The Nexus of Climate and Conflict in the Lake Chad Region: What We Know, Don't Know and Need to Know

Uche T. Okpara
Natural Resources Institute, University of Greenwich, UK

Sulaiman Yunus
Centre for Dryland Agriculture, Bayero University Kano, Nigeria

Corresponding author's emails: u.t.okpara@greenwich.ac.uk; uche4purpose@yahoo.co.uk

Abstract
Despite the substantial body of knowledge available on the nexus between climate and conflict, this knowledge remains scattered, fragmented and incomplete. There are varying interpretations of how the nexus plays out, as well as different perceptions of the spectrum of "*climate conflict*" in fragile and conflict-affected areas. This is particularly the case in the Lake Chad region, an area that is often portrayed as a unique "testbed" for understanding climate conflict relations. This study systematically mapped and analysed published work on the nexus of climate and conflict, synthesising narratives and unpacking evidence on what we know, don't know and need to know about the nexus in the Lake Chad region. Our findings outline six key areas of knowledge that provide evidence on the nexus, including (i) how the nexus has evolved with the ongoing increase in regional climatic stress where temperatures are rising 1.5 times faster than the global average, (ii) whether studies link climatic events to different phases/stages of the conflict cycle or the conflict continuum, and (iii) whether climatic events also introduce new forms of conflict along the conflict continuum. We note that studies failed to ask how fragility (assessed in terms of lack of state legitimacy, capacity and authority) shapes group identity/solidarity and spatiotemporal variations in nexus patterns and impacts. We suggest that the spectrum of what is considered "*climate conflict*" be expanded, paying particular attention to the continuum of conflict and how different conflict types interact and reinforce one another under climate shocks. Ultimately, knowledge co-creation can help integrate fragmented evidence about the nexus, fostering a unified, coherent and verifiable body of knowledge that can support joint climate and peace initiatives and wider transformative change across the region.

Keywords: Climate conflict, nexus dynamics, anecdotal evidence, conflict continuum, fragility, Lake Chad region

1. Introduction

The scientific community has increasingly studied the nexus between climate and conflict over the past decade, indicating growing interest in the subject (Ide *et al*., 2020; Watson *et al*., 2023). However, different conflicting perspectives exist about the nexus, referring to, for example, nexus dimensions, mechanisms and pathways, including diverse views on the spectrum of what 'climate' really means and how 'conflict' should be understood (Mach *et al*., 2020). Perspectives based on a combination of empirical and anecdotal evidence provide useful climate conflict lessons and suggestions for future actions (Okpara *et al*., 2018). Yet, current knowledge remains patchy, fragmented and incomplete, with many estimates and models overstating the role of climate in conflict outcomes, especially in fragile and conflict-affected areas. Relatedly, there have been few attempts to systematically assemble, harmonise, integrate and assess both empirical and anecdotal evidence related to the nexus. This means that it is now crucial to prioritise the development of a well-organised, interdisciplinary knowledge base that fosters cross-sectoral learning and exchange, while also addressing the imbalances in the production of climate-conflict knowledge.

This article is about 'climate conflict' evidence synthesis and analysis. The article focuses on the Lake Chad region, a typical fragile and conflict-afflicted environment that is considered by many researchers as particularly well-suited for pinning down the spectrum of what is considered a climate and conflict nexus (Griffin, 2020; Jedweb *et al*., 2021). The Lake Chad region is threatened by high temperatures, dry air and thermal discomfort (Okpara *et al*., 2018). Temperatures in the region are rising 1.5 times faster than the global average, spurring longer dry seasons and drying up lake ecosystems (Fisker, 2021). Temperatures are predicted to increase by 0.65 - 1.60 ^{o}C and rainfall to decrease by 13 – 11% in the next 15 years (Climate Risk Profile, 2021). At the same time, the region is wracked by brutal conflicts (Wakdok and Bleischwitz, 2021). Multiple conflict types occur simultaneously, and spillover conflict dynamics have continued to reinforce conflict tipping risks, undermining regional stability (ACLED, 2022).

Previous studies have shown that the connections between climate and conflict are particularly acute in the region (Vivekananda *et al*., 2019; Lamarche, 2023), yet evidence from such studies is less harmonised and remains scattered across several platforms and institutions. Crucially, the findings are either inconclusive or the subject of much debate (Omosefe, 2022). Patchy and scattered findings raise fundamental concerns over how to trigger 'quick wins' and move towards cooperative adaptation and peace-centred development across the region.

This article aims to fill this gap by systematically identifying, assembling, synthesising and evaluating evidence of what we know, whether certain evidence is unusual, and what we do not know about climate conflict relations in the Lake Chad region. We contend that re-examining scattered and conflicting evidence on climate conflict relations in specific settings can better enable us to resolve inconsistencies and discrepancies. This in turn can lead to a more organised, discipline-crossing and broad-based view and learning, which can ultimately support climate resilience and peacebuilding actions. The article outlines key areas of knowledge that provide evidence of the nexus as well as what we need to know to deepen our understanding and foster cross-sectoral exchanges towards unified climate and peace initiatives.

2. Methodology

Following Waddington *et al*. (2012) and Okpara *et al*. (2018), we carried out a desk-based document search and literature review to unpack existing knowledge and evidence on the nexus of climate and conflict in the Lake Chad region. Desk-based document search focused on peer-reviewed and grey literature materials that contribute to and provide different forms of evidence on the nexus, covering journal articles, reviews, reports, technical papers, thesis,

opinion pieces, newspaper articles and social media articles. These sources enabled us to assemble a wide range of narratives, perspectives and findings on the nexus.

Our search followed the criteria specified in Table 1. We used the following search terms to screen the Web of Science (WoS), Scopus and Google Scholar databases based on Title, Abstract and Keywords: “climate change and conflict” OR “climate conflict” OR “climate violence” OR “climate security” OR “climate change and terrorism” OR “climate change and tension/unrest” OR “climate change and violent extremism” OR “climate change and armed conflict” AND “Lake Chad region” OR “West African Drylands” OR “African Sahel” OR “West Africa” OR “ Northeastern Nigeria” OR “ Borno State”.

