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Water and Communal Conflict: A Review of the Literature

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ABSTRACT

Climate change increasingly shapes how groups share—or fight over—water-dependent resources. Synthesizing 235 peer-reviewed studies published between 1980 and 2022, this article clarifies when water scarcity fuels communal conflict and when it sparks cooperation. Rather than treating water scarcity as a purely physical condition, the review conceptualizes it as a socially and politically mediated process that shapes, and is shaped by, access, governance, and inequality. Evidence is concentrated in farmer–herder settings across 30 countries, yet more than half of all work focuses on five African nations and relies on single-case designs. The analysis shows that water scarcity alone rarely drives violence. Instead, outcomes depend on how water and water-dependent resources are accessed, governed, and contested across social and institutional settings. Water governance thus emerges as a central arena of power and social justice, shaping whether environmental stress produces conflict or cooperation. The same shocks foster negotiation over water resources when customary rules remain legitimate and include marginalized users. For practitioners and policymakers, strategies like conflict-sensitive adaptation, fostering institutional pluralism, and implementing early-warning systems that integrate climate forecasts with social indicators may transform water stress into opportunities for collaboration rather than sources of confrontation.

This article is categorized under:

Human Water > Water Governance

Human Water > Methods

Water and Life > Conservation, Management, and Awareness

1 | Introduction

Escalating hydrological stress and the growing volatility of rural livelihoods have propelled local disputes over water, pasture, and related natural resources from the margins of scholarly concern to the center of debates on security and sustainable development. Environmental change has been linked to conflict, and to much lesser extent with cooperation. Research in this field falls into two broad categories: case-based studies that delve deeply into specific instances of water-related conflict, and large-N statistical analyses that explore overarching patterns across numerous cases. While both approaches provide valuable insights—case studies highlight localized dynamics such as migration or grazing rights, and large-N analyses identify broader trends—there remains limited integration between these two perspectives. This review bridges that divide by demonstrating that such conflicts arise not simply because of physical scarcity alone (i.e., not enough water), but as the outcome of social and political conflicts over how the resource is managed.

This review addresses a significant gap by focusing more comprehensively on communal-level conflict and environmental

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scarcity related to water resources. First, there is a vast range of reviews that deal with climate change and conflict patterns more generally (Ide 2017; Kim and Garcia 2023; Koubi 2019; Mach et al. 2019; Scartozzi 2020; van Baalen and Mobjörk 2018). Other reviews on water more broadly focus on transboundary cooperation, typically treating water as a strategic resource managed by governments, or on large-scale climate variability (Bernauer and Böhmelt 2020; Turgul et al. 2024). As a result, the local, communal dimension remains relatively underexplored within these broader streams of scholarship. Scholars have produced valuable regional review pieces on pastoralist conflict. Those by Brottem (2020) and Seter et al. (2018) contribute valuable insights, yet they focus on specific regions or livelihood systems. The knowledge base around these types of conflicts and the potential for cooperation remains therefore somewhat fragmented, also limiting its potential policy impact due to disciplinary divides and geographic gaps. This review seeks to address these challenges.

To capture the full disciplinary and regional breadth of scholarship, a search of Web of Science, Scopus, and Google Scholar was conducted using a Boolean expression that paired water-related keywords with terms for communal actors and conflict processes. After duplicate removal and a three-stage screen, 235 peer-reviewed publications spanning 1980–2022 met the inclusion criteria. Each was coded for method (single case, comparative case, or large-N statistical), study area, first-author affiliation, and up to five water variables, creating a dataset that permits both quantitative trend analysis and qualitative thematic synthesis. In doing so, the paper maps the evolution of a field that has grown from isolated case reports into a multi-method domain producing more than 25 new studies per year.

The remainder of the article proceeds as follows: Section 2 details the search and screening protocol; Section 3 traces publication and methodological trends; Sections 4.1–4.7 distil key thematic findings on scarcity, governance, power, livelihoods, wellbeing, and critical complexity; and Section 5 outlines an agenda for future research that moves beyond deterministic scarcity narratives toward integrative frameworks that recognize the political economy of water in communal settings.

1.1 | Definitions: What Is Communal Conflict?

This research reviews literature from diverse fields (political science, geography, anthropology, and environmental studies among others) where key concepts often carry different meanings. To maintain analytical coherence across diverse literatures, this review applies these terms consistently rather than adopting field-specific definitions. Consequently, several concepts are operationalized somewhat broader to ease the comparisons across these disciplines. Starting with *water* which covers groundwater abstracted via boreholes and wells, surface flows regulated by dams and irrigation schemes, and the moisture that sustains rangelands. This recognizes that in dryland socio-ecologies pasture itself is often the most salient embodiment of hydrological variability.

This paper refers to communal conflict as "organized, collective contention between two or more informally structured non-state groups that mobilize around a shared identity, such as ethnicity, clan, religion, lineage, or livelihood". It is important to note that in this context, "non-state groups" does not refer to highly organized non-state armed groups such as insurgent movements or militias, but to livelihood-based and community actors such as farmers, herders, fishers, and similar groups, whose level of organization is typically informal and locally embedded. While group networks can be local, they can span widely within a country or even reach across a national border.

In this review the primary resource of concern is water and water-dependent assets (wells, boreholes, floodplains, pasture, among others). Communal conflicts tend to be confined to specific localities and can re-emerge periodically between the same groups, reflecting cycles of tension and temporary resolution rather than continuous territorial spread. The definition of "conflict" varies not only across disciplines but even within single studies. Some studies treat conflict as a "conflict of interest" (e.g., over access to pasture) without implying any use of threats or force. Such conflicts can be considered as part of human interaction and can provide the basis for finding solutions to resource sharing. Yet, other studies define conflict specifically as the use of violence. Therefore, in this review, *communal conflict* may range from intimidation and crop destruction to violent clashes, yet even those latter cases remain analytically distinct from civil wars and interstate disputes. However, actors in communal conflicts may be recruited by, collaborate with, or overlap with parties in more formally organized armed struggles (Benjaminsen 2008; Brosché and Elfversson 2012; Smidt 2019; van Baalen 2024). While such overlaps blur conceptual and methodological boundaries, maintaining clear distinctions remains analytically useful—even as some scholars criticize them (Watson 2023). Building on this, this paper navigates a middle path: recognizing the heterogeneous manifestations of communal conflict while distilling the shared features that justify treating it as a coherent analytical category.

The definition above remains aligned with conflict research which often relies on dataset categories, notably ACLED (Raleigh et al. 2010) and UCDP (Davies et al. 2024). The definitional approach used here broadly follows the same general logic as these datasets in distinguishing communal from civil or interstate conflict, but it applies this distinction more flexibly. Included are studies that analyze both violent and non-violent disputes over water and pasture among community actors, regardless of whether they meet formal dataset thresholds for organization or intensity. The UCDP non-state conflict category records armed contests between non-state actors that cause at least twenty-five battle-related deaths in a calendar year (Sundberg et al. 2012), while ACLED uses the term "identity militias" referring to "groups organized around a collective, common feature, including: community, ethnicity, region, religion, or—in exceptional cases—livelihood" (ACLED 2024). These categories provide important baselines for systematic analysis, but they may inevitably exclude many politically salient yet non-fatal acts—for example, blocking livestock corridors, sabotaging pumps, or destroying wells. Thus, these categories can be seen as empirical lenses useful for detecting broad patterns while limiting the analytical scope.

