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An evaluation of the alignment of drought policy and planning guidelines with the contemporary disaster risk reduction agenda

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Abstract. Drought is a major global challenge, causing significant socio-economic and environmental impacts. A paradigm shift from crisis to risk management is advocated for to reduce the impacts of droughts and to build the resilience of societies and water and environmental systems to drought. A number of drought policy and planning guidelines are developed and used to support the transition from crisis to risk management and enhancing resilience. However, research is lacking on critical reflection, evaluation, and updating of the available drought guidelines. For example, there is no study assessing the correspondence of the available guidelines to the contemporary disaster risk reduction agenda. Therefore, this study evaluates 12 sets of drought policy and planning guidelines for their alignment with the four priority areas of the *SENDAI framework for disaster risk reduction 2015–2030*. A qualitative evaluation matrix was developed and used in the assessment. The priorities and associated thematic elements examined were scored in the range of 0–100 and were classified into the very low (0–10), low (11–30), medium-low (31–50), medium-high (51–70), high (71–90), and very high (91–100) categories. Most guidelines achieved (medium-)high to very high scores on the data and information, risk assessment, and communication and dissemination elements associated with priority 1 (understanding disaster risk), while mostly very low to low coverage was found for science–policy–practice dialogue, local knowledge and practices, and research and development. Most guidelines earned high scores on strengthening disaster risk governance to manage disaster risk (priority 2), notably for strategies and plans, coordination mechanisms, community representation, and policy and governance. In contrast, most elements under priority 3 (investing in disaster risk reduction) were classified in the low to medium categories, which include financial allocation, risk transfer, mainstreaming drought risk reduction into land use and rural-development planning, business resilience and protection of livelihoods, and health and safety. Most elements under priority 4 (enhancing disaster preparedness) scored in the medium-low to medium-high ranges, as sufficient information was lacking on multi-hazard early-warning systems; post-disaster recovery, rehabilitation, and reconstruction; and the resilience of critical infrastructure. Furthermore, the study outlined several strengths, weaknesses, opportunities, and threats pertaining to the guidelines examined. In general, the study reveals an urgent need to better align drought policy and planning guidelines with the contemporary disaster risk reduction agenda outlined in the SENDAI framework. The findings of this study can be instructive in designing the next generation of drought guidelines in support of an accelerated transition towards drought risk reduction and management and in building resilient societies and ecosystems under a changing climate and increasing anthropogenic pressures.

1 Introduction

Drought is a major global challenge. Many countries face drought every year and have to bear losses to a varying degree, depending upon multiple factors such as drought severity and duration, geographical extent, vulnerability, and resilience. There were 488 drought events recorded in the international disaster database (EM-DAT, 2024) during the last 30 years (1994–2023) (see Supplement, "Supplementary material 1"). The estimates suggest that these droughts affected

about 2 billion people across the globe and caused economic damage of about USD 220 billion. A conservative estimate of the number of countries reporting drought in a year ranged from 6 (1995) to 29 (2015). The studies show that the drought events demonstrate local, regional, continental, and global coverage (Masih et al., 2014; Blauhut et al., 2022; Mondal et al., 2023). Drought impacts (directly or indirectly) various sectors such as agriculture, water management, energy, river transport, the environment, and public health (Wilhite et al., 2007; UNDRR, 2021; Rossi et al., 2023). These impacts can be short, medium, or long term and may occur over local, regional, and global scales. For example, the 2018–2020 drought event covered the largest area in Europe (36 %) compared to previous droughts (Rakovec et al., 2022). The duration of this event was estimated at 12.2 months, and the event was estimated to be the longest in the last 250 years. Central and western European countries were impacted most by this drought. Moreover, the study stressed the need to adopt European policies, plans, and strategies to cope with increasingly intense, long-duration, and widespread droughts. This is also a global need because drought occurrences and impacts are likely to increase in the future for many countries because of climate change (Spinoni et al., 2019; Naumann et al., 2021; Rakovec et al., 2022; IPCC, 2021, 2022) and human activities (Van Loon et al., 2022).

A paradigm shift in drought policy and practice from crisis to risk management is advocated for to reduce the impacts of droughts and to build the resilience of societies and water and environmental systems to drought (Wilhite, 1991; Wilhite et al., 2000; World Bank, 2012; Sivakumar et al., 2014; UNISDR, 2005, 2015; UNDRR, 2021). Wilhite (1991) and Wilhite et al. (2000) proposed a novel 10-step process to guide drought policy and planning processes in support of a transition towards risk management. The approach proposed was underpinned by the understanding and experience of science, policy, and practice from the USA. Similar to the 10-step process, the Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN) drought guidelines were developed to support pro-active and risk-based approaches to address droughts in the Mediterranean region, which is highly vulnerability to droughts (Iglesias et al., 2007). Furthermore, the European Union (EU) drought guidelines recommend an integrated risk management approach, with a strong focus on making drought plans at the river basin level or integrating them as part of the river basin plans (European Commission, 2007). These guidelines also focus on drought management in relation to agriculture, climate change, transboundary cooperation, groundwater, sustainable development, and environmental impact assessment. Furthermore, UNISDR (2007, 2009) prepared a comprehensive drought risk reduction framework, which is aligned with the five priorities outlined in the *Hyogo Framework for Action 2005–2015* (UNISDR, 2005). The UNISDR framework is based on five key elements: (1) policy and governance, (2) drought risk identification and early warning, (3) awareness and education, (4) reducing the underlying factors of drought risk, and (5) mitigation and preparedness. A few years later, in 2013, a high-level meeting on national drought policy (HMNDP) was held (Sivakumar et al., 2014). The final declaration of this landmark meeting notes that drought poses a serious challenge for the sustainable development of all countries and in particular developing countries. Many countries do not have sufficient policies for appropriate drought management and pro-active drought preparedness, and drought responses are often reactive (crisis management). Recent research corroborates this declaration, highlighting the variable degree of preparedness and the transition towards risk management within and across countries (Fu et al., 2013; Jedd et al., 2021; Blauhut et al., 2022; Jedd and Smith 2023; Biella et al., 2024). Moreover, HMNDP recognized the urgent need to develop risk management strategies and preparedness plans (Sivakumar et al., 2014), and the countries were encouraged to develop and implement national drought management policies and plans. An invitation was extended to update the relevant science and policy documents by aligning them with the recommendations made by HMNDP, which suggest focusing on developing pro-active drought management measures, enhancing collaboration and the quality of observation networks and delivery systems, improving public awareness, considering suitable economic and financial strategies, establishing emergency relief plans, and linking drought management plans to local/national development policies. Following from the HMNDP recommendations, the World Meteorological Organization (WMO) and Global Water Partnership (GWP 2014) proposed national drought management policy guidelines, which are based on the 10-step process (Wilhite 1991; Wilhite et al., 2000).