Table 1: Inclusion and exclusion criteria and questions

Question	Criteria/description
Question 1: Does the paper or document cover analysis of climate and conflict relations in the Lake Chad region?	We included studies with a “climate conflict nexus” focus that cover one or more areas in the Lake Chad areas of Far North Cameroon, Northeast Nigeria, Southeastern Niger and Southwestern Chad. Studies covering Western Sahel or West African Drylands where Lake Chad is a part were included as well. Studies that did not meet our subject-matter and geographical criteria were excluded.
Question 2: Does the study capture climate-related causes only or conflict impact on climate, or a combination of Lake Chad specific climatic and contextual issues, or the study questions or denies climate conflict relations?	Studies were included if they reported climate-related causes only or conflict impact on climate, or a combination of Lake Chad specific climatic and contextual issues. Studies that question or deny climate conflict relations were included as well.
Question 3: Is the study publicly available in English and published between 2007 and 2023?	Studies were included if they are publicly available and published in English between 2007 and 2023.
Question 4: Does the study use the term ‘Lake Chad’ in any way in its title, abstract, keywords or in the entire text?	While there are various ways authors refer to the Lake Chad region, we included studies where the term ‘Lake Chad’ is mentioned, either explicitly or implicitly, at least once in the title, abstract, keywords or in the entire text, excluding the reference list (Desktop Mendeley Reference Manager enabled the screening of texts depicting the term ‘Lake Chad’).
Question 5: Is the study accessible through electronic media (either by an open access or subscription only platform or both) to readers from various backgrounds?	Studies were included if they are accessible through electronic media (either by an open access or subscription only platform or both) to readers from various backgrounds.
Question 6: Does the study list or explain the methodological approach(es) used to generate evidence on ‘climate conflict’ relations?	Methods that authors use in climate conflict studies are diverse. As such, we included studies that used longitudinal and/or cross-sectional surveys, quantitative and/or qualitative methods and/or simulations or scenario design. We also included those that are based on case studies, systematic reviews and/or context-specific indicator approaches. Studies that have not undergone peer-review, such as thesis, opinion pieces, newspaper articles and social media viewpoints were carefully screened for their correctness and included thereafter. Anecdotal evidence, personal observation and testimonials were triangulated and verified before we included them.

‘Climate change’ often manifests in various ways in the Lake Chad region – variability, extremes, shocks and anomalies, and often operationalised as temperature, rainfall, floods or droughts. Conflict also manifests in different ways - encompassing violence, tension, war, terror, unrest, crime, protest, riot, violent extremism, kidnapping and murder. As such, we used these variety of keywords in multiple combinations to capture the fullness of our subject matter and to run additional searches.

The search process covered the period from 2007 to 2023 (last access: 22 November 2023). This time frame covers the period when issues about climate security and conflict in the Lake Chad region became markedly pronounced as subjects of growing international public concern, especially following several episodes of Lake Chad water fluctuations, escalation of Boko Haram attacks and presence of multiple Lake Chad related agendas in COP meetings (i.e. the Conference of Parties to the United Nations Framework Convention on Climate Change). Similarly, this period allows for an in-depth engagement with advances in climate conflict issues across the region. The search process resulted in a database of 102 articles that articulate climate conflict links and that referred to the Lake Chad basin region following the criteria outlined in Table 1.

We used Table 2 to systematically evaluate each selected study to more precisely detect the range of narratives, findings or evidence presented. Evaluation sought to elucidate evidence of concrete climate and conflict relations in the Lake Chad region, focusing on what is known, unknown and what we need to know. Our approach evidently demarcates what represents a particular way of viewing and explaining climate and conflict concerns.

Table 2. Analytical approach: data extraction, retrieval of evidence and evaluation

Surface descriptors	This relates to the title, abstract and keywords in the retrieved studies.
Central entities and/or issues recognised	Does the study reveal why studying climate conflict matter for the Lake Chad region? How is the nexus of climate and conflict understood and presented? What role(s) does climate play in conflict outcomes? How does conflict affect climate? What specific climate indicators and conflict types are used? How has the nexus evolved with ongoing climate change? What evidence is given to show how climate shapes the conflict cycles across various stages from latent to visible conflict, violence and war? In what ways are conflict and climate relations different across the region and what overriding evidence is provided?
Association or causality and mechanistic relationships	What narratives depicting climate and conflict links, mechanistic relationships, pathways and impacts are presented? What is the degree of uncertainty accommodated?
Normative judgements	Where do authors stand (i.e., authors’ established position on the ‘causality’ arguments). What are the varied perceptions on ways to respond and deal with climate and conflict threats? What are the policy prescriptions?
Illustrative conclusions suggesting future directions or solutions	What are the central issues recognised as next steps? Is the study explicit about where we are headed? What opportunities are identified as ways to maximise current evidence to achieve peace and stability in the region?

3. Results

Here, we map the characteristics of Lake Chad climate conflict studies (Section 3.1) to show (i) the categories and types of studies reviewed; (ii) the scope of disciplines covered; (iii) the

variety of methods used; (iv) the spatial scope of the studies; and (v) the climate indicators, conflict types, natural resource types and contextual factors captured in the publications. Then follows a description of what we know about the nexus of climate and conflict in the Lake Chad region (Section 3.2). We use our findings on 'what we know' about the nexus to inform our discussion about what 'we don't know and need to know' in Section 4.

3.1 Characterising existing publications on climate-conflict nexus in the Lake Chad Region

Figure 1 presents the various studies included in our dataset. The dataset contains a large number of journal articles (57%), with a few report papers (24%) which are primarily from practitioner organisations such as the United Nations, non-governmental organisations and civil society organisations. Book chapters, comprising in-depth climate conflict analyses within collective volumes, represent 7% of the studies we reviewed. Others include review papers (4%), technical papers (3%), viewpoint and commentary papers (3%) and PhD theses (1%). Technical papers in our dataset offer technical reviews and specialised information, written by experts, researchers or professionals, and (like journal articles) are unique by their focus on technical details, rigorous methodologies, in-depth analysis and provision of empirical evidence. Relatedly, viewpoint and commentary papers reveal the authors' personal perspectives, opinions, or interpretations of climate conflict relations, and are supported by empirical evidence or relevant experiences.

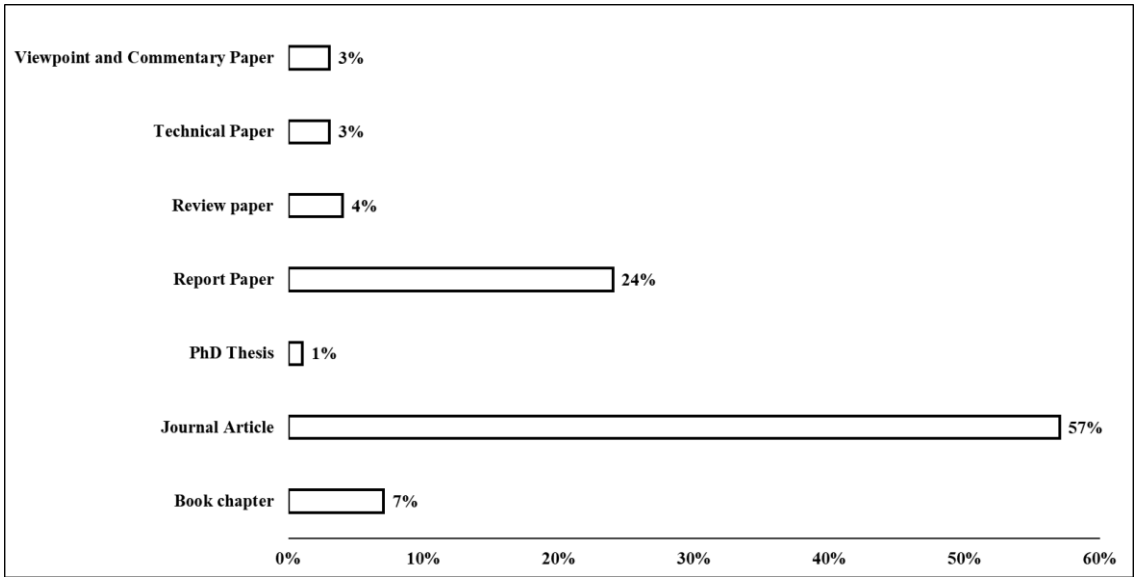

Fig. 1: Distribution and proportion of Lake Chad climate conflict publications in our dataset

