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Editorial: Sociohydrology in drylands

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Editorial on the Research Topic Sociohydrology in drylands

1 Introduction

Sociohydrology investigates interactions and coevolution of societies and water systems across multiple spatial and temporal scales (Nüsser et al., 2012; Sivapalan and Blöschl, 2015; Ferdous et al., 2018; Fischer et al., 2021). Since its emergence, the field has sought to move beyond physical descriptions of the hydrological cycle by considering social dynamics, decision-making processes and risk perception. The Research Topic traditionally addressed by sociohydrological research range from dynamics related to the development of infrastructure for water storage and flood protection, to the analysis of conflicts and cooperation in transboundary water management, including the multiple uses and dimensions of water for different stakeholders (Wei et al., 2022).

Recent research emphasises that, to be truly solution-oriented, sociohydrology should be contingent and situated, with specific links to the context and the scale of analysis (Zwarteveen et al., 2026). To address these challenges, future research should encourage the field to critically reflect on the geographical distribution of sociohydrology case studies, the types of hazards being prioritized, and whose experiences and perspectives are being represented.

Drylands (Figure 1) exemplify sensitive landscapes where human-environmental interactions are particularly complex (Reynolds et al., 2007). Representing a global hotspot of sociohydrological dynamics, drylands cover about 40% of the terrestrial surface worldwide, account for approximately 40% of global net primary productivity, and support at least two billion people. These regions include both natural and managed



FIGURE 1
Upper Tiva River in Kitui, Kawongo-Kathome sublocation (February 2023; picture taken by research partner Africa Wood Grow Foundation), from Weesie et al., an article of the Research Topic.

ecosystems where water scarcity is a defining constraint (Wang et al., 2012; IFAD, 2025; Food and Agriculture Organization of the United Nations, 2023). Studies have shown that in the last 3 decades, more than three-quarters of the planet has experienced a drier climate. Predictions indicate that two out of every five people will face dry climate conditions in the future (Vicente-Serrano et al., 2024; Pricope et al., 2025), with severe implications for ecosystems that are approaching critical water-nutrient thresholds (Berduogo et al., 2020). Therefore, studying the sociohydrological specificities and particularities of drylands is important not only for today's water management, but also for expected future challenges worldwide.

The management of limited water resources is also vital for communities living in drylands, where, at the same time, socio-environmental processes, including land use changes, land acquisition, environmental degradation, and migration, cause additional pressure on sensitive regions and vulnerable people. Despite such premises, research on the negative and positive feedback loops among social processes and local and regional hydrology remains largely unexplored. Most of the sociohydrology literature currently focuses on cases and dynamics in humid or temperate contexts. In particular, there is a strong focus on floods, whereas droughts, chronic water scarcity, and their long-term feedbacks with social systems are still underrepresented in sociohydrological case studies (Vanelli et al., 2022).

Within this context, integrating drylands more explicitly into sociohydrological research can support broadening the field beyond phenomena such as levee effect (Fusinato et al., 2024), and other common flood archetypes, toward frameworks that center on understanding long-term co-evolution of societies with water scarcity, innovations in water-related adaptation measures, strategies of land use and mobility (e.g., pastoralism), and historical water governance. By focusing on these systems, sociohydrology can advance toward more inclusive and interdisciplinary frameworks that capture the diversity of human–water co-evolution under conditions of scarcity, uncertainty, and multiple risks.

With this Research Topic, we have invited scholars from several scientific disciplines to contribute empirical, conceptual, and methodological insights into sociohydrological dynamics in drylands¹. While acknowledging that sociohydrology and hydrosocial theory are two distinct, yet related concepts (Ross and Chang, 2020), we also extended the scope of this Research Topic to the latter one. This allows us to capture a more comprehensive set of insights on human–water feedback in drylands, including questions that explicitly address power, governance, and knowledge production that are central to water management in drylands. Table 1 summarises the main features of the two approaches. This comparison is intended mainly to guide readers of the present Research Topic. It is important to note that a continuum of approaches exists within the pluralism of current human–water research, and the boundaries between sociohydrology and hydrosocial theory may be subjective.

The following sections of this editorial synthesize the main findings of the Research Topic, discuss their implications, and outline directions for future research.