Building on the Hyogo framework, the *SENDAI framework for disaster risk reduction 2015–2030* acknowledges the challenges posed by multiple disasters, despite progress made during the past decades (UNISDR, 2015). The SENDAI framework presents four priorities for action: priority 1 is understanding disaster risk, priority 2 is strengthening disaster risk governance to manage disaster risk, priority 3 is investing in disaster risk reduction for resilience, and priority 4 is enhancing disaster preparedness for effective response and "build[ing] back better" in recovery, rehabilitation, and reconstruction. Additionally, the UNISDR *Strategic framework 2016–2021* highlights the contribution of disaster risk reduction to the achievement of the global sustainable development agenda (UNISDR, 2017). There are a few sets of drought guidelines developed after the SENDAI framework was created (UNCCD, 2018, 2019; World Bank, 2019; Marj and Abadi, 2020; Filho et al., 2023). However, there is a lack of information on how these guidelines consider the goals and priorities of the SENDAI framework and related global disaster risk reduction agendas. Nevertheless, most recent guidelines (UNCCD, 2019; World Bank, 2019) highlight the importance of the three pillars of drought risk reduction (Tsegai et al., 2015; Verbist et al., 2016), which

include drought monitoring and early warning (pillar 1), vulnerability and impact assessment (pillar 2), and drought mitigation and preparedness measures (pillar 3). These three pillars are a subset of the elements outlined as the priorities of the SENDAI framework and also reflect the components included in the declaration of HMNDP.

In general, there are a number of drought policy and planning guidelines developed before and after the SENDAI framework. However, there is a lack of understanding of how the available guidelines align with the contemporary disaster risk reduction agenda. Furthermore, adjusting drought policy and plans to the contemporary drought thinking and changing needs is essential to accelerate progress toward drought risk reduction and to build the resilience of societies to drought under changing climate and increasing anthropogenic pressures. While several sets of global, regional, and local guidelines have been developed over the past 50 years, the research is lacking on critical reflection, evaluation, and updating of these guidelines. To date, there is no study, to the author's knowledge, assessing the correspondence between the available drought guidelines and the contemporary disaster risk reduction agenda. Therefore, this study evaluates the drought policy and planning guidelines for their alignment with the four priority areas delineated in the *SENDAI framework for disaster risk reduction 2015–2030*. Furthermore, the study explores strengths, weaknesses, opportunities, and threats and provides insights to better align future generations of drought guidelines with the contemporary disaster risk reduction agenda.

2 Materials and methods

The drought policy and planning guidelines were found through multiple internet sources such as Scopus, Google and Google Scholar. The document search also benefited from the author's knowledge gained through education and capacity development activities related to drought management, including teaching on the drought policy and planning guidelines. Various keywords were used to find the guidelines, which were mainly centred around drought policy, drought planning, drought guidelines, drought policy and planning frameworks, and drought risk management. The search resulted in the selection of 12 sets of guidelines published as journal articles and reports in the English language. A brief description of these guidelines and the main references for further information are provided in Table 1. A few more insightful documents and web sources were found (EDO, 2024; IDMP, 2024; NDMC Planning, 2024; Steinemann and Cavalcanti, 2006; UNISDR et al., 2009; Rossi et al., 2007; Rossi and Castiglione, 2011; WMO and GWP, 2016; Cook et al., 2017; Vogt et al., 2018; CISA, 2021; Vogel and Kroll, 2021; Walker et al., 2024) but were not selected for evaluation because of their limited scope compared to this study's objectives, the lack of details needed to conduct the evaluation, or a very high degree of similarity with the guidelines selected. The list of guidelines evaluated is not exhaustive, but it is sufficient for the purpose of this study.

A qualitative scoring matrix was developed and used in the evaluation (Table 2). The four priority areas of the SENDAI framework, along with their corresponding elements, were scored on a scale of 0–100 (very low – 0–10; low – 11–30; medium-low – 31–50; medium-high – 51–70; high – 71–90; and very high – 91–100). The evaluation grid used in this study is similar to the one used to monitor the progress toward Sustainable Development Goal 6 (SDG6) indicator 6.5 and toward target 6.5.1 of the integrated water resources management (IWRM; UNEP, 2021). While the scoring ranges and classes used in this study are similar to those applied for IWRM evaluation, a novel scoring grid was formulated corresponding to the objectives of this study (Table 2). Additionally, the work carried out by Fu et al. (2013), Jedd et al. (2021), and Jedd and Smith (2023) to evaluate drought and drought-related policies and plans was instructive in formulating the evaluation methods for this research. For the evaluation, first, each core element in a certain priority area was scored and categorized. Then, an average score was calculated for the priority area. All elements were assigned equal weights in estimating the overall score. Furthermore, a strength, weakness, opportunity, and threat (SWOT) analysis was carried out. The elements scored in the high to very high categories for most of the guidelines were considered to be strengths. Weaknesses were identified based on elements scored in the very low to low categories in most cases. Opportunities represent areas with medium or good coverage by a few sets of guidelines and demonstrate the potential to translate into strengths with minimal efforts. Threats correspond to insufficient coverage by emerging science–policy–practice discourses in the field of disaster risk reduction, in particular, drought risk management. Ignoring or paying limited attention to these important discourses may significantly undermine the quality and effectiveness of the drought policy and planning guidelines for the future.