The publications in our dataset are highly diverse in their disciplinary roots, primarily crosscutting human geography, peace science, political science and earth and environmental sciences. The journal articles we reviewed were published in journals such as *Regional Environmental Change*, *Sustainability*, *Environmental Science & Policy*, Political Geography, *Global Environmental Change*, and *Geopolitics*.

Figure 2 shows the variety of methods – four distinct method clusters – that the publications in our dataset used. These are (i) descriptive methodologies (52%): covering observational studies, surveys and case studies; (ii) mixed methods (36%): collection and analysis of both quantitative and qualitative data; (iii) exploratory methods (9%): use of brain-storming sessions, workshop discussions, interviews with experts and posting of online surveys; and (iv) statistical and quantitative methods (2%) which use mathematical models to detect patterns, correlations and statistical significance.

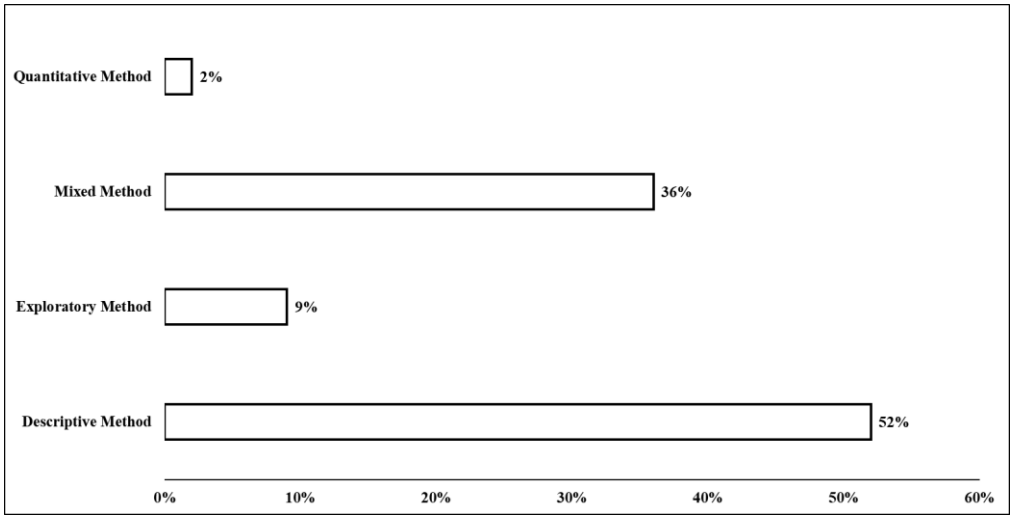

Fig. 2: Four method clusters/categories used in the publications in our dataset.

All publications had a geographical focus (Fig. 3) as we intended. In delineating the publications' spatial scope, three distinct categories emerged, each reflecting a different level of geographical specificity. First are the publications exclusively centered on the nexus of climate and conflict within the geographic boundaries of the Lake Chad basin (61%). Second are those that, although centered on the Lake Chad region, also extend their focus to cover other locations within the broader African region (sub-Saharan Africa, 2%; West Africa, 5%; West African Sahel, 4%; and the wider Africa, 13%). Publications in this second category explored the interconnectedness of climate and conflict issues, drawing comparisons and contrasts between the evidence in Lake Chad region and other African contexts. Third are those that focused on sub-regions or specific smaller parts of the Lake Chad region (15%) such as Northeast Nigeria in Borno State.

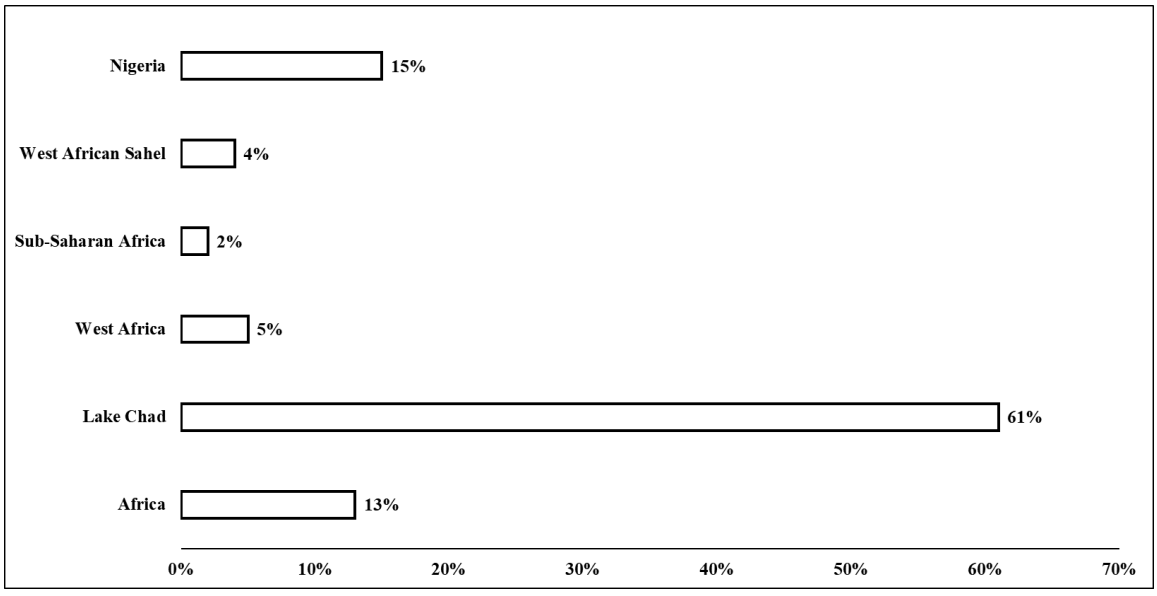

Fig. 3: Spatial scope of the publications reviewed.