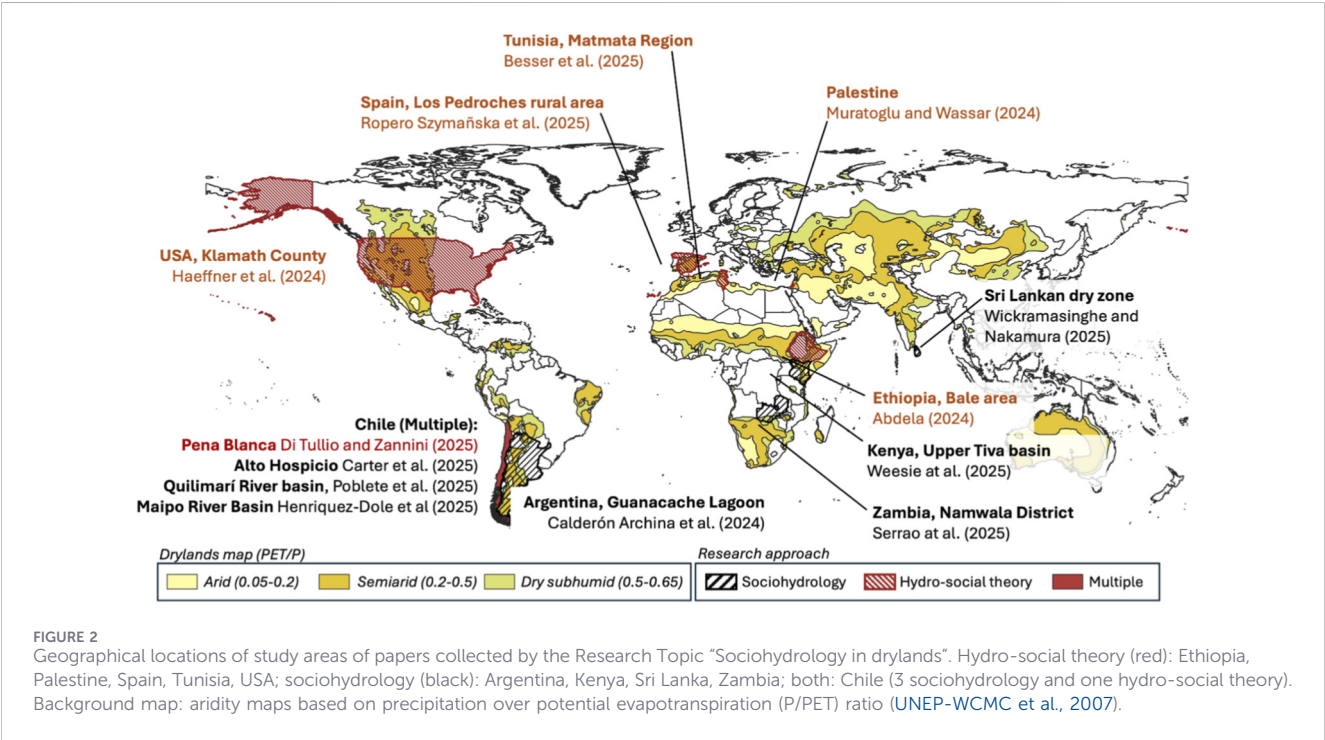
2 Overview of the Research Topic

The Research Topic “Sociohydrology in drylands” collected 13 original articles and one corrigendum, for a total of 14 contributions (Figure 2). Some of the articles have a more engineering/modelling approach common in sociohydrology, while others have a stronger focus on qualitative methodologies, more common in hydro-social analysis. It should be highlighted that the boundary between sociohydrology and hydro-social analysis is not always clear. The two approaches share common concepts and

¹ For the full list of Research Topic and the call for papers, see: <https://www.frontiersin.org/research-topics/60458/sociohydrology-in-drylands>

TABLE 1 Comparison between Sociohydrology and Hydrosocial theory, derived from Wesselink et al. (2017), Di et al. (2019), and Ross and Chang (2020).