The evaluation results need to be interpreted with caution, owing to the inherent uncertainties associated with the evaluation process. Considering this, the overall ratings in terms of categories are used in the interpretation and discussion of the results rather than focusing on actual scores. However, the evaluation remarks alongside the scores are provided in the Supplement for reference ("Supplementary material 2"). It is pertinent to note that, in some cases, the assigned scores were very close to the border of two categories. These cases show a comparatively higher degree of uncertainty in their classification compared to the situations when the scores were in the middle of a category. Alongside the acknowledgement of these uncertainties, it is assumed that the overall pattern of scoring is likely to stay the same in most cases even if a few elements are rated a bit differently within the expected uncertainty range of one category. Therefore, the main patterns of the results and the emerging insights are considered

Table 1. A summary of the drought policy and planning guidelines evaluated in this study.

A brief description of the drought policy and planning guidelines examined and suggested sources for further information.
The 10-step drought planning process (Wilhite, 1991; Wilhite et al., 2000; WMO and GWP, 2014; UNDRR, 2021) The 10-step process is a ground-breaking work on drought policy and planning. This novel and most widely used process was developed based on the experience from the USA. The development process was triggered by increasing concerns about the inability of the state drought contingency plans to mitigate the impacts of droughts, especially during the 1980s and early 1990s when many states faced severe and widespread droughts. The guidelines were developed in close collaboration with key stakeholders from seven selected states (Pennsylvania, South Carolina, Kentucky, Oklahoma, Montana, Colorado, and Oregon), while the drought-related experiences of other states were also incorporated. The first version mainly focused on supporting state governments and decision-makers to improve their drought contingency plans. Over time, the risk assessment and risk management aspects were strengthened, advocating for and supporting a transition from crisis to risk management. Experience from other countries was also (briefly) included, as the document received global recognition and adoption. For example, HMNDP in 2013 recommended that countries use the 10-step process to formulate national drought risk management plans. Following this recommendation, WMO and GWP (2014) published national drought policy guidelines underpinned by the 10-step process. This document is available in six languages: English, Arabic, Chinese, French, Russian, and Spanish. A brief introduction of the 10 steps is provided below; details can be found in the corresponding documents. Step 1 – appoint a national drought management policy commission to supervise and coordinate the policy and plan development and implementation at all levels of government. Step 2 – state or define the goals and objectives of a risk-based national drought management policy. Step 3 – seek stakeholder participation and define and resolve conflicts between key water use sectors, while also considering transboundary implications. Step 4 – inventory data and financial resources available and identify groups at risk. Step 5 – prepare/write the key tenets of the national drought management policy and preparedness plans following the three-pillar approach (pillar 1 –early warning and prediction; pillar 2 – risk and impact assessment; and pillar 3 – mitigation and response). Step 6 – identify research needs and fill institutional gaps. Step 7 – integrate science and policy aspects of drought management. Step 8 – publicize the national drought management policy and preparedness plans and build public awareness and consensus. Step 9 – develop education programmes for all ages and stakeholder groups. Step 10 – evaluate and revise national drought management policy and supporting preparedness plans.
Dealing with Drought: A Handbook for Water Suppliers in British Columbia (British Columbia, 2004, 2022) The handbook was prepared by an inter-ministerial task force established in 2003 when the province of British Columbia was facing a severe drought. At that time, several water supply systems were found to be vulnerable to prevailing drought conditions and were not able to deal with long-term droughts. The guide is part of the province's efforts towards drought risk planning and water scarcity management, with a specific focus on water suppliers. The main goals of this document are to support water suppliers in enhancing proactive drought management and to improve drought management efforts by strengthening demand management and conservation planning alongside the protection of water resources and aquatic ecosystems. The first edition of the British Columbia handbook was published in 2004 and the second one in 2022, which is mostly similar to the previous version. The document is considered an important resource as part of British Columbia's drought and water scarcity response planning (British Columbia, 2022, 2024). The handbook provides useful guidelines by providing specific templates for local drought management teams, drought level and response, water supply and demand assessment, drought planning and water conservation, and emergency drought planning. Furthermore, a drought management plan template is proposed, which is composed of eight components. Component 1 – build a local drought management team. Component 2 – document the water system profile. Component 3 – evaluate the impacts of drought on the region's economy. Component 4 – monitor water supplies and climate. Component 5 – define drought stages. Component 6 – establish drought responses. Component 7 – develop communications. Component 8 – evaluate drought management plan.

Table 1. Continued.