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Throughout this review, *governance* is understood as both the management of natural resources and the social and institutional structures that enable such management (Bodin and Crona 2009). In this sense, governance encompasses formal institutions, customary norms, and the power relations that determine who can access, use, and control water and water-dependent resources. Institutional capacity refers to the ability of these governance arrangements to enforce rules, resolve disputes, and adapt to changing conditions (Ostrom 1990; Lund 2008).

Finally, disaggregating communal conflict into sub-types (e.g., farmer-herder clashes, cattle raiding, or vigilante action) is crucial because each follows distinct seasonal logics and conflict-management pathways. This heterogeneity becomes especially relevant when linking conflict dynamics to water availability, infrastructure, and governance, themes that recur throughout the review. Rather than assuming that water scarcity leads to violence, this review builds on a growing body of work showing that such links are always contingent on governance, inequality, and social context.

2 | Review Methods

This review applies systematic search and screening procedures to produce a comprehensive overview of scholarship that links communal conflict to water resources. All database queries and the initial screening were completed on August 2, 2022.

2.1 | Search Strategy and Selection of Material

Searches were conducted in Clarivate Web of Science [WoS], Elsevier Scopus, and Google Scholar. While Google Scholar indexes some gray literature, it was included here primarily to capture peer-reviewed articles that may not be indexed in the commercial databases, particularly those published in regional journals or interdisciplinary outlets. Consistent with *WIREs* guidelines, only peer-reviewed studies were retained. The same search string was applied to ensure comprehensive coverage, as each database indexes partly overlapping but not identical sets of journals. Using several databases therefore minimizes the risk of missing relevant peer-reviewed studies. The following Boolean search string was used uniformly across the three sources:

> (water* OR groundwater OR drought* OR river* OR rainfall OR precipitation OR borehole* OR flood* OR "climate change") AND (conflict OR disputes OR violence) AND (communal OR pastoral* OR nomad* OR "farmer-herder" OR herder).

In WoS all available sub-databases and the full temporal range were included. WoS and Scopus searches were restricted to the *title, abstract, and keyword* fields. Google Scholar results were ordered by relevance, and the first 50 records were exported, after which additional results yielded few novel, eligible studies. The search-and-screen cycle was iterative: whenever new keywords emerged during reading, they were tested until no further relevant items appeared. The combined search yielded 733 records, 683 from WoS and Scopus and 50 from Google Scholar. Screening proceeded in three stages. First, records that were inaccessible, duplicates, or not available in English were removed automatically. Second, titles and abstracts were read to exclude studies clearly unrelated to the topic, such as research on water-borne disease, medical treatment evaluations, wildlife conflict, or literature studies. Third, the remaining articles were comprehensively examined and publications without a demonstrable link between communal actors and water resources (e.g., governance studies that did not feature a water component) were discarded.

The principal inclusion criterion required that a study examines communal actors (for instance farmers, herders, or other non-state groups) in relation to access to—or disputes over—water-related resources. Research that treated water as an explanatory factor in communal conflict, even if only indirectly, was retained. After the screening, 235 peer-reviewed publications met all criteria (see list included as Supporting Information). To ensure that the narrative synthesis captures recent developments, additional papers known from domain expertise and those published after the search date were consulted; however, all quantitative summaries reported below draw exclusively on the systematically derived corpus.

For each included study three elements were recorded: (i) the methodological approach, distinguishing single-case, comparative-case, and large-N statistical designs; (ii) the study area; (iii) the institutional country of the first author; and (iv) up to five water-related variables (e.g., drought, groundwater, or floods) that capture the breadth of water issues discussed.

2.2 | Limitations

The review remains subject to several limitations. First, it does not employ blind double-coding. Second, gray literature (particularly NGO reports and think-tank assessments) was excluded, potentially omitting valuable practical insights. Third, chapters in edited volumes are not always indexed in bibliography databases and may therefore be underrepresented. Fourth, the search was limited to English-language publications, omitting studies in Spanish, Portuguese, Russian, and numerous local languages and thereby introducing potential geographic and cultural biases.

3 | General Trends

Over the last four decades, research on communal conflict and water resources has gradually evolved into a more established literature. During the 1980s and 1990s, only a small number of articles—primarily descriptive accounts of local disputes—were published each year. It was not until the mid-2000s that the field began to see notable growth, with the annual number of publications increasing from around three to eight between 2005 and 2009 (compare Figure 1). By 2010–2015, the output had doubled again, reaching the tens per year, and since 2016, the field has seen consistent growth, with publication counts exceeding 25

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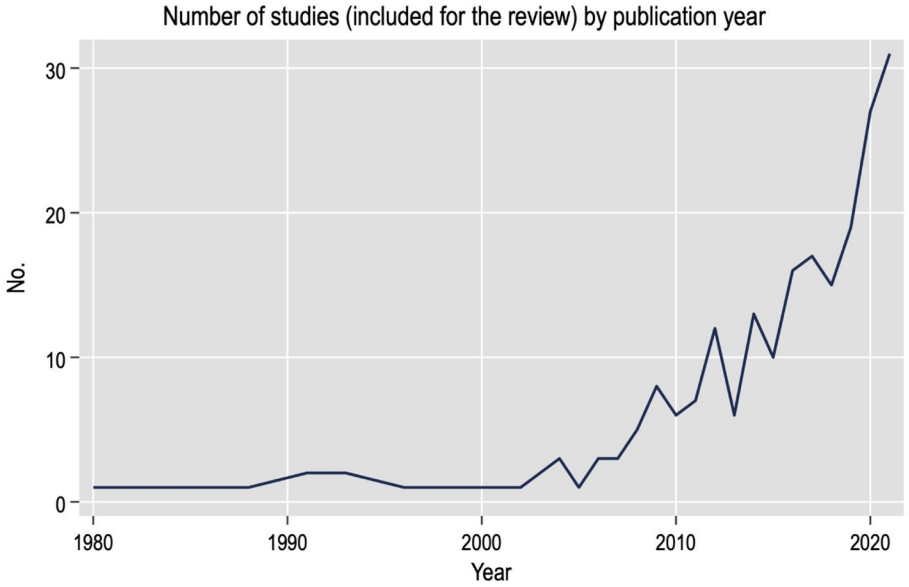

FIGURE 1 | Reviewed articles by publication year (1980–2021).

annually and peaking at 31 articles in 2021. This reflects a steady rise in academic interest and contributions to understanding the relationship between water-related communal conflict and cooperation dynamics.

The reviewed research spans several disciplinary traditions and therefore a diversity of research approaches. Quantitative political science and economics studies typically use event or survey data to examine institutional drivers of conflict; anthropology, geography, and qualitative political science emphasize ethnographic depth and local governance arrangements; while hydrology and environmental science focus on water availability and land-use change. Increasingly, these strands intersect through mixed-method and cross-disciplinary collaborations, reflecting a gradual convergence between social and environmental approaches to communal resource governance.

Methodologically, the reviewed literature is still dominated by in-depth case studies. Of the roughly 235 articles, about 62% rely on small-n, often qualitative, case analyses—typically focusing on a single river basin, one herder group, or conflict episode. These case studies provide rich descriptions of how water scarcity or governance failures precipitate local clashes such as grazing-land encroachments or drought-induced cattle raids in the Sahel. Only about 15% represent large-N observational designs with cross-case (often cross subnational units) regressions linking rainfall or other water-related variables to recorded conflict events, or multi-year surveys of pastoralist households across regions. Another 8% combine qualitative and quantitative approaches (e.g., site-specific fieldwork paired with district-level statistical modeling). The remaining 15% consist of reviews, theoretical pieces, or secondary analyses that do not introduce new empirical data.