	Sociohydrology	Hydrosocial theory or research
Focus	"[...] the two-way feedbacks between human and water systems that result in a wide range of phenomena that arise in different places around the world and in different contexts." (Di et al., 2019: 6,328)	"[...] conceptualizing the complexity of power relations relative to water in terms of the economic, social, spatial, and political aspects of ecology." (Ross and Chang, 2020: 1,445)
Originates from	Natural scientists/hydrologists	Social sciences
Paradigms	Positivist; postpositivist	Constructivist; critical theory
Ontology	Objectivist; holistic; parts can be separated; interaction gives emergent properties	Holistic; parts constitute each other and cannot be separated
Epistemology	Objective	Subjective
Main methodology	Quantitative modelling	Historical materialist analysis, qualitative methods
Starting point	Natural system	Society (and technology)
Axiology	(Post) positivist; researchers are and should be neutral	Critical or interpretivist; researchers cannot be and should not be neutral



may sometimes overlap in terms of methods. Our classification should thus be interpreted as a heuristic to showcase dominant approaches rather than as a rigid classification. This balance may highlight the conceptual and methodological diversity required to study human–water interactions in drylands. It also indicates an increasing collaboration among researchers studying water, as qualitative perspectives, often employed in hydro-social analysis, are essential to complement sociohydrological approaches when addressing the complexity of dryland systems.

2.1 Sociohydrological approach

Calderón Archina et al. reviewed the bibliographic material available for the region and utilized an ethnographic,

ethnohistorical, archaeological and hydrological approach based on fieldwork in the area of Guanacache Lagoon, Central Western Argentina. They highlighted how local knowledge is effective in managing water scarcity, and how adaptations of traditional techniques are necessary, but that changes should not ignore indigenous knowledge and local practices. Instead, local communities should be included as knowledge co-creators.

Weesie et al. employed qualitative storytelling sessions to understand how agro-pastoralists in the Upper Tiva basin (Kenya) experience and narrate the relationship between droughts and subsequent floods. Results showed how droughts frequently ended with large rain events/floods which had both beneficial (regenerative) and damaging effects. Drought adaptation measures damaged by floods, have shown to in turn

produce vulnerability to subsequent drought. They argued that further research should explore how post-drought floods can be harnessed to support recovery, allowing agro-pastoral livelihoods to thrive rather than erode under increasing climate pressures.

Carter et al. analysed the potential of fog Research Topic in the urban area of Alto Hospicio, located in the northern Chilean Atacama Desert. They employed *in-situ* fog water Research Topic data, numerical modeling, and analysis of social data. According to their findings, the current potable water supply for the study area depends on deep-groundwater aquifers that are non-renewable and the city's water consumption is rising, while fog Research Topic could alleviate water scarcity.

Wickramasinghe and Nakamura developed a sociohydrological model capturing the relationships among reservoir storage, cultivation area, irrigation water demand and small tank storage with different farmers' adaptation strategies, in the Mahaweli H irrigation scheme, within the Sri Lankan dry zone. Here, indigenous system farmers perceive a significantly low rainfall threshold indicating greater adaptability to dry conditions. The sensitivity of perception levels to cultivation area demonstrates that modern system farmers have a 18% higher dependence on reservoir water availability when deciding on cultivation area than indigenous farmers. This stark dependency on reservoir water availability of modern system farmers is rooted in a lack of accessibility to small tanks, a feature that enhances drought resilience of farmers in the indigenous system.

The work by Serrao et al. in Namwala District, Zambia, goes beyond a water balance and dam optimization analysis to explore sustainability from a better understanding of the territorial and socioeconomic conditions that will assure that a new dam does not only addresses water scarcity during dry seasons its and in different future climate and water allocation scenarios, but also its implications for future resilience. The research included interviews, surveys, climate time series, stream sediment transport calculations and Digital Elevation Model analysis to explore the sustainability of small dams for community irrigation and livestock supply, and the potential impacts of new infrastructure on the sociohydrological system.

Poblete et al. followed a participatory Robust decision making (RDM) approach aiming to guide the identification of options or strategies to increase water availability that can perform well in the context of uncertainties and different possible futures on the Quilimarí River basin, Chile. Their vulnerability scenarios were tested in a WEAP-MODFLOW coupled model, suggesting a complex future, with up to a 40% reduction in precipitation and increased water demand from household and tourism use. The RDM approach highlighted desalination as a favorable option for meeting local human consumption demands, although it was tested only at the basin level.