A brief description of the drought policy and planning guidelines examined and suggested sources for further information.
Drought Risk Reduction Framework and Practices: contributing to the implementation of the Hyogo Framework for action (UNISDR, 2007, 2009) This framework was developed with a global effort led by several UN agencies (especially UNISDR), with contributions from several international experts from academia, research, government agencies, and private-sector organizations. The realization that drought is a global issue and the need for new paradigms and frameworks to address increasing drought risk led to several global and regional initiatives and events from 2003 to 2009, which contributed to the development of this guiding document. The preliminary version of the UNISDR framework was published in 2007, and the final framework was made available in 2009. The framework is composed of five core elements, each aligned with one of the five priorities of the Hyogo framework for action 2005–2015. Component 1 – policy and governance as an essential element for drought risk management and political commitment. Component 2 – drought risk identification, impact assessment, and early warning, which includes hazard monitoring and analysis, vulnerability and capability analysis, assessments of possible impacts, and the development of early-warning and communication systems. Component 3 – drought awareness and knowledge management to create the basis for a culture of drought risk reduction and resilient communities. Component 4 – reducing underlying factors of drought risk such as changing social, economic, and environmental conditions; land use; weather, water, and climate variability; and climate change. Component 5 – effective drought mitigation and preparedness measures to move from policies to practices in order to reduce the potential negative effects of drought.
The MEDROPLAN Guidelines for Drought Management (Iglesias et al., 2007) The MEDROPLAN guidelines were developed under the European Commission-funded MEDROPLAN project, with a focus on the Mediterranean countries. These countries face frequent droughts with widespread impacts on the economy and society due to the high vulnerability of the water supply and agricultural systems. The MEDROPLAN project was executed from 2003 to 2008 by eight academic and non-academic partners from six countries (Cyprus, Greece, Italy, Morocco, Spain, and Tunisia). The project aimed to improve water management for the benefit of society, bridging the science–policy–practice gaps and supporting a transition from reactive to proactive drought management in the Mediterranean region. While the guidelines are underpinned by the context and experience from the participating Mediterranean countries, the approach was deemed highly relevant for other countries in the region and beyond. The publication of the guiding document in six languages (Arabic, English, French, Greek, Italian, and Spanish) highlights its global relevance. The guidelines contain five main components. First, the planning framework is used to set up a multidisciplinary stakeholder team to define the purpose and process. Second, the organizational component is used to evaluate the legal, social, and political processes. Third, the methodological component identifies risk and potential vulnerabilities. Fourth, the operational component identifies and selects both long- and short-term priority activities and actions based on the agreed-upon criteria. Fifth, the public review component conducts public review, revision, and dissemination of the drought plan.
Drought management plan report including agricultural, drought indicators and climate change aspects (European Commission, 2007) These guidelines were developed by the European Commission, with contributions from all the EU member states, the accession countries, Norway, and other stakeholders and non-governmental organizations. The information presented is an informal consensus of the development partners and stakeholders. The document is an important communication from the commission published in 2007, which underlines the importance of reducing drought impacts on society and the environment. It recognizes the need for a paradigm shift from reactive to proactive drought management. The document aims to provide a comprehensive guideline for the preparation of drought management plans (DMPs) to better prepare the EU countries to deal with droughts. While the formulation of DMPs is not legally binding under the EU's Water Framework Directive (WFD), this document provides useful communication for those countries that may need to make their DMPs. In terms of contents, these guidelines cover the following four key components of drought planning and management within the context of EU member states. Component 1 – drought management planning within the EU policies and river basin management plans (RBMPs), with a focus on WFD and integration with the river basin development plans. Component 2 – core elements and contents of DMPs, including drought indicators and thresholds, measures for different phases of drought, the organizational framework, and dedicated sections on dealing with prolonged droughts and transboundary aspects. Component 3 – the related issues are agriculture, groundwater, and climate change. Component 4 – the strategic environmental impact assessment of DMPs. Additionally, the guidelines provide examples from several EU member states to substantiate some of the key components of the proposed DMPs.

Table 1. Continued.

A brief description of the drought policy and planning guidelines examined and suggested sources for further information.
The Near East Drought Planning Manual: guidelines for drought mitigation and preparedness planning (FAO and NDMC, 2008) This guiding manual was developed to address the need to develop proactive drought preparedness and mitigation plans in the near-east region, where droughts have been affecting millions of people and impacting multiple sectors of the economy. Droughts experienced during 1998–2001 further strengthened the awareness and realization of the need to better prepare to reduce drought risk. Reducing drought risk in a proactive manner is also recognized as an important element of the strategies to address the impact of climate change and combat desertification in this water-scarce region. These factors have contributed to enhanced efforts in the near-east region to address drought issues in a well-structured and proactive manner. Several countries expressed their need to develop a comprehensive framework to guide their efforts to develop drought preparedness and mitigation plans. These exploratory discussions and the development of the framework itself were mainly led by the Agriculture and Land and Water Use Commission of the Food and Agriculture Organization (FAO) for the near east during the period of 2004–2008. *The Near East Drought Planning Manual* is tailored to the context of the near-east countries and is mainly underpinned by the 10-step process and MEDROPLAN and UNISDR guidelines. The following six steps were proposed to develop and implement a national drought plan. Step 1 – creating political momentum and authority. Step 2 – strategic planning and coordination. Step 3 – fostering involvement and developing common understanding. Step 4 – investigating drought monitoring, risk, and management options. Step 5 – writing a drought plan. Step 6 – implementing a drought plan.
Guidelines for preparation of the drought management plans: development and implementation in the context of the EU Water Framework Directive (GWPCEE, 2015) The GWPCEE guidelines were developed from the Integrated Drought Management Programme's work in central and eastern European countries during 2013–2015. Drought and water scarcity have been seen as increasingly pressing issues in this region. Soil degradation and desertification were identified as noteworthy challenges linked to drought. A situation analysis of drought revealed that there was a lack of progress toward developing DMPs and/or integrating them under RBMPs (mandatory for the EU member states) in the 10 study countries (Bulgaria, Czech Republic, Hungary, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia, and Ukraine). These guidelines aimed to address these gaps by providing guiding framework tailored to the context of central and eastern European countries. The pilot project in Slovakia to develop DMPs contributed to the first draft of the guidelines. This was then used as the basis for consultation with focus countries, which resulted in the revisions and finalization of the guidelines. The GWPCEE guidelines are organized into seven main steps. These steps are largely based on the 10-step process and also consider EU and MEDROPLAN guidelines in addition to alignment with the relevant EU policies, especially WFD alongside the national and river basin contexts of the central and eastern European countries. Step 1 – develop a drought policy and establish a drought committee. Step 2 – define the objectives of a drought-risk-based management policy. Step 3 – take inventory of data for the development of the drought management plan. Step 4 – produce/update the drought management plan. Step 5 – publicize the drought management plan for public involvement. Step 6 – develop a research and science programme. Step 7 – develop an educational programme.
Strategic framework for drought risk management and enhancing resilience in Africa (UNCCD, 2018) The drought resilient and prepared Africa (DRAPA) framework was prepared within the framework of an initiative of FAO and the United Nations Convention to Combat Desertification (UNCCD). The development was led by the University of Nebraska – Lincoln. Additionally, input was provided by participants of the African Drought Conference held in Namibia during 2016 and by a few other stakeholders in Africa. The framework recognizes drought as a major disaster for Africa that has historically impacted millions of people by disrupting livelihoods and vulnerable people, communities, socio-economic sectors, and the environment. For the African continent, droughts are projected to increase in frequency, severity, and intensity in the future due to climate change. For instance, the 2015–2016 El Niño drought impacted many countries in Africa, indicating the insufficiency of reactive crisis management approach that dominates the drought response in most African countries. The need to shift to proactive risk management approaches has been increasingly recognized: guiding drought mitigation and preparedness policies and plans that address specific challenges faced in Africa and that align well with the global, regional, and local policies and initiatives. Therefore, the UNCCD DRAPA framework focuses on the African context. The framework is composed of six elements. The proposed elements are closely related to those outlined in the UNISDR framework. The six elements include (1) drought policy and governance for drought risk management; (2) drought monitoring and early warning; (3) drought vulnerability and impact assessment; (4) drought mitigation, preparedness, and response; (5) knowledge management and drought awareness; and (6) reducing the underlying factors for drought risk.