Overall, the literature very much reflects the cross-disciplinary aspect of this type of research. This field clearly spans across various disciplines. The reviewed studies are from journals within anthropology, environmental science, hydrology, political science, or sociology, to name a few. Taken together, these summaries reveal two overarching patterns. First, the wide application of case studies shows the field's initial emphasis on understanding the granular dynamics of water-related disputes. These involve identifying the actors involved, tracing the buildup (and breakdown) of local institutions, and unpacking how cultural norms mediate access to shared resources. This emphasis has yielded a literature that is exceptionally rich in contextual nuance, yet perhaps offers less generalizability. Second, although large-N observational studies have proliferated in the past decade, they still constitute only a modest share of the corpus. Consequently, many broad patterns, such as extreme weather variability on conflict frequency across different ecological zones, are only beginning to be tested systematically.

The progress on large-N studies is further constrained by data limitations. Systematic information on communal interactions is scarce for both cooperative and conflictual events. High-quality, sub-national datasets on cooperation are almost nonexistent, in part because non-violent resource-sharing arrangements rarely attract media coverage and therefore escape event-database coders (Bernauer and Böhmelt 2020; Döring 2020b). Conflict datasets face analogous challenges: many clashes are non-fatal and thus fall outside the scope of projects such as UCDP, while others occur in media-poor environments and are consequently under-reported (Croicu and Eck 2022; Dietrich and Eck 2020; Öberg and Sollenberg 2011). These blind spots hamper efforts to subject theoretical claims to rigorous, large-scale testing. Even so, the growing adoption of mixed-method designs and interdisciplinary collaboration would suggest that the evidentiary base will broaden in the coming years. This would entail triangulating ethnographic depth with remotely sensed environmental indicators, household surveys, and event records, and promises a more generalizable understanding of the conditions under which water stress produces conflict and cooperation.

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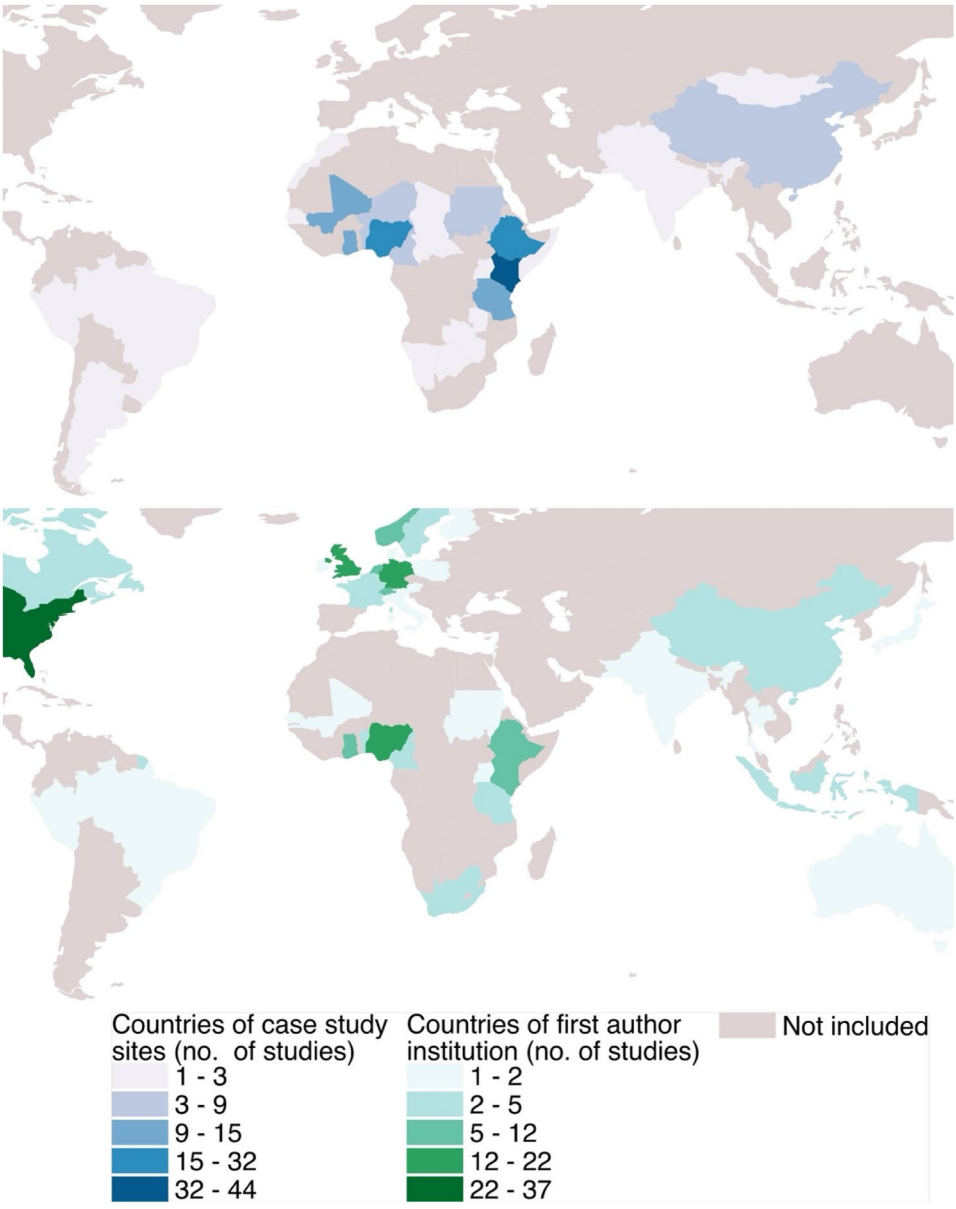

FIGURE 2 | Countries of case study sites and first author institutions.

3.1 | Geographic Focus of Research Under Study

The two maps in Figure 2 capture different dimensions of the reviewed studies. The first shows countries where case-based studies were conducted, while the second reflects the institutional affiliation of first authors. These patterns do not necessarily overlap because some publications are comparative, non-case-specific, or based on global or regional analyses that are not tied to a single study site.

The study-region data encompass 30 distinct countries, with a pronounced concentration in Sub-Saharan Africa. At the top of the list is Kenya (44 studies), followed by Nigeria (32), Ethiopia (27), Tanzania (15), and Ghana (14). Together, these five countries account for nearly half of all case studies, underscoring the extent to which water-related communal conflicts have been empirically investigated in East and West African contexts. Beyond Africa, South Asia appears modestly represented: India (3 studies) and Pakistan (1 study) each feature, while Afghanistan (1 study) also appears, reflecting some attention to pastoralist or farmer–herder tensions in that region. A handful of Latin American cases—Brazil (2), Argentina (1), and Peru (1)—indicate limited engagement with South American contexts.