Again in Chile, in the Maipo River basin, Henriquez-Dole et al. (2025) explore which class-level landscape metrics—such as urban patch density, agricultural contagion, and vegetated connectivity—influence the most hydrological signatures in two dryland catchments, including flow duration curves, recession rates, and low-flow frequency. Using several spatial analysis methods, information from local decision-makers and modeling in WEAP-MODFLOW, the authors identified 74 key metrics, such as mean urban patch shape and agricultural patch fragmentation,

that significantly influence hydrological signatures. These findings emphasize the importance of spatial configuration, beyond mere land cover composition, in modulating hydrological regimes in drylands.

2.2 Hydrosocial approach

Haefner et al. (2024) investigated the “Water Wars” in Klamath County, United States of America. Using Q methodology, they found that this conflict was characterized by a landscape of diverse and nuanced groundwater values among well users. The authors identified distinct water perspectives that differ in how people understand fairness, responsibility, trust in institutions, and accountability.

Abdela (2024) utilized a mixed-methods approach to capture both qualitative and quantitative data in the Bale zone of Ethiopia. Pastoralists reported rising temperatures and declining rainfall. These trends resulted in crop failures, food insecurity, livestock mortality, increased human and livestock disease, and higher school dropout rates among children. At the same time, they have developed a multifaceted approach to cope with drought, focused on traditional social safety nets (named “*hirpa*”, “*dare*,” and “*hameessa*”) for crucial support and assistance.

Muratoglu and Wassar analyzed how geopolitical constraints affect water accessibility and management in Palestine, particularly in Gaza. Here, the scarcity of water resources has a profound impact on agriculture and the economy, leading to increased food insecurity due to insufficient water for irrigation. Furthermore, the unequal distribution of water resources between Israel and Palestine perpetuates the crisis, with Israeli settlements consuming a disproportionate share compared to Palestinians. This research also highlights the widespread Research Topic of water discrimination, where Israeli policies systematically restrict Palestinian access to water resources, thereby exacerbating existing disparities. Addressing the water crisis in Palestine necessitates concerted efforts to enhance water security, safeguard water quality, and uphold the fundamental rights of the population. Exploring alternative solutions, such as rainwater harvesting and wastewater reuse, could also be essential for equitable and sustainable water management.

Di Tullio and Zannini show how water scarcity in northern Chile is shaped not only by climate conditions but also by political and cultural factors, including poor governance. Using ethnography and discourse analysis, the authors investigated how the community of Peña Blanca sees water as part of a lived hydrosocial territory marked by conflict, resilience, and place identity. What sets the study apart is its integration of critical discourse methods with fieldwork to highlight bottom-up water practices implemented by citizens that challenge technocratic and market-driven narratives.

The article by Besser et al. explores gender equity in water-energy-food-ecosystems (WEFE) transition plans in the Matmata region in southeastern Tunisia. Using a combination of participatory qualitative methods (i.e., focus groups, Delphi method, survey) and prioritization using hierarchical ranking, the authors identified that although water availability and quality are the primary challenges for all, the lack of funding resources represents a huge barrier for women. This article highlights why securing WEFE

nexus transition requires social integration, gender equity Research Topic, institutional arrangements, and funding resources.

The work by [Ropero Szymańska et al. \(2025\)](#), analyzed how extensive livestock farmers in the Los Pedroches rural area, Spain, adapt to prolonged drought, by using semi-structured interviews with farmers and regional actors, focus groups with cooperative members and extension agents, and several workshops. Their results show that farmers combined short-term coping measures with longer-term adaptive measures during the drought. Water management responses were found to be individual and reactive, while adaptive actions were planned and often led by cooperatives.

3 Discussion and way forward

Some common features can be highlighted in the papers collected by the Research Topic. All articles in this Research Topic incorporate local knowledge at some level and stage of the exploration of a water problem in a dryland. Some articles consulted with local decision makers to better explore alternatives or understand the nuances of a water challenge ([Poblete et al.; Henriquez-Dole et al., 2025; Serrao et al.](#)). Other authors strongly stressed the importance and validity of including local knowledge in water management strategies, such as [Abdela \(2024\), Calderón Archina et al., Di Tullio and Zannini, Wickramasinghe and Nakamura, and Ropero Szymańska et al. \(2025\)](#). All findings underline the importance and potential of including traditional knowledge and knowledge co-creation practices into sociohydrological sciences ([Basel et al., 2021; Castelli et al., 2025](#)), as well the cross-fertilization with hydrosocial studies and methods. Such practices could further contribute to “grounding” sociohydrology and relating its findings to more specific contexts ([Zwarteveen et al., 2026; Massuel et al., 2018](#)), fostering solutions-oriented approaches.

