and cover mapping

Livelihood Zones: The FEWSNET Livelihood Zone database provides this information

Climatic data:

Climatic data (broken down by season) would specifically be tailored to rangeland conditions and would likely need to include: NDVI + Net Primary Productivity/ Dry Matter Productivity. Rainfall data could be included as well but a series of rainfall indicators would be needed, including: days without rain, length of season, monthly totals, seasonal total.

Livestock Infrastructure

Data on pastoral water points, vaccination parks, veterinary posts, markets, can provide an understanding on investments in infrastructure and pastoral livelihoods (Fig. 3). Typically this data is kept by the Ministry of Livestock.

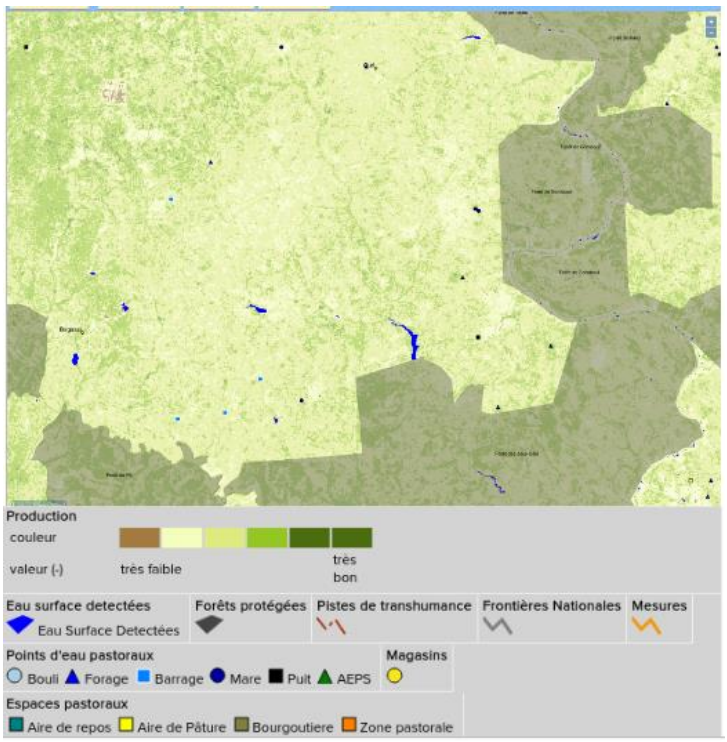

Fig. 3. Example of pastoral infrastructure data in Burkina Faso

A Potential Model

Data

- ACLED data for agro-pastoral conflicts
  - Manual recoding of ACLED data to only include events relevant to agro-pastoral conflict.
- Land use change comparisons (pasture to cropland, forest to cropland, etc)
  - Accuracy assessment and selection of land use change indicators
  - Aggregate land use change into megapixels
- Map transhumance routes and seasonal zones of concentration across countries of interest
  - Use PGIS to create a series of maps identifying areas that are frequented by livestock during seasonal movements.
  - Similar PGIS exercises could be performed to identify hazards and map out local perceptions of changes such as: which areas have become less accessible, where is pasture/water less abundant, where is insecurity worse?
- Climatic indicators: Rainfall, NDVI, Soil moisture
  - These could be worked into a single “drought index”

Analysis

- A revised model that aggregates this data into megapixels. Areas with high conflict or an upwards trend of conflict would be compared against land use changes and climatic indicators. It would also allow for conflict data to be overlayed or filtered by the presence of livestock corridors/ concentration zones (see Fig. 4 and 5)