Several striking blind spots emerge from these country-level counts. These are also largely in line with more general selection biases documented in the climate-conflict literature (Adams et al. 2018; von Uexkull and Buhaug 2021). First, Western Asia is almost entirely absent: neither Yemen, Iraq, nor other countries from the Arab region appear, despite documented pastoralist conflicts over dwindling water supplies in those regions (Ide 2015). Central Asia is also missing entirely; for example, Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, and Turkmenistan do not appear as study sites, even though transhumant herding and water-sharing disputes are historically significant there. In Latin America, despite major tensions

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in Andean and Patagonian pastoralist contexts, countries like Chile, Colombia, and Mexico are unrepresented, and only minimal coverage exists for Brazil, Argentina, and Peru. Within Africa itself, North African countries such as Algeria, Morocco, and Sudan's neighbors (e.g., Libya) do not appear; remarkably, Egypt is absent despite its Nile-dependent herding communities. Furthermore, Madagascar's absence highlights that even island nations with substantial pastoralist or agro-pastoralist populations are being overlooked. Moreover, while India and Pakistan surface, their counts are low relative to the scale of farmer–herder disputes in those countries, suggesting under-sampling of South Asian cases. These gaps suggest that research may overlook critical water-resource conflicts in areas where diverse livelihood systems (pastoral, agricultural, or mixed) intersect with communal tensions. East and Southeast Asia are likewise scarcely represented, suggesting that language and indexing biases, rather than a lack of relevant research, partly explain their absence. However, this pattern likely reflects the review's focus on peer-reviewed, English-language sources indexed in major databases, which may omit some regional research. Although regional concentrations are evident, thematic patterns tend to cut across geography: East African studies often emphasize mobility and local governance, while West African work more frequently links water and land-tenure politics. Beyond Africa, the limited number of cases precludes strong regional generalizations.

3.2 | Geographic Variation in Author-Affiliation

The author-affiliation data covers 39 distinct countries. Because the method is necessarily simplified, affiliations are assigned according to the country of the first author's institution. Of course, this may not reflect an author's country of origin: many scholars study their home countries while working abroad. In addition, articles often have multiple authors, with second or third authors based elsewhere. Still, this approach offers a reasonable picture of where research is conducted. The top five countries represented are the United States (37 articles), Germany (22), Nigeria (17), the United Kingdom (16), and Ethiopia (12). Three of these—the United States, Germany, and the United Kingdom—are in the so-called Global North (North America and Western Europe), reflecting well-resourced research institutions. Nigeria and Ethiopia, by contrast, are in the so-called Global South (West and East Africa), signaling growing scholarly attention from African institutions to communal conflict and water-resource issues. Together, this blend of affiliations highlights both established research centers and emerging contributions from regions most directly affected by farmer–herder dynamics and water-related pastoralist livelihoods.

There are nonetheless clear geographic blind spots here as well, that is, in who is producing and publishing research on communal conflict and water resources. For instance, despite the prominence of scholars from the United States, Germany, Nigeria, the United Kingdom, and Ethiopia, there are virtually no first authors based in South Asia or Latin America, nor from West Asia (e.g., Yemen, Iraq) or Central Asia (e.g., Kazakhstan, Kyrgyzstan). Even within Africa, aside from Nigeria and Ethiopia, countries in the Sahel (such as Mali, Niger, Chad) and the Horn of Africa (such as Somalia, Sudan) are underrepresented among first authors, despite those regions' well-documented water-related conflicts. This distribution suggests that certain regional perspectives, especially voices from areas where pastoralist or farmer–herder tensions are acute, may be missing from the literature, clearly limiting the range of case studies, local knowledge, and policy insights that inform our understanding of water-related communal dynamics.

4 | The Role of Water in Communal Disputes

Water plays a central but multifaceted role in communal disputes, particularly in agro-pastoral and pastoral regions where access to water is both a livelihood necessity and a source of contention. Unlike generalized narratives of scarcity, the dynamics of conflict and cooperation are shaped by how different types of water—groundwater, surface water, and rainfall-dependent pasture—are accessed, governed, and distributed. The following sections examine governance, institutional adaptation, and livelihood strategies in relation to water-related conflict and cooperation.

While not a water source per se, pasture is perhaps the most critical indirect expression of water availability in pastoral systems. Its regeneration depends almost entirely on rainfall, making access to quality pasture fundamentally tied to hydrological cycles. In drought years, the decline in pasture quality and quantity pushes pastoralists to migrate longer distances, often into contested agricultural zones or across administrative borders. In many areas in the Sahel, these movements can lead to frequent tensions with settled farmers, conservation or industries, especially when mobility routes are blocked or pasture is degraded by overuse or conversion to cropland (Asrat and Anteneh 2020; Behnke et al. 2020; Brottem 2014; Brottem et al. 2014; Houessou et al. 2019). Importantly, rainfall variability affects not just mobility but also livestock health, reproduction rates, and market dynamics, making pastoralist wellbeing acutely sensitive to both seasonal patterns and long-term climate shifts (Bah et al. 2006; Balehegn et al. 2022; Coughlan De Perez et al. 2019). Although boreholes and fodder conservation can help bridge dry-season feed gaps, they are no substitute for predictable and equitable access to pastureland. In this way, rainfall operates as both a biophysical and socio-political driver of resource access, shaping the conditions under which cooperation or conflict over pasture emerges (Döring and Mustasilta 2024; McCabe 2004; Pas 2018; Turner et al. 2014).

Access to groundwater, through boreholes, dug wells, and mechanized pumps, has become increasingly crucial to pastoralist and agro-pastoralist livelihoods, particularly in arid and semi-arid regions where surface water is unreliable. Boreholes and wells offer more permanent sources of water, enabling year-round livestock rearing, but they are also deeply political technologies. The drilling of boreholes, often facilitated by state or development actors, has altered traditional mobility patterns by encouraging sedentarization and creating resource clustering that intensifies competition. In contexts where customary water access has been governed by negotiated social norms, the shift to fixed, state-managed or privately controlled water

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points has sometimes weakened local institutions and sparked disputes over use rights. Moreover, elite capture of borehole infrastructure—through capital-intensive investments in motorized pumps—can exclude poorer herders, reinforcing socio-economic inequalities and exacerbating vulnerability during dry spells (Akall 2021; Benjaminsen and Ba 2009; Beyene and Korf 2012; Bhalla et al. 2024).

Surface water (i.e., rivers, streams, ponds, and seasonal floodplains) continues to be a critical but contested source of water in many agro-pastoral zones. Large-scale irrigation schemes and dam projects often reallocate surface water from traditional users, such as pastoralists and smallholder farmers, toward commercial agriculture or hydropower production. This shift can generate profound local-level tensions, particularly when floodplain ecologies are disrupted and traditional land uses are displaced. In the Sahel and East Africa, for instance, the construction of dams has reduced the flooding of key ecosystems, undermining both flood-recession farming and grazing, and increasing competition between fishers, herders, and farmers (Delclaux et al. 2010; Hodbod et al. 2019; Kpera et al. 2012; Okuku et al. 2016). Small-scale irrigation schemes also present points of contention, especially when formalized water allocations bypass customary dispute resolution mechanisms or fail to account for seasonal variability in water availability (Akuriba et al. 2020; Carney 1993; Mbonile 2005; McKune and Silva 2013). Even when such systems provide tangible benefits, their operation must navigate a mosaic of competing claims, highlighting the need for inclusive, context-specific governance frameworks that recognize the varied and sometimes conflicting ways users engage with and value water resources (Abrahams 2020; Naiga 2021; Olumba et al. 2022).

Climate change intensifies the pressures on all forms of water access—groundwater, surface water, and pasture—by amplifying environmental variability and stressing already fragile livelihood systems. Rising temperatures and shifting rainfall patterns increase the frequency and severity of droughts, which in turn elevate demand for groundwater while reducing its recharge rates (IPCC 2022). In many regions, boreholes drilled to buffer against rainfall shocks are overexploited or poorly maintained, leading to breakdowns that disproportionately affect marginalized users (Detges 2016; Döring 2020a; Okpara et al. 2017; van Weezel 2019). Surface water sources such as rivers and floodplains are also highly vulnerable to changing precipitation regimes and upstream dam regulation, with drier years reducing flow volumes and wetter years producing unpredictable flooding, both of which disrupt established usage patterns (Coughlan De Perez et al. 2019; Nordkvelle et al. 2017; Okuku et al. 2016). Meanwhile, pasture conditions—tied closely to seasonal rains—become more erratic, shortening grazing periods, delaying regeneration, and forcing pastoralists to travel further in search of viable rangeland (Brottem 2016; Fjelde and Von Uexkull 2012; Kongnso et al. 2021). These compounded stressors create a more volatile environment for negotiating access, heightening the potential for local disputes, particularly when institutional mechanisms are weak or exclusionary (Benjaminsen and Lund 2002; Beyene and Korf 2012; Linke et al. 2015). As such, rather than acting as a direct cause of communal conflict, climate extremes seem to be a catalyst for worsening existing vulnerabilities in water-dependent systems.