Rainfall (8%), temperature (3%) and a combination of the two (88%) represent the common climatic factors used by the authors (Fig. 4). Consequential events, such as floods and droughts, are perceived as tangible outcomes of extremes in temperature and rainfall in the area.

Table 3 provides a summary of the variables (climate indicators, conflict types, natural resource types and contextual factors) that authors included in their study of climate conflict in the region. We show in Fig. 4 that temperature and rainfall were used separately or in combination as proxies for climate (change and variability). To link climate to conflict, authors often used one or more types of conflict. The common ones are farmer-herder conflicts, inter and intra-communal violence, extremist insurgency (linked to the Boko Haram and Islamic State of West Africa Province sects), ethnic conflicts, water disputes, and political strife.

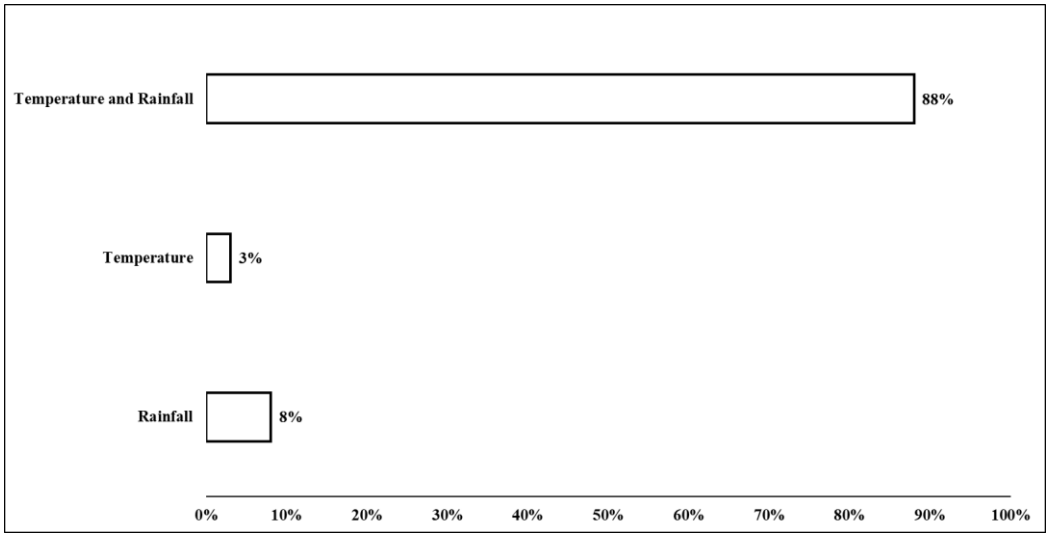

Figure 4: Temperature and rainfall measures are common climatic factors.

Authors recognise the significance of location-specific contextual factors, covering socioeconomic (e.g., population pressure, deficiency in governance, corruption, livelihood underperformance, weak social and financial assets, hike in food prices) and environmental variables (e.g., land, forest or water scarcity) in their analyses. In doing this, they convey evidence depicting either a direct or an indirect link between climate and conflict in the presence of pre-existing factors.

3.2 What do we know about the nexus of climate and conflict in the Lake Chad region?
Before considering 'what we know' about the nexus, it is useful to note that the publications in our dataset focused on the Lake Chad region for a number of reasons. First, the region has experienced significant environmental changes, including shrinking water levels and desertification, which historically have led to different conflict types. Second, the geopolitical significance of the Lake Chad basin, with multiple countries sharing its borders, makes it an important 'testbed' for understanding regional and transboundary dynamics of climate conflict relations. Knowledge from studies of climate conflict in the region is shown as useful to policymakers, researchers and humanitarian organisations working to both address climate impacts and prevent conflicts in the region (Vivekananda *et al*., 2019).

Table 3: Climate indicators, conflict types, natural resource types and location-specific factors that authors use in Lake Chad climate conflict studies.

Climate indicators	Conflict types	Natural resource types	Contextual factors
Temperature and rainfall (Busby *et al*, 2011; Okpara *et al*., 2018; Ferreira *et al*., 2019; Wakdok and Bleischwitz, 2021; Daoust and Selby, 2021; Ehiane and Moyo, 2021)	**Herder-farmer conflict** (Brottem, 2016; Frimpong, 2020; Regan and Kim, 2020; Caron, 2020; Skah and Lyammouri, 2020; Wakdok and Bleischwitz, 2021; Larémont, 2021; Buba, 2021; Nagabhatla *et al*., 2021; UNDP, 2021; George *et al*., 2021; Tarif, 2022; Oyekanmi, 2022)	**Water and land resources combined** (LCBC, 2018; Scheffran, 2019; Vivekananda, 2020; Skah and Lyammouri, 2020; Larémont, 2021; Wakdok and Bleischwitz, 2021; Nagabhatla *et al*., 2021; Ehiane and Moyo, 2021; UNDP, 2021; UNDP, 2021; Granguillhome *et al*., 2021; LCBC, 2022; Faborode, 2022; Newman *et al*., 2023)	**Poor governance, poverty, marginalisation and corruption** (Adelphi, 2018; SIDA, 2018; Vestby, 2019; Vivekananda *et al*, 2019; Caron, 2020; Lyammouri, 2020; Fisker, 2021; Stuart, 2022; Skah and Tarif, 2022)
Temperature, (Namasaka, 2015; Okpara *et al*., 2017; Maharana, Abdel-Lathif and Pattnayak, 2018; van Weezel, 2019; Griffin, 2020; Skah and Lyammouri, 2020; Stuart, 2022; Osuoka *et al*., 2022)	**Rebel conflict – Boko Haram/ISWAP** (Onyia, 2015; UNDP OCHA, 2018; LCBC, 2018; van Weezel, 2019; Vivekananda *et al*, 2019; Ferreira *et al*., 2019; Griffin, 2020; Varin, 2020; UNDP, 2020; Fisker, 2021; UNDP, 2021; Oyekanmi, 2022; United Nations ICJRI, 2022; Ani and Uwizeyimana, 2020; Sampaio, 2022; Galli *et al*., 2022)	**Water** (Okpara, 2016; Rudincová, 2017; Okpara *et al*., 2017; 2018; Vivekananda *et al*, 2019; Griffin, 2020; Frimpong, 2020; Fisker, 2021; Jedwab *et al*., 2021; Ehiane and Moyo, 2021; Oyekanmi, 2022; Oke, 2022; Ruppel and Funteh, 2022; Galli *et al*., 2022)	**Environmental dynamics and lake water fluctuation** (Cabot, 2017; Okpara *et al*., 2017; Scheffran, Link & Schilling, 2019; Scheffran, 2019; Griffin, 2020; Ehiane and Moyo, 2021; Daoust and Selby, 2021; Oyekanmi, 2022; Oke, 2022)
Rainfall (Gao *et al*., 2011; Asah, 2015; Papaioannou, 2016; Vivekananda, 2020; Nagabhatla *et al*., 2021; Gupta *et al*., 2021; Akinyetun and Ogunbodede, 2023)	**Communal conflict** (Obioha, 2008; Benjaminsen, 2016; Oyekanmi, 2022; Lenshie *et al*., 2022; Newman *et al*., 2023)	**Land** (Brottem, 2016; Nagarajan *et al*., 2018; Sánchez, 2020; GEOGLAM (Global Agricultural Monitoring), 2020; Isah and Bitrus, 2021; Wakdok and Bleischwitz, 2021)	**Social, humanitarian and population pressures** (Obioha, 2014; UNFPA, 2017; Frimpong, 2020; UNDP, 2021; Venturi and Barana, 2021; Mondo Internazionale, 2022; Chiarelli *et al*., 2023)