In this sense, the research featured in this Research Topic presents a distinct viewpoint. The dryland case studies presented here highlight places with historical resilience to drought and water scarcity. In such a context, the (often positive) importance of traditional practices for sociohydrological dynamics is evident, as it is in many other dryland regions worldwide ([Piemontese et al., 2024; United Nations University Institute for Water Environment and Health, 2009](#)). At the same time, these systems are facing unprecedented pressures that challenge existing adaptive capacities and require new approaches to water management ([Madani, 2026](#)).

In addition to the climate change pressures observed across nearly all analyzed case studies also highlight the persistence of historical injustices that continue to shape current water and resource governance dynamics. In particular, [Muratoglu and Wassar](#) highlighted the specific situation of unequal distribution of water resources between Israel and Palestine, and the widespread Research Topic of water discrimination. Similarly, [Besser et al.](#) describes gender inequity in current transition policy discussions in rural Tunisia. In such cases, addressing the water management Research Topic, still under a sociohydrological lens, should focus on water security and justice approaches. In the same paper, the authors argue that exploring alternative solutions, such as rainwater harvesting and wastewater reuse, could also be a pathway to sustainable water management.

It should be noted that papers analyzed the potential impact of non-conventional water in drylands (e.g., [Di Tullio and Zannini; Poblete et al.; Carter et al.; Serrao et al.](#)). Both [Di Tullio and Zannini](#) and [Carter et al.](#) focused on fog Research Topic in Chile, but with nuanced outcomes. While [Carter et al.](#) developed a sociohydrological approach to evaluate the potential of such practice for the urban area of Alto Hospicio, [Di Tullio and Zannini](#), in Pena Blanca, showed how fog Research Topic could imply further marginalisation and vulnerabilisation for some inhabitants, given that the structure needed for their functioning represents a hindrance to other communal practices.

Finally, this Research Topic revealed a general call for increased collaboration across disciplines, especially when analysing human-water feedback in drylands. Some papers ([Muratoglu and Wassar; Calderón Archina et al.](#)) employed historical analysis to develop their analysis, while several others implemented a social sciences approach to disclose local views and perceptions about water management in drylands ([Haeffner et al., 2024; Besser et al.; Serrao et al.; Poblete et al.; Weesie et al.; Di Tullio and Zannini; Wickramasinghe and Nakamura](#)).

To summarize, working in specific sensitive landscapes such as drylands, where human-water interactions are complex - yet still one of the main elements that could guarantee social-ecological resilience - is an opportunity for integrating sociohydrological and hydrosocial studies. This Research Topic “Sociohydrology in drylands” highlighted how further interdisciplinary and integration of sociohydrology and hydrosocial approaches is possible, focusing on knowledge co-creation and grounded social sciences. Research should not be depoliticized, but must acknowledge specific socio-political dynamics that impact water management and the environment in an inter- and even transdisciplinary way ([Rusca et al., 2026](#)). In this regard, further analysis should focus on the interaction between traditional and innovative practices. Such findings, stemming from a focus on drylands, should be investigated and referred to diverse climatic contexts.

Author contributions

GC: Investigation, Writing – review and editing, Methodology, Writing – original draft, Conceptualization, Visualization. FW: Writing – review and editing, Conceptualization, Investigation, Writing – original draft, Methodology. EB: Writing – review and editing, Methodology, Conceptualization, Investigation. LP: Visualization, Writing – review and editing, Investigation, Conceptualization, Methodology. MN: Methodology, Writing – review and editing, Investigation, Conceptualization, Writing – original draft. AO-M: Writing – review and editing, Methodology, Writing – original draft, Investigation, Conceptualization. MB: Investigation, Conceptualization, Writing – review and editing, Writing – original draft, Methodology.