4.1 | Resource Scarcity, Environmental Change, and Access to Water

Access to water, and by extension, to productive pasture, is a foundational concern shaping communal relations, livelihoods, and patterns of conflict in many agro-pastoral regions. Considerable attention has been given to exogenous shocks that create water scarcity, for example, through prolonged droughts, diversion through dams, or limited access through security concerns. Early studies often framed scarcity as a direct trigger of conflict, but more recent research emphasizes that environmental stress interacts with political and institutional conditions rather than determining outcomes. A more common view that has emerged in recent scholarly work argues that disputes over access to renewable resources rarely trigger violence directly. Instead, worsening environmental conditions tend to heighten competition at the local level, but whether this leads to violence depends heavily on the existing power relations among rural groups and their ability to negotiate access. In many settings, access to land and water resources is shaped less by formal government policy and more by these local power dynamics. Thus, while exogenous shocks create pressures, their impact is mediated by socio-economic factors and the broader context of marginalization and inequality.

Communal disputes over water are deeply entangled with broader questions of land tenure, climate variability, and social grievance. In this sense, pasture access cannot be analytically separated from water access: in dryland systems, rainfall determines both, and most conflicts around "land" are ultimately about water-dependent productivity. Seasonal changes in pasture quality and the spatial distribution of water points create predictable pressures and patterns of movement (Brottem et al. 2014; Houessou et al. 2019; McCabe 2004; Schnegg and Kiaka 2019). In Niger, the expansion of irrigated gardens around seasonal lakes enclosed shared floodplains, restricting pastoral mobility and triggering recurrent disputes between gardeners and herders over lost watering points (Snorek et al. 2014). Disputes therefore tend to intersect with issues of migration (a fundamental adaptation mode for many pastoralists), local and national governance, and patterns of marginalization. For example, while pastoralists often move to areas with more favorable vegetation to avoid direct land conflict (Lenshie et al. 2020), such movements may generate new tensions elsewhere (Döring and Mustasilta 2024). The role of governance is discussed in more detail in the next section; however, it is important to stress that any group competition over water and pasture depends critically on governance arrangements and the degree of socio-economic marginalization (Balestri and Maggioni 2017; Benjaminsen et al. 2012; Detges 2014; Fjelde and Von Uexkull 2012; Linke et al. 2015; Linke and Tollefsen 2021; Petrova 2022; Vestby 2019). Thus, subsequent arguments presuppose contested, unequal governance over communal resources. Historical land and water regimes often shape how scarcity is experienced and politicized. In regions where colonial boundaries or conservation zones restricted pastoral mobility, present-day drought and land transformation are frequently interpreted through long memories of exclusion.

Recurring droughts, erratic rainfall, and environmental hazards directly undermine water availability, leading to delayed

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planting, poor crop development, low pasture regeneration, and ultimately heightened food insecurity. Studies from Nigeria, Cameroon, and Ethiopia report that both pastoralists and farmers identify shrinking arable and grazing land and competition over water as key drivers of recurrent confrontations (Asrat and Anteneh 2020; Awazi and Avana-Tientcheu 2020; Lenshie et al. 2020). Environmental shocks such as drought are often more damaging for pastoralists, whose livelihoods are closely tied to both water and pasture access (Ali 2019; Anderson et al. 2021; Kongnso et al. 2021). In semi-arid and arid regions, the sequential occurrence of climatic extremes can severely undermine pastoral sustainability by causing livestock losses, diminishing incomes, and amplifying vulnerability (Schilling et al. 2015; Wennström 2024; Witsenburg and Adano 2009). Pasture is essentially a water-dependent resource, and its availability is determined by rainfall patterns. For many, the decline in pasture quality or availability is indistinguishable from water scarcity itself. In times of drought, competition for both pasture and water intensifies, leading to seasonal migration and, in many instances, scholars have argued this can explain clashes between groups over these increasingly scarce resources (Fjelde and Von Uexkull 2012; Lengoiboni et al. 2010; Schwarz et al. 2022; Seter 2016; von Uexkull and Petterson 2018).

While resource scarcity, particularly of water and pasture, is often cited as a key cause of communal conflict, more recent analyses caution against simplistic "scarcity equals conflict" narratives. Indeed, many studies cited in this review find that environmental stressors are *insufficient on their own* and matter primarily in combination with political and social drivers. Instead, it is the interaction between scarcity and political, institutional, or social dynamics that often determines outcomes (Benegiamo 2020; Benjaminsen et al. 2012; Brottem 2014; Usman and Nichol 2022). For example, some regions facing severe rainfall variability do not experience violent conflict if effective institutions or coping mechanisms are in place, while others with comparable or lesser environmental stress see more violence due to governance failures, power imbalances, or social marginalization (Benjaminsen et al. 2009; Benjaminsen and Ba 2009; Brottem 2020; Seter et al. 2018). Water and pasture scarcity create conditions for conflict, but it is the interaction with social and political structures that ultimately drives it.

Resource scarcity linked to water can lead directly to food insecurity, declining livestock productivity, and increased vulnerability for both farmers and pastoralists (Anderson et al. 2021; Lawson et al. 2014; Nnaji et al. 2022; Nnaji et al. 2023). These impacts are often compounded for marginalized or less-resourced groups, whose coping capacities are weakest (Ahmad and Afzal 2022; Beyene and Korf 2012; Kongnso et al. 2021). Governance and institutional capacity are important not just for managing access, but for ensuring that disputes over water and pasture do not undermine broader wellbeing. There is significant evidence that robust, trusted local institutions—including customary authorities and religious organizations—are often more effective at resolving water disputes peacefully than central authorities, particularly where there is higher community trust (Brosché and Elfversson 2012; Cao et al. 2018; De Juan 2015; Greiner 2013; Krause 2018; Mustasilta 2020; Petrova 2022; Wig and Kromrey 2018). Thus, resource scarcity and environmental change, especially as they impact access to water and pasture, remain central to communal relations and conflict. However, the literature consistently shows that environmental drivers alone rarely determine outcomes: social, political, and institutional contexts shape whether scarcity leads to conflict or cooperation.

4.2 | Institutions and Governance

Communal conflicts over water and pasture do not stem solely from physical scarcity; instead, they are shaped by the ways institutions, both formal and informal, allocate, regulate, and contest these resources. Scholarly debates in this area have shifted from whether scarcity causes conflict to how governance and inequality shape divergent outcomes. In many contexts, political and economic elites capitalize on ambiguous property rights to entrench power and redirect grievances. For example, in Nigeria, local chiefs and business elites have financed herdsmen militias to serve electoral and commercial agendas, turning water and grazing disputes into strategic levers of influence (Ajala 2020; Babatunde and Ibnouf 2024; Okoli and Ogayi 2018). In Sudan, connections between large-scale farmers and state authorities have legalized land acquisitions that marginalize pastoralists, triggering cycles of violent resistance and retribution (Sulieman 2015). Clearly, any types of identity framing can upscale local disputes or titling into wider security contests, as such disputes' labels can travel through local authority networks or across borders.