In considering how the nexus is understood and presented, a sizeable body of studies portray the nexus as one that revolves around a single net climatic event (Eberle *et al*., 2020; Fisker, 2021) or as one enabled by conditional forces shaping societal vulnerability (e.g., Vivekananda *et al*, 2019; Caron, 2020; Bressaglia and Martone, 2020; Skah and Lyammouri, 2020;

Frimpong, 2020). In relation to the former, we show in Table 4 three example narratives and references depicting conflict outcomes of a specific climatic event or stressor.

Tabe 4. Example narratives and references showing conflict outcomes of a specific climatic event.

……a 1 degree increase in temperature is associated with a 54% increase in conflict probability in areas that are home to herders and farmers, and a 17% increase in conflict in other areas - Eberle *et al.* (2020)
.....climate-related stresses experienced in terms of hot temperatures provide a backdrop for the recruitment and mobilisation of extremist groups, leading to heightened security risks – LCBC (2018)
……a positive temperature anomaly of one standard deviation (higher-than-usual temperature) is associated with 17.6% points increase in the yearly number of conflict events taking place especially in cropland zones during growing seasons – Fisker (2021)

Regarding narratives portraying conditional forces that shape societal vulnerabilities, we found that the nexus is understood as one that is deeply rooted in contextual vulnerability forces, varying widely spatiotemporally within and across societies, and enmeshed in complexity and sometimes with unpredictable spillover effects (see Table 5). This understanding shapes how some authors present the nexus, e.g. as one substantially mediated by livelihood underperformance, societal vulnerability and deep-rooted multidimensional fragility factors such as weak state capacity and authority, and weal state legitimacy (Fig. 5). Although "vulnerability" is mentioned much less frequently, the largely "indirect link" premise upon which the climate conflict nexus is presented in most studies attests to the existence of multiple nexus transmission routes, raising caution over simplified interpretations of the nexus. Notably, according to Vivekananda *et al*. (2019), the nexus reflects a continuum of multidimensional fragility forces that work through the "discomforting state of nature" (e.g., farmland degradation and lake drying) to shape the "nature and condition of the state/region" or the conflict behaviours of citizens.

Table 5. Narratives and references showing example intervening (conditional) vulnerability forces in climate conflict relations.

…..the ongoing conflict in the Lake Chad region can be seen as a manifestation of long years of suboptimal territorial underdevelopment and climate chaos -Tayimlong (2020)
.....absence of effective strategies to adapt to climate change increases vulnerability, potentially triggering conflicts – Frimpong (2020)
.....unequal distribution of the impacts of climate change have deepen economic disparities, fostering resentment and conflicts over limited economic opportunities – LCBC (2018)
.....insufficient collaboration among countries in the Lake Chad region to address shared climate challenges contributes to conflicts over resource management – UNDP (2021)
……. the gendered impacts of climate change, particularly on women, are increasingly recognised as a potential source of conflict, shaping the dynamics of social and economic struggles – Tower (2020)

Relatedly, "powerlessness" is central to both practitioner and academic understandings of the nexus. Using a language that communicates "powerlessness" (Frimpong, 2020) invokes an acknowledgement of the deep-rooted vulnerabilities of livelihoods across the region (Njoku, 2022). It follows that the contexts in which humans live, the boundaries in which states operate and the state of the natural environment in the region portray endemic weaknesses and a

condition of powerlessness, which according to LCBC (2018) and UNDP (2021) create conditions where climate readily fuels conflict outbursts.

Concerning how studies portray the roles of climate in conflict and the role of conflict in climate, we found that several authors (95%) view climate as a '*threat multiplier*', '*conflict accelerator*' or '*accelerator of relative deprivation and local grievances'*. A small set of publications (10%) reveal that climatic events, such as floods and droughts, do not necessarily start conflicts. Rather, they play an '*amplifying role*', for example when they trigger zero-sum struggles and contribute to entrenched illicit economies – which are conditions that local conflict actors leverage upon to drive and sustain violence (Nagarajan *et al.,* 2018; Onuoha, 2019; UN News, 2019; Jedweb, 2021). Climate is a threat multiplier when it undermines the capacity of the state to prepare for and carry out conflict prevention and national security responsibilities (UNDP, 2018).

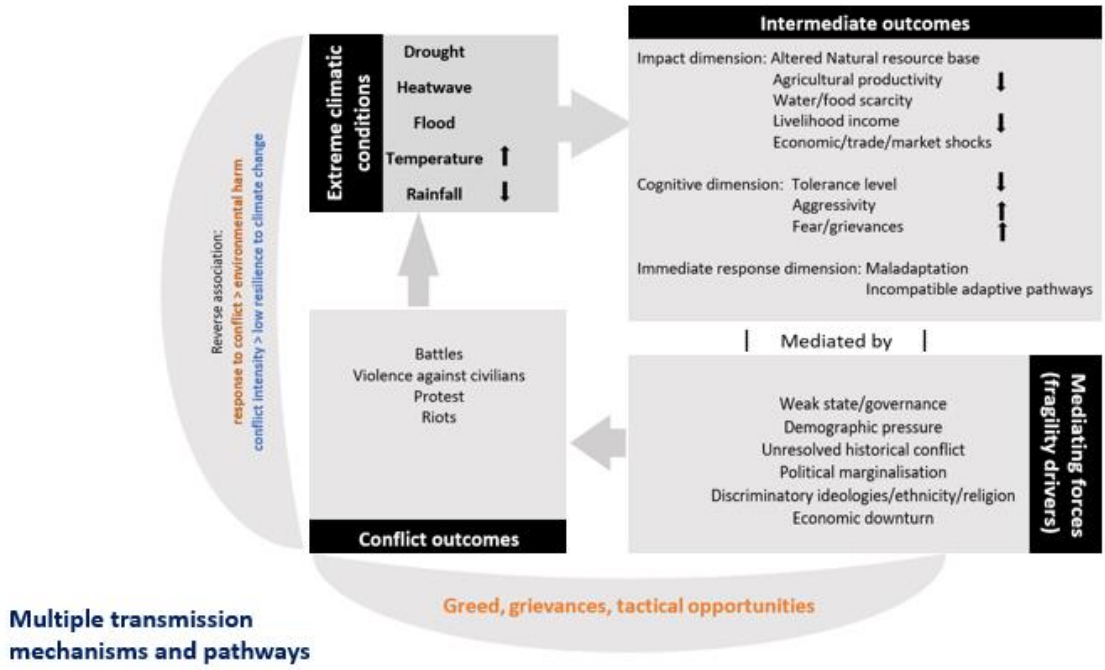

Fig. 5. Summary of how the nexus is understood and presented in a sizeable body of studies reviewed.