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The author(s) declared that generative AI was not used in the creation of this manuscript.

References

- Abdela, U. (2024). Assessment of community-driven drought risk management strategies in pastoral and agro-pastoral district of bale zones south east Ethiopia. *Front. Environ. Sci.* 12, 1411138. doi:10.3389/fenvs.2024.1411138
- Basel, B., Hernández Quiroz, N., Velasco Herrera, R., Santiago Alonso, C., and Hoogesteger, J. (2021). Bee mietii rak rkabni nis (the people know how to seed water): a Zapotec experience in adapting to water scarcity and drought. *Clim. Dev.* 13, 792–806. doi:10.1080/17565529.2020.1855100
- Berdugo, M., Delgado-Baquerizo, M., Soliveres, S., Hernández-Clemente, R., Zhao, Y., Gaitán, J. J., et al. (2020). Global ecosystem thresholds driven by aridity. *Science* 367 (6479), 787–790. doi:10.1126/science.aay5958
- Castelli, G., Howard, B. C., Adyel, T. M., AghaKouchak, A., Agramont, A., Aksoy, H., et al. (2025). Co-creating water knowledge: a community perspective. *Hydrol. Sci. J.* 70, 2899–2919. doi:10.1080/02626667.2025.2571065
- Di, B. G., Sivapalan, M., Rusca, M., Cudennec, C., Garcia, M., Kreibich, H., et al. (2019). Sociohydrology: scientific challenges in addressing the sustainable development goals. *Water Resour. Res.* 55 (8), 6327–6355. doi:10.1029/2018WR023901
- Ferdous, M. R., Di Baldassarre, G., Brandimarte, L., and Palmer, R. (2018). Socio-hydrological spaces in jamuna river floodplain in Bangladesh. *Hydrol. Earth Syst. Sci.* 22, 5159–5173. doi:10.5194/hess-22-5159-2018
- Fischer, A., Miller, J. A., Nottingham, E., Wiederstein, T., Krueger, L. J., Perez-Quesada, G., et al. (2021). A systematic review of spatial-temporal scale issues in sociohydrology. *Front. Water* 3, 730169. doi:10.3389/frwa.2021.730169
- Food and Agriculture Organization of the United Nations (FAO) (2023). *Resilient drylands: innovating for sustainable agricultural landscapes and livelihoods*. Rome: FAO.
- Fusinato, E., Han, S., Kobiyama, M., and de Brito, M. M. (2024). Safe development paradox: evidence and methodological insights from a systematic review. *Nat. Hazards* 120 (15), 13693–13714–13714. doi:10.1007/s11069-024-06774-z
- Haefner, M., Cowal, J., Walker, B., and McClellan, C. (2024). When overextended surface allocation turns to groundwater: a Q methodology of well users in Oregon's high desert. *Front. Environ. Sci.* 12, 1398439. doi:10.3389/fenvs.2024.1398439
- Henriquez-Dole, L. E., Gironás, J., Meza, F., Salazar, E., and Henriquez, C. (2025). Landscape metrics selection and influence over hydrological signatures: land use change's effect over water resources in Chile. *Front. Environ. Sci.* 13, 1569574. doi:10.3389/fenvs.2025.1569574
- International Fund for Agricultural Development (IFAD) (2025). *Annual report 2025*. Rome: IFAD.
- Madani, K. (2026). Water bankruptcy: the formal definition. *Wat. Res. Manage.* 40, 78. doi:10.1007/s11269-025-04484-0
- Massuel, S., Riaux, J., Molle, F., Kuper, M., Ogilvie, A., Collard, A.-L., et al. (2018). Inspiring a broader socio-hydrological negotiation approach with interdisciplinary field-based experience. *Water Res. Res.* 54, 2510–2522. doi:10.1002/2017wr021691
- Nüsser, M., Schmidt, S., and Dame, J. (2012). Irrigation and development in the upper Indus Basin: characteristics and recent changes of a socio-hydrological system in central Ladakh, India. *Mt. Res. Dev.* 32 (1), 51–61. doi:10.1659/MRD-JOURNAL-D-11-00091.1