Table 1. Continued.

A brief description of the drought policy and planning guidelines examined and suggested sources for further information.
Assessing Drought Hazard and Risk: Principles and Implementation Guidance (World Bank, 2019) This guide is the output of a collaborative team effort by the experts from the World Bank and Deltares (lead organizations), with contributions from a few international academic institutions and UN organizations. This work is based on the recognition that conducting a scientifically sound drought hazard and risk assessment is fundamental to developing and implementing proactive drought risk reduction and management policies and plans. There are numerous datasets, tools, and models developed in the recent past that could provide a solid foundation for conducting such an assessment. The guide aims to provide a step-by-step process for both non-expert professionals (e.g. policy makers) and experts from various fields, such as water management and disaster risk reduction, to conduct drought hazard and risk assessment. The process can be applied to a specific sector (e.g. agriculture or hydropower) or can assess hazard and risk at a country level, involving multiple sectors and scales. The World Bank assessment guide is organized around four main phases. The scoping phase is when issues that arise when droughts occur are broadly identified within a wider context. The inception phase is when the first estimate of the drought hazard and risk in the area of interest is made by collecting the available (relevant) data from the literature as well as from a variety of other sources (in many cases online sources). The assessment phase is when a detailed analysis of ongoing, current, and/or future drought hazard and risk is carried out. The implementation phase is when actions that are most appropriate to solve the problem at hand are identified. Additionally, the guide recommends datasets, methods, models, and tools that could be used in each phase. An online catalogue has also been developed to support the application of these guidelines.
Drought resilience, adaptation and management policy framework: supporting technical guidelines (UNCCD, 2019) These guidelines were prepared to support the implementation of the Drought Resilience, Adaptation and Management Policy (DRAMP) framework (UNCCD, 2018). This framework outlines a list of measures to achieve six goals: reducing exposure to drought; reducing vulnerability to drought; increasing resilience to drought risk; transformation; preparing for, responding to, and recovering from drought; and transferring and sharing drought risks. However, the framework does not detail the underpinning elements of monitoring and forecasting, vulnerability and risk assessment, and transfer. Thus, the supporting technical guidelines aim to cover these gaps. The guidelines also aim to support the drought policy and planning process by covering key elements under three pillars of the disaster risk reduction. Hence, these also support drought planning process like step five of the 10-step process, which deals with preparing the drought plans underpinned by the three-pillars approach. Therefore, these UNCCD technical guidelines mainly focus on the three pillars of the disaster risk reduction. The main focus under the first pillar is the selection of indicators and triggers; the drought forecasting system; communication and response to drought warnings; and linkages between drought risk assessment, monitoring, and early warning. Pillar 2 provides guidelines to complete vulnerability and risk assessments for locations, people, and economies vulnerable to drought. Pillar 3 focuses on limiting the impacts of drought and creating a better response to drought. It also delivers information on structural (physical) and non-structural measures that can be implemented to reduce the impacts of drought for nations, economic sectors, and communities.
A nine-step approach for developing and implementing an "agricultural drought risk management plan"; case study: Alamut River basin in Qazvin, Iran (Marj and Abadi, 2020) The nine steps for agriculture mainly build on the existing guidelines (e.g. the 10-step process, EU and MEDROPLAN guidelines, and the near-east manual) and the experience gained through a 3-year pilot project in Alamut-Rud basin, Qazvin province, Iran. The work was led by the National Center for Agricultural Drought Management of the Soil Conservation and Watershed Management Institute. A combination of various research methods was employed to develop the agriculture sector plan and the guidelines. The methods included a review of the literature and best practices, workshops and think-tank meetings, database and library studies, resource and vulnerability assessment, defining the indicators, surveys with local stakeholders and decision-makers, plan development, and guideline development. The resulting nine-step process is a tailored guide for a pilot river basin in Iran, which could be applied to other regions as well. The nine steps, also called phases, include the following. Phase I – formation of the "executive team of delegations". Phase II – encouraging stakeholder engagement. Phase III – establishing a coherent communications network between stakeholders and teams, with a plan to collaborate and exchange information. Phase IV – establishment and activation of the "recognition and assessment team". Phase V – establishment and activation of the "supervision, monitoring, and early-warning team". Phase VI – compilation of "mitigation" and "contingency" plans. Phase VII – activation and monitoring of the "contingency" plan. Phase VIII – activation and monitoring of the "mitigation" plan. Phase IX – reassessment, control, modification, and updating of the entire plan and sub-plans.