The role of conflict in climate (e.g., through adaptation and mitigation) is often not specified, although some publications (15%) reveal that conflict in the region generates a big downward push on climate resilience, increasing vulnerability and maladaptation (Frimpong, 2020). Okpara *et al* (2016), for example, indicate that conflict often undermines the capacity of individuals and groups to adapt to climate change, amplifying climate vulnerability and reinforcing climate conflict tipping and spillover impacts. UN (2021) reveals that conflicts linked to terror groups often fuel environmental losses and damages, driving and raising carbon emissions and hot climates. Uncoordinated military response to terror groups harms the environment, further reinforcing extreme climatic conditions and thermal discomfort which 'weakens the state of the natural environment', predisposing the region to a continuous cycle of violence. Vivekananda *et al*. (2014 & 2019) call this a "climate-fragility-conflict trap". A final point to note here is that, across the Lake Chad region, climate and conflict are tied together in a vicious circle where conflict undermines the capacity to cope with climatic events, with climate making it harder to address conflicts and promote peace (Nagarajan, 2018; Singh, 2022)

Switching to how the nexus has evolved with ongoing increase in regional climatic stress where temperatures are rising 1.5 times faster than the global average, more recent studies reveal: heightened rate of forced migration (UNHCR, 2016; Akubor, 2017; IOM, 2019; Kamta *et al*., 2021; Lamarche, 2022; Tower, 2022); more land use changes (Nwilo *et al*., 2019; Nwilo *et al*., 2020); and hike in food prices (Blankespoor, 2020; Pham-Duc *et al.,* 2020; Olowoyeye & Kanwar, 2022). Multiple conflict types (e.g., gender-based violence and violence against children) are happening simultaneously with communal battles and land violence increasing by more than 50% since the emergence of Boko Haram conflict in 2009 (Cole, 2016; Brechenmacher, 2019; UNDP, 2022; Escola de Cultura de Pau, 2023). Conflict fatalities peaked in 2014 and 2015 to around 1,000/year (ACLED, 2022) and regional conflict spillover under hot temperatures has continued to reinforce interactions between different conflict types, further strengthening the nexus (Okpara *et al*., 2016).

As has been echoed in the environmental security literature, empirical evidence and anecdotal evidence on the nexus often differ and sometimes misrepresent the nexus, leading to flawed policies (Detges, 2017). However, this is not the case in the Lake Chad region where both types of evidence (when integrated) can provide insightful knowledge about the nexus (Skah & Lyamouri, 2020). While the authors advancing scientific evidence rely on rigorous research methodologies, data analysis and peer-reviewed studies to draw conclusions, studies based on anecdotal reports and stories capture the lived experiences and narratives of individuals and local communities, offering qualitative perspectives on the nexus. The former offers a more systematic and somewhat reliable quantitative understanding of the nexus patterns, whereas the latter enriches the narrative with contextual nuances that capture the human and locational aspects of the nexus. In cases where certain structural determinants of the nexus – such as fractured social and political structures, poverty and resource depletion - are difficult to capture in empirical models, anecdotal narratives come in to help provide more insightful ways of pinning down the breadth and scope of the determinants and the overall nexus dynamics.

We note that perceptions and responses regarding how to deal with climate conflict concerns differ across the various publications we reviewed. Some (e.g., Okpara *et al*., 2018; Vivekananda *et al*, 2019; Griffin, 2020; Frimpong, 2020; Fisker, 2021; Jedwab *et al*., 2021) emphasised the integration of climate action, peace action and water action, whereas others (e.g., Adelphi, 2018; SIDA, 2018; Vestby, 2019; Caron, 2020; Lyammouri, 2020; Stuart, 2022) suggested interventions that target behavioural change, building of stronger environmental governance and human rights institutions, and maintaining sustainable access to jobs and income. Ultimately, breaking the nexus requires differentiating between specific conflict- versus climate-induced vulnerabilities and related socioeconomic crises fuelling the nexus (Griffin, 2020). Doing this is particularly challenging because the climate conflict nexus often overlays other nexus dynamics at play – namely the humanitarian-development-peace nexus, thus making it even harder for authors to identify effective strategies to address climate conflict stressors and local peace needs all at once.

For these reasons, especially considering the urgency of the climate conflict crisis, UNDP (2021, 2022) posits that promoting integrated and multidisciplinary approaches to addressing climate and conflict-related crises is crucial. In fact, according to Mercy Corps (2017), multidimensional approaches, combining both science-based and traditional response/resilience mechanisms, are necessary to promote effective locally-relevant and community-led resilience – not only to operationalise locally-led conflict transformation principles, but also to identify effective responses specifically aiming at preventing and/or compensating climate and conflict induced losses and damages. Notably, solutions that address the nexus in a holistic manner are emerging, but clear impacts are hard to pin down or yet to emerge.

From the interdisciplinary review and results presented in this section, Table 6 provides a summary of what we know about the nexus of climate and conflict in the Lake Chad.

4. Discussion: What we don't know and need to know

In reviewing studies on Lake Chad climate conflict, we observed six important knowledge clusters that convey evidence of the nexus, i.e., "what we know" (see Table 6). While our results are somewhat consistent with other systematic reviews of published work in the field of climate conflict and security (e.g., see Scartozzi, 2021), we do not claim that Table 6 provides an exhaustive summary about the nexus for the Lake Chad region. The increase in climate conflict publications on this region indicates a growing interest in studying the material consequences of climatic events on livelihoods, the economy and on land and water resources, yet it remains the case that conflict is often emphasised but rarely assessed as a continuum.

Table 6: Summary – what we know.