Land use change and interventions such as dam construction, privatization of land, and the fencing of communal grazing areas often make it even harder for people to access water and pasture. In many cases, these changes are more disruptive than shifts in climate alone. Such interventions frequently benefit wealthier or politically connected groups, leaving less land available for mobile pastoralists and deepening inequalities (Adugna 2011; Akall 2021; Kamara et al. 2005; Unks et al. 2019). Conflicts often arise when new property rights or water policies override established local or customary arrangements (Benjaminsen and Ba 2009; Boone 2014; Katusiime and Schütt 2020; Lund 2008; Turner and Moumouni 2018). Crucially, government intervention—whether impartial or biased toward a specific group—plays a pivotal role in either mitigating or exacerbating disputes over resources (Brosché 2022; Elfversson 2015; Klaus 2022; Krause 2018). On top of this, ecological changes like the spread of invasive species or new dams can disrupt access to water, adding further pressure and new kinds of disputes (Ayeni et al. 2019; Delclaux et al. 2010).

Across much of the literature, several studies indicate that institutional reforms over land access often inadvertently dismantle customary safety nets. Eastern Ethiopia's land-tenure changes transformed communal water points into privatized assets, shifting upkeep burdens onto rural households while enriching some elites; this fragmentation undermined long-standing drought-sharing arrangements and heightened vulnerability for poorer herders (Beyene and Korf 2012; Bogale and Korf 2009). Yet, where customary councils remain cohesive, for instance if backed by locally respected elders and flexible dispute-resolution norms, these institutions are able to absorb stress and preserve

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inclusive governance, even amidst official privatization drives (Hendrickson et al. 1998; Hodbod et al. 2019).

Against these top-down shifts, hybrid governance arrangements have offered promising alternatives. International NGOs and multi-stakeholder committees have facilitated resource-sharing agreements that reframe scarcity as a platform for cooperation. Negotiated pacts between herders, farmers, and fishers around agro-pastoral dams illustrate how inclusive management committees can defuse conflict and promote joint maintenance, even when initial disputes were intense (Kpera et al. 2012; Okuku et al. 2016). Participation in such governance arrangements is not evenly distributed: gendered norms and social hierarchies often limit who speaks for communities in water-management forums, affecting whose needs are reflected in institutional design. Resource-sharing agreements mediated by NGOs in other regions have likewise transformed water points into forums for interethnic dialogue and collective decision-making (Adano et al. 2012; Bond and Mkutu 2018; Okpara et al. 2017). In Benin, for instance, an INGO-mediated dam agreement helped to shift a recurrent farmer–herder dispute toward cooperative resource sharing, leading to a committee that jointly manages watering schedules and maintenance (Kpera et al. 2012).

Ultimately, regions that cultivate institutional pluralism, blending customary norms, statutory frameworks, and market mechanisms, seem to demonstrate greater resilience to environmental shocks. This means strong local governance institutions reduce the risk of water-related communal conflicts by providing clear rules and trusted dispute-resolution mechanisms (Butler and Gates 2012; Fokou 2010; Mustasilta 2020; Petrova 2022). Yet, where state capacity is limited or unevenly extended, mid-level authorities—such as district officials or local courts—may inadvertently heighten tensions by issuing decisions or laws that conflict with customary institutions or overlap with other jurisdictions (Eck 2014; Mustasilta 2019; Wig and Kromrey 2018). The effective role of customary councils and community leaders in negotiating local pacts underscores the importance of traditional resolution instruments: robust customary dispute-resolution systems have been shown to mitigate conflict escalation (Beyene and Korf 2012; Dipierri and Zikos 2020; Hoffmann 2004). Beyond these, informal authorities such as religious leaders and respected elders can galvanize nonviolent remedies and strengthen social cohesion, mobilizing collective action to manage resources without violence (Djoudi et al. 2013; Homann et al. 2008; Krause 2018). By harmonizing formal land laws with local water-sharing practices and reinforcing clear, trusted governance at every level, policy interventions can preserve adaptive networks and distribute bargaining power more evenly, reducing the likelihood that scarcity spirals into violence.

4.3 | Power, Inequality, and the Political Economy

Water-related disputes reflect and reproduce unequal power relations and economic disparities. Control over water and land resources frequently consolidates existing power hierarchies and economic inequalities. Elites often leverage political influence for their own access to water sources and fertile lands, systematically marginalizing weaker or politically less-connected groups. This includes government-supported land acquisition policies which might benefit commercial farmers but displace pastoralist communities and exacerbate ethnic tensions (Lawson et al. 2014; Sulieman 2015). In Sudan's Blue Nile region, state-backed large-scale farms appropriated communal rangelands for mechanized agriculture, displacing pastoralists and fueling cycles of resistance and retaliation (Sulieman 2015). Similarly, political elites can monopolize water points or other resources, intensifying grievances among marginalized pastoral communities and fueling confrontations (Brosché 2022; Okoli and Ogayi 2018).

The political economy of resource allocation also influences vulnerability to climate variability. Low-income groups often are more vulnerable to environmental shocks due to limited access to adaptive resources and political leverage. Marginalized pastoral communities, lacking political representation and economic capital, experience heightened vulnerability during drought periods as their water rights and access are disproportionately curtailed (Ajala 2020; Beyene 2009; Beyene and Korf 2012; Wennström 2024). Inequitable policies that favor settled agriculturalists over mobile pastoralists reinforce patterns of marginalization, leading to recurrent cycles of conflict and displacement. These inequities significantly heighten vulnerabilities to environmental shocks. Moreover, market dynamics and commercial agricultural expansion exacerbate these power imbalances, transforming communal water resources into contested commodities. Large-scale irrigation and agricultural investments, for example as witnessed in Kenya and Ethiopia, can disrupt traditional water-sharing systems, amplifying local tensions and undermining collective resource management (Bekele et al. 2021; Muok et al. 2021). Effectively addressing these deep-rooted inequalities requires targeted policy interventions that challenge entrenched political and economic structures (AU 2010). Such interventions must focus on redistributing resources equitably, strengthening inclusive governance, safeguarding customary rights, and enhancing the political voice of marginalized groups. Recognizing water governance as a critical arena for social justice and conflict resolution, rather than solely an environmental concern, is essential to mitigating conflict risks and promoting equitable and sustainable resource management. These dynamics also expose difficult trade-offs between livelihood protection and environmental conservation, as efforts to curb degradation or regulate resource use can disproportionately constrain poorer groups while privileging wealthier landholders.

4.4 | Livelihoods, Mobility, and Adaptation to Water Variability

Migration or mobility is a response to water and pasture scarcity, particularly for pastoralists who frequently move to avoid direct conflict or to find more favorable vegetation (Lenshie et al. 2020). However, such adaptive migration can generate new sources of tension in destination areas, highlighting the interconnectedness of environmental change, migration, and communal disputes.

Communal conflicts related to water and pasture resources cannot be fully understood without appreciating the critical role of livelihoods, mobility patterns, and adaptive capacities

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of affected communities. Pastoralist and farming communities respond to environmental variability and resource scarcity through diverse adaptive strategies, with mobility playing a crucial role in pastoralist livelihood resilience. Pastoralist groups commonly employ strategic migration to access geographically dispersed water and grazing resources, mitigating the impacts of drought and seasonal shortages (Muok et al. 2021; Nelson et al. 2020; Nnaji et al. 2022; Pas 2018; Schwarz et al. 2022). Land privatization, administrative boundary enforcement, and agricultural expansion severely limit these mobility options, increasing vulnerability to drought and intensifying disputes over resource access (Detges 2014; Nagabhatla et al. 2021; Nordkvelle et al. 2017; Unks et al. 2019; van Weezel 2019).