Table 1. Continued.

A brief description of the drought policy and planning guidelines examined and suggested sources for further information
Integrated proactive drought management in hydrosystems and cities: building a nine-step participatory planning methodology (Filho et al., 2023) This approach was developed to support ongoing efforts in Brazil to develop drought risk management policies and plans. The country targets the development of drought preparedness plans at five levels: national, state, hydrographic regions/basins, hydrosystems, and water users. The nine steps for hydrosystems and cities are designed to formulate drought preparedness plans (DPPs) for hydrosystems and cities and are underpinned by the available global knowledge and experience (especially the 10-step process and the three pillars of disaster risk reduction). The approach is specifically tailored to the Brazilian context of water and drought management but has the possibility of being applied to other areas. This approach guides the formulation of DPPs, with the first four steps resulting in a DPP without the application of modelling tools (a socio-technical DPP built mainly on tacit knowledge) and all nine steps including modelling approaches to facilitate in-depth scientific analysis of issues, scenarios, and actions (a socio-technical DPP with modelling-intensive simulation). Step 1 – characterization of the study area. Step 2 – task force creation and initial contact with key actors attending the workshop. Step 3 – workshop 1. Step 4 – elaboration of a socio-technical drought plan. Step 5 – conducting technical visits for data collection. Step 6 – hydrological/hydraulic modelling. Step 7 – model implementation. Step 8 – conducting workshop 2 with key actors to present the results (e.g. modelling outcomes). Step 9 – the final socio-technical DPP with modelling-intensive simulation.

Table 2. Description and classification scheme of the evaluation matrix developed and used in this study.

Classification	Score range	Scoring guide
Very low (VL)	0–10	The element is not covered or is just briefly mentioned.
Low (L)	11–30	The element is mentioned in some detail, but sufficient information is lacking on the concept, methods, data, and tools. The references to supporting materials and examples are very limited.
Medium-low (ML)	31–50	The element is a core component of the approach. Although some information is provided on the concept, methods, data, and tools, important details are missing. Few references on supporting materials are included.
Medium-high (MH)	51–70	The element is a core component of the approach and has good coverage of the concept, methods, data, and tools. Most of the important details are reasonably well covered. A few references on supporting materials are included. The information is well supported by at least one or a few case study examples.
High (H)	71–90	The element is a core component of the approach and has very good coverage of the concept, methods, data, and tools. Most of the important details are well covered. Most important references on supporting materials are included and are discussed in detail. The element is sufficiently underpinned by state-of-the-art research on the topic and builds on the case study examples.
Very high (VH)	91–100	The element is a core component of the approach and has excellent coverage of the concept, methods, data, and tools. The important details are covered in a comprehensive and in a very good manner. The element is strongly underpinned by state-of-the-art research on the topic and builds on the case study examples and global best practices.

reliable and instructive for further discussion by, application to, and research by the science–policy–practice community concerned with drought management.

Moreover, I acknowledge that the terms "disaster risk reduction" and "disaster risk management" are often used interchangeably and are not easily distinguishable. However, this work recommends following the meanings outlined by UNDRR (2017):

> Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster

> risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. While disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. Disaster risk reduction is the policy objective of disaster risk management, and its goals and objectives are defined in disaster risk reduction strategies and plans.

The guidelines examined in this study aim to support developing polices, plans, and strategies in support of both disaster risk reduction and management aspects.

3 Results and discussion

3.1 Performance compared to the SENDAI framework priorities

The evaluation results for the four priority areas of the SENDAI framework and underpinning thematic elements are presented in Table 3. Under priority 1 (understanding the disaster risk), drought risk assessment and data and information are the two best-covered themes, which received high to very high scores in most of the guidelines evaluated. Communication and dissemination are mostly scored in the medium to high categories. In contrast, four thematic areas scored poorly in most cases. These include local knowledge and practices, capacity development, science–policy–practice dialogue, and research and development. These areas tend to receive lower coverage over time, as most of the guidelines developed after 2009 obtained lower scores compared to the earlier documents. For example, science–policy–practice was covered well by the 10-step process, MEDROPLAN guidelines, and UNISDR framework. The remaining sets of guidelines evaluated, including the most recent ones, do not provide good coverage of these topics.

Most of the sets of guidelines evaluated scored high to very high in all thematic areas falling under disaster risk governance (priority 2). For instance, the UNISDR framework provides very good to excellent coverage of this priority area. A few other sets of guidelines scoring high include the UNCCD DRAPA framework, the GWPCEE guidelines, the 10-step process, the MEDROPLAN guidelines, and the EU guidelines. However, the four most-recent guidelines developed during 2019-2023 (World Bank assessment guide, UNCCD technical guidelines, nine steps for agriculture, and nine steps for hydrosystems and cities) obtained comparatively low scores. These guidelines scored very low to low for political will, low to medium low for periodic assessment and reporting, and medium-low to medium-high for policy and governance aspects. The most recent guidelines place a very high emphasis on covering the three pillars of drought risk reduction and tend to give less attention to other important themes linked to the SENDAI framework. In contrast, drought risk reduction strategies and plans received good to excellent coverage by the guidelines evaluated. Similarly, stakeholder participation, including community engagement and coordination mechanisms within or across multiple sectors, are very well covered in most cases.