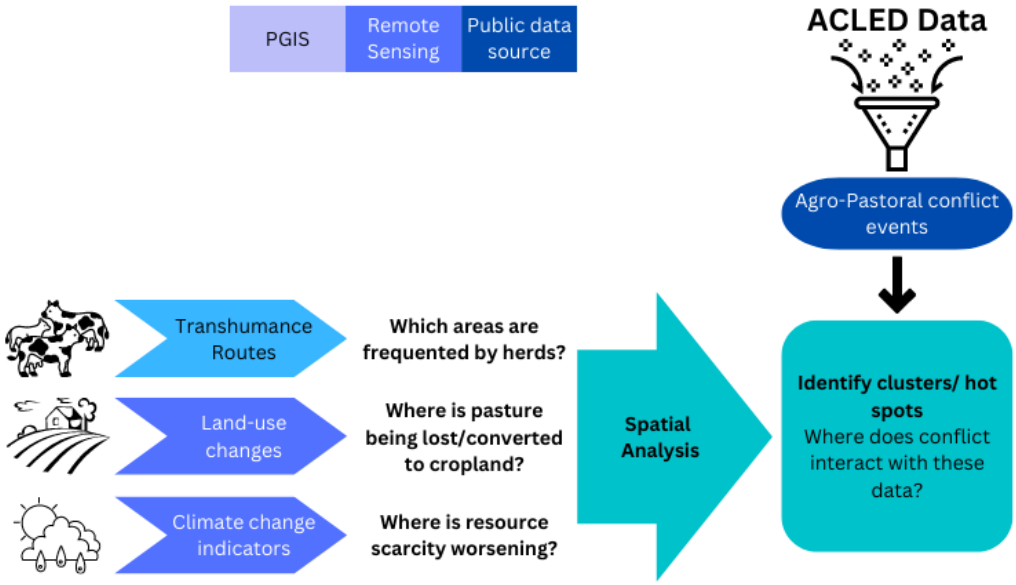

Fig. 4. Conceptual framework for livestock-specific CSO hotspot mapping

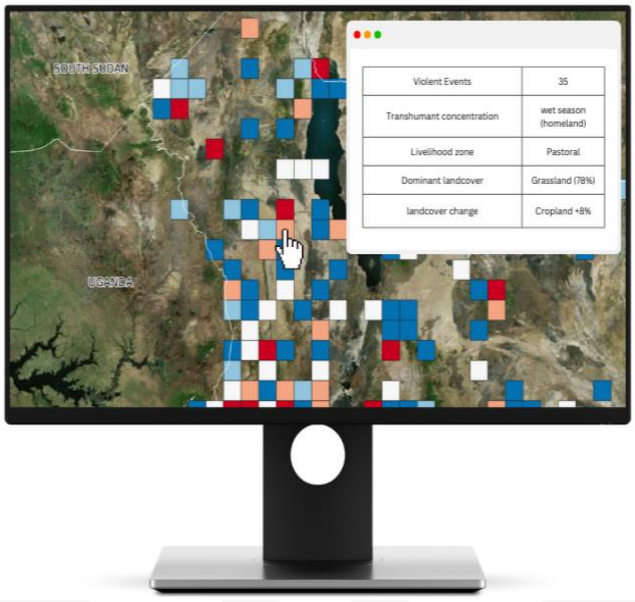

Fig. 5. Mock up for hotspot mapping tailored to livestock systems and related conflicts

ANNEX

CSO: Datasets currently used

Climate Security Pathway analysis

- Web of science
- Google scholar
- Knowledge products (reports, briefs, policy papers) from climate security-specific research institutions are retrieved from their websites. These included: UNEP, UNDP, Clingendael Institute, SIPRI,NUPI, adelphi, Mercy Crops, Interpeace, International Crisis Group, Toda Peace Institue, The Strauss Center for International Security and Law, among others. Further sources included the National Communications to the UNFCCC, the Climate Risks Profiles developed by USAID, and the Climate Risk Country Profiles issued by The World Bank.

Spatial and network analysis

- Climate
  - Rainfall: CHIRPS: Rainfall Estimates from Rain Gauge and Satellite Observations
  - Temperature: CPC Global Daily Temperature
  - TerraClimate
- Conflict
  - ACLED
- Socioeconomic
- Google Earth Engine
- Food insecurity (Institute for Health Metrics and Evaluation)
- Facebook (wealth data)
- FAO (Irrigation and livestock)
- Socioeconomic Data and Applications Center Columbia university (migration data)

Econometric analysis

- ACLED
- DHS (demographic and health surveys)
- TerraClimate