Devolution of resource access may create overlapping mandates between government agencies and indigenous communities, obstructing seasonal migration routes and igniting clashes at key water points during dry seasons (Muok et al. 2021; Nnaji 2022). Boundary remapping and devolution that ignore transhumant corridors often force encounters in more resource-scarce regions. Similar redrawing of subnational borders can obstruct transhumant corridors, forcing pastoralists and farmers into contested spaces and escalating communal tensions (Brottem et al. 2014; Houessou et al. 2020; Nuvey et al. 2021; Okaeme et al. 1988). Among Kenya's Samburu herders, shrinking access corridors and land privatization have lengthened migration routes by over 100 km, forcing herders into unfamiliar territories and heightening confrontation risks with neighboring groups (Pas 2018; Detges 2014).

Migration decisions are also shaped by identity narratives and intergroup relations. Historical displacement and perceptions of belonging can influence whether movement is seen as legitimate adaptation or as encroachment, often determining whether mobility fosters cooperation or sparks tension. Farming communities similarly adapt to environmental variability by diversifying livelihood strategies, such as integrating crop cultivation with livestock rearing, non-farm employment, and temporary migration (Dika et al. 2022; Gebeyehu et al. 2021). However, these strategies are often constrained by limited political support, economic exclusion, and inequitable governance structures, resulting in heightened vulnerability among marginalized groups during environmental crises (Adano et al. 2012; Benjaminsen and Ba 2009; Brosché 2022; Fjelde and Von Uexkull 2012; Hillesund 2017). Additionally, divergent adaptation strategies, such as agricultural expansion driven by institutional policies, may inadvertently undermine the adaptive capacities of pastoralists by encroaching on vital pasture routes and water points, thereby aggravating tensions (Snorek et al. 2014; Soeters et al. 2017).

The ability of communities to manage shared resources through cooperative mechanisms and collective decision-making significantly influences resilience and conflict outcomes. Successful examples of collaborative governance, such as community-based water committees and negotiated grazing agreements, demonstrate that inclusive resource management can stabilize livelihoods and reduce conflict potential, even in periods of acute resource scarcity (Bond and Mkutu 2018; Lengoiboni et al. 2010). Thus, recognizing adaptive strategies as critical mechanisms for conflict prevention and resilience-building is one way to support long-term stability and social cohesion, enabling communities to better navigate the complexities of environmental variability and resource scarcity.

4.5 | Nexus of Violence, Food Security, and Wellbeing

Communal conflicts over water and pasture access have profound effects on food security, livelihoods, and community wellbeing. These conflicts disrupt agricultural production and pastoralist activities, resulting in reduced crop yields, livestock losses, and constrained access to critical resources. The direct outcomes are often severe food insecurity, income loss, and deteriorating health and nutrition, particularly for vulnerable populations such as children and the elderly (Coughlan De Perez et al. 2019; George et al. 2021; Lawson et al. 2014; Pike 2004). Displacement caused by conflict is especially damaging to livelihood systems and household stability. In the Sahel, repeated displacements undermine agricultural productivity and pastoral sustainability, leaving communities trapped in cycles of diminished food access and increased dependence (Bergius et al. 2020; Beyene 2015). The breakdown of local economies and service access to healthcare, education, and markets further entrenches long-term vulnerability (Lumborg et al. 2021; Pike et al. 2016).

For pastoralists, loss of livestock during conflict or drought represents not just an economic loss, but also the erosion of a food system and a social safety net. These shocks have interrelated effects, including malnutrition, psychosocial trauma, and deteriorating household resilience (Adger 2003; Dika et al. 2022; Hendrickson et al. 1998; Tubi 2020). In some cases, conflict has weakened traditional institutions that previously supported coping and recovery, exposing communities to greater risks in future drought exposure or other extreme weather (Singh et al. 2013; Thébaud and Batterbury 2001). Environmental degradation and infrastructural destruction, often side effects of conflict, contribute to longer-term food system disruption. In some floodplain regions, climate and development pressures (e.g., dams and irrigation projects) have negatively affected food-producing ecologies and intensified resource competition between fishers, farmers, and herders (Cao et al. 2020; Delclaux et al. 2010; Kpera et al. 2012; Okuku et al. 2016).

The nature of conflict itself, whether protracted or episodic, civil war related or intercommunal, further shapes its outcomes. Many areas that see communal violence are nearby areas affected by civil wars (Brosché and Elfversson 2012; Döring and Mustasilta 2024; UNECA 2017). Prolonged or cyclical violence tends to cause structural changes in land use and livelihood systems, while sudden, high-intensity clashes often produce acute humanitarian crises (Vesco et al. 2025). Some conflicts, particularly those involving politicized narratives or ethnic mobilization, can entrench divisions, making future cooperation over resources more difficult (Benjaminsen et al. 2009; Bollig 1993; Brosché 2022; Young and Ismail 2019). Moreover, the use of violence to secure or deny access to water infrastructure—such as wells, pumps, or dams—can have strategic and symbolic dimensions, which deepens grievances and creates lasting scars on inter-group relations (Gravesen and Kioko 2019; Lengoiboni et al. 2010; McCabe 2004). Thus, conflict undermines trust and

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cohesion. With less communal cooperation and local governance, collective capacity to manage shared resources decreases, contributing to recurrent conflict cycles and compounding the negative effects (De Juan and Hänze 2020; Sonneveld et al. 2019; Weesie and Kronenburg García 2018; Young and Ismail 2019).

Addressing these complex outcomes requires conflict-sensitive recovery strategies that link livelihood restoration, psychosocial support, and inclusive governance. Interventions must prioritize rebuilding productive assets, securing access to water and land, and enhancing local institutional capacities. Food security and wellbeing are not only humanitarian concerns but essential components of peacebuilding in conflict-affected resource landscapes.

4.6 | Other Cross-Cutting Themes

The preceding sections highlight how historical legacies, identity narratives, gender relations, and migration patterns intersect with scarcity, governance, and livelihoods. This brief section synthesizes these cross-cutting dimensions, emphasizing that social inequalities and collective memory shape how resource disputes emerge and evolve. Their partial underrepresentation in existing studies also points to key directions for future research.

Today's farmer-herder tensions are often rooted in colonial and early post-independence land regimes that introduced fixed boundaries, large-scale concessions, or conservation enclosures at odds with mobile pastoral practice (Boone 2014; Lund 2008; Benjaminsen and Ba 2009). These early policies hardened ethno-territorial claims, empowered certain chiefs over others, and embedded "winner-take-all" logics in local politics—legacies that still shape today's disputes over wells, migration corridors, and grazing reserves (Kamara et al. 2005; Unks et al. 2019). Across communities, earlier dispossessions become part of generational memories, which makes more recent interventions, whether titling, fencing, or new dams, seen through a long memory of exclusion, making even well-intended reforms politically charged.

It is important to stress that scarcity, enclosure, and conflict do not affect groups uniformly. Women often lose access when irrigated schemes or private wells replace communal water points, and they shoulder extra labor hauling water during droughts (Beyene and Korf 2012; Kongnso et al. 2021). Within pastoral households, elder men may capture compensation or borehole fees, while youth—armed yet land-poor—turn to raiding or out-migration (Greiner 2013). These intra-group asymmetries complicate blanket notions of "pastoral vulnerability": some elites profit from land deals or conservation jobs, whereas other groups as well as women and the youth face heightened food insecurity and exposure to violence.