The scores for priority 3 (investing in disaster risk reduction for resilience) were very low to low in most cases. Only 1 of the 12 sets of drought guidelines, the UNISDR framework, scored in the medium-high to high range for the key elements under priority 3. The remaining 11 sets of guidelines mostly achieved (very) low to medium scores. For example, resource allocation (especially finances) and risk transfer (including insurance) are either not core elements or lack sufficient coverage in most cases. Similarly, mainstreaming drought risk reduction into land use policies and rural-development plans lacked sufficient attention. Business resilience, protection of livelihoods and productive assets, and health and safety are classified under the very low to low categories because of insufficient coverage. However, sustainable use and management of the ecosystem received variable coverage, as a few sets of guidelines (UNISDR and UNCCD DRAPA frameworks, EU and GWPCEE guidelines) provide good to very good coverage of this theme. Last but not least, most thematic areas under priority 4 are rated in the low to medium categories. An exception is the topic of disaster preparedness and contingency policies, plans, and programmes, which received medium to high coverage in most cases. However, the least amount of attention was paid to elements related to post-disaster recovery, rehabilitation, and reconstruction; resilience of critical infrastructure; and multi-hazard forecasting and early-warning systems.

3.2 Overall assessment and SWOT analysis

Figure 1 shows the average ratings of the guidelines examined compared to each of the four priority areas of the SENDAI framework. In general, none of the sets of guidelines examined align very well with all four priority areas of the SENDAI framework. Nevertheless, the UNISDR framework performed better compared to other guidelines examined in this study, even though it needs considerable improvement for priorities 3 and 4. Contrary to expectations, the most widely adopted 10-step process was not able to score very high on any of the four priority areas but scored medium-low on two of the four priorities (3 and 4), medium-high on priority 2, and high on priority 1. A couple of the sets of guidelines examined (UNCCD technical guidelines and World Bank assessment guide) are focused on a few thematic areas, such as addressing the three pillars of disaster risk reduction, and scored high to very high on these elements but achieved low to medium overall scores on all four priorities. On the other hand, the two most-recent guidelines (nine steps for agriculture and nine steps for hydrosystems and

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Table 3. The evaluation results of the alignment of the guidelines examined with the four priority areas of the SENDAI framework.

SENDAI framework priority area and the main elements considered in the evaluation	The 10-step process	British Columbia handbook	UNISDR framework	MEDROPLAN guidelines	EU guidelines	The near-east manual	GWPCEE guidelines	UNCCD DRAPA framework	World Bank assessment guide	UNCCD technical guidelines	Nine steps for agriculture	Nine steps for hydrosystems and cities
"Priority 1 – understanding disaster risk. Disaster risk management needs to be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment." (UNISDR, 2015)												
Overall evaluation of priority 1	MH	ML	H	MH	MH	ML	MH	MH	ML	ML	ML	L
Data and information	H	H	VH	H	H	H	H	VH	VH	VH	MH	MH
Risk assessment	H	MH	VH	VH	H	H	H	MH	VH	VH	MH	MH
Local knowledge and practices	VL	L	H	VL	VL	VL	VL	L	VL	VL	VL	VL
Capacity development	H	L	VH	ML	ML	VL	ML	MH	L	L	L	VL
Science–policy–practice dialogue	H	VL	H	H	VL	VL	VL	L	VL	VL	VL	VL
Research and development	MH	VL	MH	L	H	L	MH	L	L	L	ML	VL
Communication and dissemination	H	MH	VH	MH	H	L	H	MH	MH	H	MH	ML
"Priority 2 – strengthening disaster risk governance to manage disaster risk. Disaster risk governance at the national, regional and global levels is vital to the management of disaster risk reduction in all sectors and ensuring the coherence of national and local frameworks of laws, regulations and public policies that, by defining roles and responsibilities, guide, encourage and incentivize the public and private sectors to take action and address disaster risk." (UNISDR, 2015)												
Overall evaluation of priority 2	H	MH	VH	H	H	H	H	H	MH	ML	MH	ML
Policy and governance	H	ML	VH	H	H	MH	H	VH	MH	ML	ML	ML
Strategies and plans	H	H	VH	H	85	MH	H	H	H	H	H	H
Community representation	MH	H	VH	MH	MH	MH	MH	H	H	H	H	ML

Table 3. Continued.

SENDAI framework priority area and the main elements considered in the evaluation	The 10-step process	British Columbia handbook	UNISDR framework	MEDROPLAN guidelines	EU guidelines	The near-east manual	GWPCEE guidelines	UNCCD DRAPA framework	World Bank assessment guide	UNCCD technical guidelines	Nine steps for agriculture	Nine steps for hydrosystems and cities
Coordination mechanisms	H	H	VH	H	H	H	H	H	MH	MH	H	H
Political will and support	H	H	VH	H	H	H	H	H	L	VL	L	VL
Periodic assessment and reporting	H	ML	H	H	H	MH	H	MH	L	VL	ML	ML
"Priority 3 – investing in disaster risk reduction for resilience. Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. These can be drivers of innovation, growth and job creation. Such measures are cost effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation." (UNISDR, 2015)												
Overall evaluation of priority 3	ML	L	H	L	ML	L	L	ML	ML	ML	L	L
Resource allocation, including finance	MH	VL	H	MH	VL	VL	L	MH	MH	ML	VL	VL
Risk transfer and insurance	L	VL	H	MH	VL	L	VL	MH	ML	H	VL	VL
Mainstreaming disaster risk reduction assessments into land use policy	L	ML	H	L	L	L	L	L	ML	MH	ML	VL
Mainstreaming disaster risk reduction into rural-development plans	L	L	MH	VL	H	L	L	L	L	L	VL	VL
Business resilience and protection of livelihoods and productive assets	ML	L	H	L	L	L	VL	ML	ML	L	ML	VL

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Table 3. Continued.