- Piemontese, L., Terzi, S., Di Baldassarre, G., Menestrey Schwieger, D. A., Castelli, G., and Bresci, E. (2024). Over-reliance on water infrastructure can hinder climate resilience in pastoral drylands. *Nat. Clim. Change* 14, 267–274. doi:10.1038/s41558-024-01929-z
- Pricope, N. G., Vicente-Serrano, S. M., Toreti, A., Ocampo-Melgar, A., Spinoni, J., Morán-Tejada, E., et al. (2025). Increasing aridification calls for urgent global adaptive solutions and policy action. *Nat. Water* 3, 512–515. doi:10.1038/s44221-025-00432-9
- Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P. J., et al. (2007). Global desertification: building a science for dryland development. *Science* 316, 847–851. doi:10.1126/science.1131634
- Ropero Szymańska, N., Hernández-Mora, N., and De Stefano, L. (2025). Characterizing adaptation responses to drought risk of livestock farmers in the Spanish dehesa agroforestry system. *Front. Environ. Sci.* 13, 1540818. doi:10.3389/fenvs.2025.1540818
- Ross, A., and Chang, H. (2020). Socio-hydrology with hydrosocial theory: two sides of the same coin? *Hydrol. Sci. J.* 65 (9), 1443–1457–1457. doi:10.1080/02626667.2020.1761023
- Rusca, M., Zwarteveen, M., Acharya, A., Alba, R., Krueger, T., and Haefner, M. (2026). Water justice needs careful interdisciplinary research. *Nat. Water*. doi:10.1038/s44221-026-00595-z
- Sivapalan, M., and Blöschl, G. (2015). Time scale interactions and the coevolution of humans and water. *Water Resour. Res.* 51, 6988–7022. doi:10.1002/2015WR017896
- UNEP-WCMC (2007). A spatial analysis approach to the global delineation of dryland areas of relevance to the CBD programme of work on dry and subhumid lands. Dataset based on spatial analysis between WWF terrestrial ecoregions (WWF-US, 2004) and aridity zones (CRU/UEA; UNEPGRID, 1991). Dataset checked and refined to remove many gaps, overlaps and slivers (July 2014). Cambridge (UK): UNEP-WCMC
- United Nations University Institute for Water, Environment and Health (UNU-INWEH) (2009). *Seeing traditional technologies in a new light: using traditional approaches for water management in drylands*. World Water Assessment Programme pide publications series: insights. Paris: UNESCO. Available online at: <https://unesdoc.unesco.org/ark:/48223/pf0000181799> (Accessed February 20, 2026).
- Vanelli, F. M., Kobiyama, M., and de Brito, M. M. (2022). To which extent are socio-hydrology studies truly integrative? The case of natural hazards and disaster research. *Hydrol. Earth Syst. Sci.* 26, 2301–2317. doi:10.5194/hess-26-2301-2022
- Vicente-Serrano, S. M., McVicar, T. R., Miralles, D. G., Yang, Y., and Tomas-Burguera, M. (2024). The global threat of drying lands: regional and global aridity trends and future projections. *Glob. Chang. Biol.* 30, e70009. doi:10.1111/gcb.70009
- Wang, L., D'Odorico, P., Evans, J. P., Eldridge, D. J., McCabe, M. F., Caylor, K. K., et al. (2012). Dryland ecohydrology and climate change: critical issues and technical advances. *Hydrol. Earth Syst. Sci.* 16, 2585–2603. doi:10.5194/hess-16-2585-2012
- Wei, Y., Wei, J., Li, G., Wu, S., Yu, D., Ghoreishi, M., et al. (2022). A socio-hydrological framework for understanding conflict and cooperation with respect to transboundary Rivers. *Hydrol. Earth Syst. Sci.* 26, 2131–2146. doi:10.5194/hess-26-2131-2022
- Wessellink, A., Kooy, M., and Warner, J. (2017). Socio-hydrology and hydrosocial analysis: toward dialogues across disciplines. *Wiley Interdiscip. Rev. Water* 4, e1196. doi:10.1002/wat2.1196
- Zwarteveen, M., Barreteau, O., Ogilvie, A., Kuper, M., and Venot, J. P. (2026). A situated proposal for a grounded approach to socio-hydrology. *J. Hydrol.* 667, 134828. doi:10.1016/j.jhydrol.2025.134828