Themes	Summary: What we know
How the nexus is understood and presented	The nexus is understood to revolve around, and is shaped by, a single *net climatic event* or as one enabled by *conditional forces* linked to societal vulnerability and the powerlessness and weakness of the state and citizens. The nexus dynamics is rooted in a "weakened state of the natural environment" and "a highly vulnerable nature of the state", producing climate conflict outcomes that vary widely across the region. Notably, evidence from the Lake Chad region challenges the '*climate centric*' and '*denial claim*' discourses espoused in Okpara *et al* (2016): conflict in any guise is **not a direct response** to climatic events in the region. The **direct impacts** of climatic events are keenly observed in the alteration and strain on natural resources, particularly land and water, which in turn serve as catalysts for struggles, unrest and conflict. Stated differently, climate-sensitive asset holdings derived from unstable land and water-based activities are a medium through which climatic events undermine livelihoods, offering a pathway to conflict.
Role of climate in conflict and role of conflict in climate	A sizeable body of studies portray climate in the Lake Chad region as a '*threat multiplier*', a '*conflict accelerator*' and an '*accelerator of relative deprivation and local grievances*'. Climatic events do not readily start conflicts. However, they can propel early conflict onset, stretch conflict duration over multiple timescales and across societies or amplify conflict severity. Conversely, conflict weakens the resilience of communities and institutions to respond to climatic events; it weakens the capacity of governments to initiate and execute climate-compatible development. Across the Lake Chad region, climate and conflict are tied together in a vicious circle where conflict undermines the capacity to cope with climatic events, with climate making it harder to address conflicts and promote peace.
How the nexus has evolved with ongoing increase in regional climatic stress	With temperatures rising 1.5 times faster than the global average, the region has experienced heightened rate of conflict-induced forced migration, more land use changes and hike in food prices. Multiple conflict types are happening simultaneously with battles and violence increasing by more than 50% since the emergence and rise of new conflict types such as Boko Haram conflict and gender-based violence. Conflict fatalities peaked in 2014 and 2015 to around 1,000/year and regional conflict spillover under hot temperatures has continued to reinforce multiple conflict types, further strengthening the nexus and worsening living conditions.

Empirical evidence vs anecdotal evidence	When integrated and properly triangulated, both types of evidence can provide insightful understandings of the nexus in the Lake Chad region.
How authors link climate change across the conflict continuum or conflict cycle	A small set of studies link climate to two noticeable phases in the conflict cycle: conflict onset/emergence and violence escalation. We note that authors need to consider climate influences on other conflict phases, e.g., conflict duration, patterns of conflict spillover, de-escalation and resolution, and reoccurrence.
Perceptions and responses for dealing with climate conflict challenges	Solutions that address the nexus in a holistic manner are emerging, however clear impacts in terms of sustainable peace and climate resilience are yet to be seen.

Conflict in the Lake Chad region manifests as a *continuum* that stretches from latent conflict to visible conflict and armed violence (Griffin, 2020; Frimpong, 2020; Singh, 2022). It is experienced in different forms and types, ranging from banditry, kidnapping and violent extremism to gender-based violence, farmer-herder conflict, land and water communal conflict and rebel violence (van Weezel, 2019; Ferreira *et al*., 2019; Buba, 2021; Nagabhatla *et al*., 2021; UNDP, 2021; Oyekanmi, 2022; Lenshie *et al*., 2022; Newman *et al*., 2023). These conflict types are dynamic, manifesting in a continuum and sometimes interacting and reinforcing one another spatiotemporally (Skah and Lyamouri, 2020). They interact in ways that undermine the capacity of regional authorities to prioritise, pursue and achieve conflict transformation.

In considering how authors link climate across the conflict continuum and whether climate affects the conflict cycle in terms of conflict emergence (onset), escalation, de-escalation and conflict resolution, we note that a small set of studies (10%) link climate to two noticeable conflict stages or phases in the conflict cycle: i.e., conflict onset (Okpara, 2016; Fisker, 2021) and violence escalation (UNDP, 2022). However, how climate influences other conflict phases, e.g., conflict duration, patterns of conflict spillover, de-escalation and resolution, and reoccurrence, remains largely understudied. It follows that authors have failed to account for how climate interacts with different conflict stages and cycles, and whether climatic events also introduce new forms of conflict along the conflict continuum. There is also no account of how climate impacts experienced in one part of the region produce conflict outcomes in another part.

Furthermore, the exact conflict types linked to climatic events in the region remain the subject of much debate. In the past, the focus used to be on transboundary water conflicts, but now evidence of indirect climate connection to farmer-herder conflict, rebel violence, land theft/grabbing, and cattle rustling has emerged (Lamarche, 2023). There is the likelihood that climate might affect all conflict cycles/phases in different ways, yet we do not know the effects of climate in regional conflict tipping, including conflict spill over and the rising conflict economies across the region.

We note that the most important question for policymakers in the region is not whether climatic events contribute to conflict but whether and how such events affect all or a few stages of the conflict cycle (Vivekananda *et al*., 2019; Fisker, 2021). This means that, to better meet the information need of policymakers, there is a need for careful analyses at each conflict stage across the conflict continuum, including analyses that capture how different conflict types reinforce each other under varying climatic conditions.

It appears that authors have taken note of temperature and rainfall, including droughts, floods and heatwaves as important climate indicators. However, climate is often not well conceptualised and there is a lack of interest to delineate it as either a slow-onset event or a sudden-onset change. Slow-onset events, such as droughts, are easily noticeable in the Lake

Chad region, alongside sudden-onset disasters, such as floods, which are more readily discernible and very destructive. These events exert different influence on conflict. For example, the psychosocial discomfort and other subjective life situations droughts and hot climates create often contribute to the development and aggravation of hostile thoughts, mental disorder, maladaptive behaviour and violence (Dodgen *et al*., 2016; Hayes *et al*., 2018; White *et al*., 2023; Savelli *et al*., 2023). As a consequence, studies focusing on the region should consider delineating climate analysis along slow-onset effects and sudden-onset disasters in ways that account for country specific constraints and impact pathways.

There is currently little knowledge about how the nexus differs across Lake Chad countries and communities. It seems reasonable to assume that Chad and Nigeria, where a relatively large portion of the Lake Chad waters is currently located, might reflect a somewhat positive signal of climate conflict relations in the presence of economic and political exclusion compared to Cameroon and Niger. It also seems that some areas facing extreme droughts and desertification (e.g., Far North Cameroon) might experience less conflict if the nexus amplifies the need for survival, cooperation, delivery of humanitarian aid and other development assistance. Similarly, pastoralists might be highly vulnerable than other livelihood groups in terms of climate-induced aggressive behaviours and willingness to fight – their migratory lifestyle could mean they have poor social networks and income strategies which could fuel their motivation to fight. Diverse patterns of and exposure to climate and conflict across the region might indicate a need for differential intervention measures based on disparate local contexts. These propositions are based on Okpara (2016) whose work on climate, conflict and livelihood vulnerability acknowledges the wider regional socioeconomic contexts in which the nexus could exert differential impacts and responses.