Lastly, resource disputes are rarely understood as technical struggles over water alone; they are often narrated through identity frames that depict "foreign herders," "encroaching farmers," or "terrorists" (Brosché 2022; Elfversson 2015; Krause 2018). Political actors use such labels to mobilize supporters, turning localized disputes over wells or land titling into broader ethnic and security conflicts. Recent studies challenge resource-conflict narratives, showing that identical drought shocks can generate either cooperation or violence depending on how institutions distribute access and manage inclusion (Benjaminsen et al. 2012; Usman and Nichol 2022). Mobility further illustrates this tension: herd movements often buffer households against rainfall shocks but can reignite disputes where privatization or enclosure obstructs corridors (Lenshie et al. 2020; Schwarz et al. 2022). Migration thus serves as both an adaptation strategy and a source of new contestation, particularly where policy responses restrict movement rather than manage it.

4.7 | Critical Complexity and Synthesis

The relationship between water scarcity and communal conflict is often portrayed in overly deterministic terms—suggesting that as water becomes scarcer, conflict becomes inevitable. Yet this review finds that water scarcity does not inevitably lead to violent communal conflict. Rather, conflict outcomes are mediated by how scarcity interacts with governance failures, inequality, identity politics, and historical grievances (Brottem 2020; Kim and Garcia 2023; Olumba et al. 2022; Seter et al. 2018; von Uexkull and Buhaug 2021; Walwa 2020). Deterministic narratives—which argue scarcity makes violence unavoidable—have misguided policy and overlooked successful cooperation under stress. For instance, many pastoralist zones maintain longstanding reciprocal arrangements despite resource pressure (Aderinto et al. 2020; Akuriba et al. 2020; Bogale and Korf 2007; Griffith et al. 2020; Tubi and Feitelson 2016; Wang and Zhang 2012), though such cases are often under-reported in favor of violent outcomes.

Framing water scarcity as a direct driver of conflict overlooks the capacity of communities to adapt through established institutions. Many communities facing water variability maintain peace through customary agreements, seasonal migration, or hybrid governance (Bogale and Korf 2009; Muok et al. 2021; Tadie and Fischer 2017; Thébaud and Batterbury 2001). This finding has clear implications. For policy, it underscores that vulnerability is as much political as environmental; top-down solutions that bypass or erode these local institutions are likely to fail. As researchers, we should caution against alarmist frames that depoliticize conflict. Such narratives obscure how interacting factors—like structural inequalities or power dynamics—are often instrumentalized by elites to justify exclusionary policies and land grabs. For instance, degradation narratives in the name of conservation or development have served to displace pastoralists and facilitate elite capture of resources, exacerbating grievances and undermining trust (e.g., Sulieman 2015; Benjaminsen et al. 2012; Bergius et al. 2020; Young and Ismail 2019; Walwa 2020). Understanding who frames scarcity, and to what end, is therefore crucial. Critically engaging with the complexity of water-conflict dynamics requires to consider how intersecting factors—state capacity, land tenure, institutional legitimacy, historical marginalization, and intergroup relations—interact in specific settings. Research shows that variations in institutional trust, access to groundwater, and local governance integrity strongly influence whether environmental stress results in violence (Döring 2020a; Petrova 2022; Weesie and Kronenburg García 2018). Similar ecological conditions can yield very different conflict trajectories based on governance arrangements

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(Eriksen and Lind 2009; Gebeyehu et al. 2021; Linke et al. 2015; Seter et al. 2018).

5 | Conclusion

Taken together, the studies reviewed portray a research domain that has matured from scattered ethnographies into a multidisciplinary field capable of speaking to both security scholars and water-resource managers. Three conclusions stand out. First, water matters most as access, not merely as a strictly quantifiable scarcity: droughts, dam releases, or groundwater declines become matters for disputes only when they collide with opaque tenure, exclusionary politics, and unequal bargaining power. The same hydrological shock that triggers violence in one district can catalyze cooperation in a neighboring area where customary or formal institutions remain trusted or hybrid committees give farmers, herders, and fishers a genuine voice. Second, explanatory leverage lies at the intersection of scales. Micro-level work has pushed insights over mobility routes, borehole fees, or cattle trade which shape day-to-day interactions, whereas large-N studies reveal broad patterns linking rainfall anomalies or water projects to conflict incidence. However, when these approaches are followed independently, they often fall short: detailed case studies may lack broader applicability, and statistical correlations can oversimplify the complex institutions that govern resource access. Bridging these scales—through mixed-methods designs, interdisciplinary scholarship, and the triangulation of ethnography with remote sensing and sub-district event data—could be one of the more promising ways to resolve long-running debates about scarcity, governance capacity, and political economy. Third, despite a recent uptick in quantitative work, the evidentiary base remains geographically skewed. More than half of all studies cluster in five African countries, while vast dryland systems in Central and West Asia, the Andes, and Central America receive scant attention. Where research is conducted mirrors this imbalance: scholars based in the Global North still dominate publication counts, raising concerns about missing perspectives from regions where pastoralist livelihoods and water stress are most acute. These gaps limit not only theoretical generalizability but also the relevance of policy prescriptions exported from a narrow set of contexts (Adams et al. 2018).

Looking ahead, three key research frontiers and practice areas appear to hold the most potential for addressing these challenges effectively. On the scientific side, the most fertile opportunities appear in (i) data integration, where advances in satellite-derived soil-moisture, groundwater storage, and vegetation indices can be linked to crowd-sourced or machine-coded event datasets to generate fine-grained, longitudinal panels of both cooperation and conflict; (ii) causal identification, exploiting natural experiments such as sudden borehole failures, dam openings, or administrative boundary reforms to isolate institutional effects under comparable ecological conditions; and (iii) intersectional analysis, moving beyond group averages to trace how gender, age, and wealth shape access to water and pasture within ostensibly homogeneous communities. On the applied side, insights from this review point toward (a) conflict-sensitive adaptation planning, whereby climate-resilience projects are vetted for their distributional impacts on mobile and sedentary users alike; (b) institutional pluralism, supporting forums that weave statutory water law together with customary norms instead of replacing one with the other; and (c) early-warning and rapid-response mechanisms that pair hydrological forecasts with social indicators, such as livestock prices, migration permits, or social-media sentiment, to trigger responses like mediation before disputes turn violent. Achieving these advances will require collaborative platforms that foster integrated partnerships among researchers, practitioners, and local knowledge-holders, as well as open data protocols that allow findings to cumulate across regions and methods (Ide 2017; Krampe 2017). In short, the next generation of research must treat water not merely as a physical input but as a deeply political resource embedded in histories of migration, governance, and inequality. Such an approach can enhance environmental security theories, provide insights into everyday cooperation, and offer policymakers practical tools tailored to the needs of communities facing hydrological challenges and conflict risks. Future research should continue to bridge disciplinary and thematic divides by examining how historical, gendered, and identity-based inequalities interact with environmental variability.

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Stefan Döring: writing – original draft (lead), writing – review and editing (lead).

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Conflicts of Interest

The author declares no conflicts of interest.

Data Availability Statement

The list of included studies will be shared as supplementary data.

Related WIREs Articles

Conflict and cooperation in the water-security nexus: a global comparative analysis of river basins under climate change.

Research methods for exploring the links between climate change and conflict.

Climate mitigation policies and the potential pathways to conflict: Outlining a research agenda.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information.

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