Notably, consideration of differential nexus patterns and impacts suggests a need to also account for heterogenous fragility. Yet, it seems authors have missed to ask the question of how fragility (assessed in terms of lack of state legitimacy, capacity and authority) shapes ‘group identity/solidarity’ and differential nexus patterns and impacts. The Lake Chad region is characterised by a fragmentation of countries inhabited by groups with opposing identities, who view the Lake Chad's resources as essential assets to be captured, controlled and plundered. Groups (e.g., farmers, fishers and herdsmen) perceive their struggles for economic gains as a zero-sum game. Climate conflict impact is experienced differently by these groups, and their levels of tolerance and vulnerability vary depending on their asset holding. The mentality of "*it is our turn or right to control and rule*" is prevalent in the region. Groups do not perceive the authorities governing the assets in the region as legitimate. This motivates the formation of diverse oppositional identities to confront state authorities and undermine the rule of law. The Boko Haram sect, for example, does not accord legitimacy to the Lake Chad regional governments. This lack of legitimacy and the view of the region as a resource to be plundered exacerbate climate conflict in the area.

The inability of the states in the region to perform basic functions, such as supporting community adaptation to climate change, providing climate services, ensuring citizen security, and developing infrastructure, hinders the effectiveness of climate and peace actions. This lack of state capacity is compounded by a lack of state authority and legitimacy in the face of climatic stress, resulting in sporadic clashes, violence and rebel attacks. Insecurity is further compounded by insufficient household income, an underdeveloped private sector and an economy that is heavily dependent on climate-sensitive assets and activities. This feedback loop contributes to weak government revenues, further shrinking state capacity and authority and exposing countries in the region to socioeconomic and climatic shocks.

Some methodological approaches, such as big data analytics and machine learning, have yet to be employed in studies investigating climate conflict relations in the region. Others, such as Artificial Intelligence, geospatial techniques (such as geographic information systems and remote sensing), and predictive analytics have not been utilised, suggesting that our

knowledge of how these methods could enhance understanding of climate conflict in the area remains unclear. Additionally, "complex systems" techniques such as futures thinking, scenario design, and multifactor mapping, which can help unpack important dimensions such as the role of cognition (in relation to human thermal discomfort, mental health, and other cognitive dimensions) and maladaptation in climate conflict, have not been widely adopted. Geospatial techniques, for example, provide exceptional capabilities in spatial analysis and visualisation, offering a valuable perspective for examining the different geospatial impact dimensions of climate conflict dynamics (Kamel *et al*., 2023). Comparative case studies, historical analyses, modelling, and scenario designs enable researchers to delve into nuanced contextual factors, historical trajectories, and potential future scenarios, thereby enriching the depth and breadth of climate conflict analyses (Ide, 2017).
The apparent omission of these methodologies in the publications we reviewed highlights a crucial gap in methods as well as a promising opportunity for future methodological innovation in climate conflict research in the Lake Chad region. Integrating advanced techniques can offer a more comprehensive and nuanced understanding of the intricate connections between climate and conflict, and ultimately contribute to the refinement of strategies for conflict prevention, mitigation, and sustainable development in the area. Taken together, Table 7 provides a summary of what we don't know yet about the nexus of climate and conflict in the Lake Chad region.

Table 7. Summary: what we don't know

***Since conflict manifests as a continuum**, we don't know (i) how climatic events affect all stages of the conflict cycle and continuum; (ii) whether climatic events also introduce new forms of conflict along the conflict continuum; (iii) how climate impacts occurring in one part of the region produce conflict outcomes in another part; (iv) whether climatic events influence how different conflict types interact and reinforce one another; and (v) the role of climate in regional conflict tipping, conflict spill over and the rising conflict economies across the region.*
***Climate is often not well conceptualised** and there is a lack of interest to delineate it as either a slow-onset event or a sudden-onset disaster in a manner that reflects country specificity.*
*There is **little knowledge about how evidence of the nexus differs** across the Lake Chad countries and communities, and moreover less is known about the differential impacts of climate and conflict exposures on different livelihood groups.*
*Any consideration of differential nexus patterns and impacts would need to take account of heterogenous fragility, yet authors have missed to ask the question of **how fragility (assessed in terms of lack of state legitimacy, capacity and authority) shapes 'group identity/solidarity' and differential nexus patterns and impacts**.*
*Certain beneficial methods (e.g., big data analytics, machine learning, geospatial techniques and predictive analytics) have yet to be employed in studies investigating climate conflict relations in the region, suggesting that **our knowledge of how these methods could enhance understanding of climate conflict in the area is limited**.*

5. Conclusions and ways forward

We have reviewed published work on the nexus of climate and conflict in the Lake Chad region from a range of disciples to identify what is known and what remains unknown about the nexus. Our analysis has revealed six key areas of knowledge that provide evidence of the nexus (i.e., "what we know"), which are summarised in Table 6. Additionally, we have outlined what we don't know yet and what we need to know to deepen our understanding of the nexus, (presented in Table 7).

The value of this study lies in the creation of a structured, interdisciplinary knowledge base on climate conflict to foster collaborative learning and cross-sectoral exchanges in the Lake Chad region and beyond. Our core 'ways forward' questions in relation to the findings in Section 3

and discussion in Section 4 are: *How do we best utilise the available evidence, and how do we make the unknown known to support efforts towards joint climate resilience and sustainable peace?*

In addressing these questions, we note that solutions that account for the interplay of climate and conflict are emerging (e.g., peace-centred and climate-compatible development through livelihood rehabilitation and environmental stewardship), but it is currently difficult to determine their precise impacts. To better maximise current evidence and *make the unknown known*, we argue that there is a need to combine methods, theories and transdisciplinary approaches from multiple knowledge systems and *'ways of knowing'*. This can happen through collaborative work between environmental and social scientists, mediators, peace actors, humanitarian agencies and policymakers. Encouraging 'knowledge co-creation' (e.g., by using citizen labs) can help integrate fragmented knowledge into a unified, coherent and verifiable body of evidence.

Notably, there is a need to identify the most promising solutions for long-term transformation and peace, and determine how to move them forward. There is also a need to understand how policymakers are utilising existing evidence and the best ways to collaborate with them to creatively address the compounding threats of climate and conflict simultaneously. This involves not only building strong administrative systems but also demonstrating political will and making the necessary choices to drive the required changes. It is important to recognise the positive aspects of the current situation, such as how climate could serve as a catalyst for prosperity and peacebuilding efforts, including how it can better create opportunities for peace education, collaboration and policy development.

Ultimately, transforming any fragile region such as the Lake Chad region will require a combination of context-specific environment, security and development actions – that is, actions that are long-term in design and that span multiple generations rather than a single event. Certain pivotal events, such as changes in leadership and financing for climate and peace, can present opportunities for citizens and the elites to recognise and pursue transformative change, making it easier for the region to escape the climate-fragility-conflict trap. Pivotal events present several opportunities for both international actors and governments to implement needs-based strategies focused on achieving "quick wins", such as peace-promoting investments and climate-resilient entrepreneurial initiatives and other actions that can lead to visible, immediate, rapid and significant improvements for the region.

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