The SENDAI framework priority area and the main elements considered in the evaluation	The 10-step process	British Columbia handbook	UNISDR framework	MEDROPLAN guidelines	EU guidelines	The near-east manual	GWPCEE guidelines	UNCCD DRAPA framework	World Bank assessment guide	UNCCD technical guidelines	Nine steps for agriculture	Nine steps for hydrosystems and cities
Sustainable use and management of ecosystems	ML	ML	H	ML	H	ML	H	H	MH	MH	L	MH
Health and safety	L	L	MH	L	L	L	L	MH	L	ML	VL	L
"Priority 4 – enhancing disaster preparedness for effective response, and to 'Build Back Better' in recovery, rehabilitation and reconstruction. Experience indicates that disaster preparedness needs to be strengthened for more effective response and ensure capacities are in place for effective recovery. Disasters have also demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of the disaster, is an opportunity to 'Build Back Better' through integrating disaster risk reduction measures. Women and persons with disabilities should publicly lead and promote gender equitable and universally accessible approaches during the response and reconstruction phases." (UNISDR, 2015)												
Overall evaluation of priority 4	ML	ML	MH	ML	MH	ML	ML	MH	ML	ML	ML	ML
Disaster preparedness and contingency policies, plans, and programmes	H	H	H	H	H	H	H	H	MH	L	H	MH
People-centred multi-hazard, multi-sectoral forecasting and early-warning systems	ML	ML	ML	ML	ML	ML	MH	ML	MH	ML	L	ML
Disaster response, including in emergencies	MH	MH	MH	MH	ML	L	ML	MH	ML	ML	L	L
Post-disaster recovery, rehabilitation, and reconstruction	ML	L	H	L	ML	L	L	ML	L	L	L	L
Resilience of new and existing critical infrastructure	L	L	MH	ML	MH	L	VL	L	ML	ML	L	L

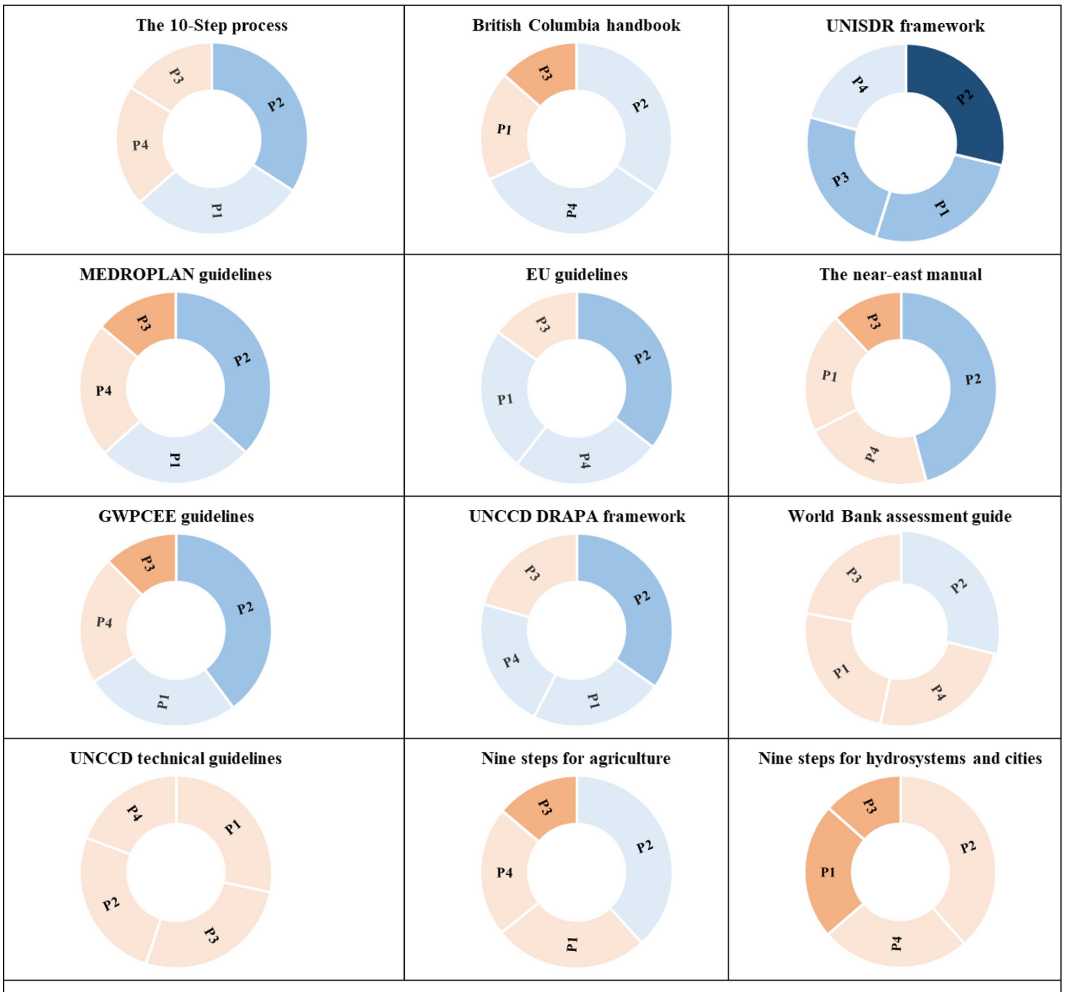

Figure 1. Average scores obtained by the drought guidelines examined for each of the four priority areas of the SENDAI framework.

cities), aiming to provide a comprehensive drought planning process, also achieved lower scores in general. Similarly, the regional guidelines (the near-east manual, the UNCCD-DRAPA framework, and the MEDROPLAN and EU guidelines) achieve low to medium scores in most cases. Furthermore, building on these evaluation results, the SWOT analysis was conducted, which is summarized in Fig. 2 and discussed below.

3.2.1 Strengths

There are several areas that are covered (very) well by most of the sets of guidelines (strengths), including data and information, risk assessment, policies and plans, coordination, and stakeholder participation (Fig. 2). These areas should be kept during new developments, updates, or applications, as these subjects will require few to moderate efforts to adjust to the scope and context of the new guidelines. The available guidelines provide a detailed account of the state of the art related to these topics, which can be very instructive for future work. For example, drought risk assessment is cov-

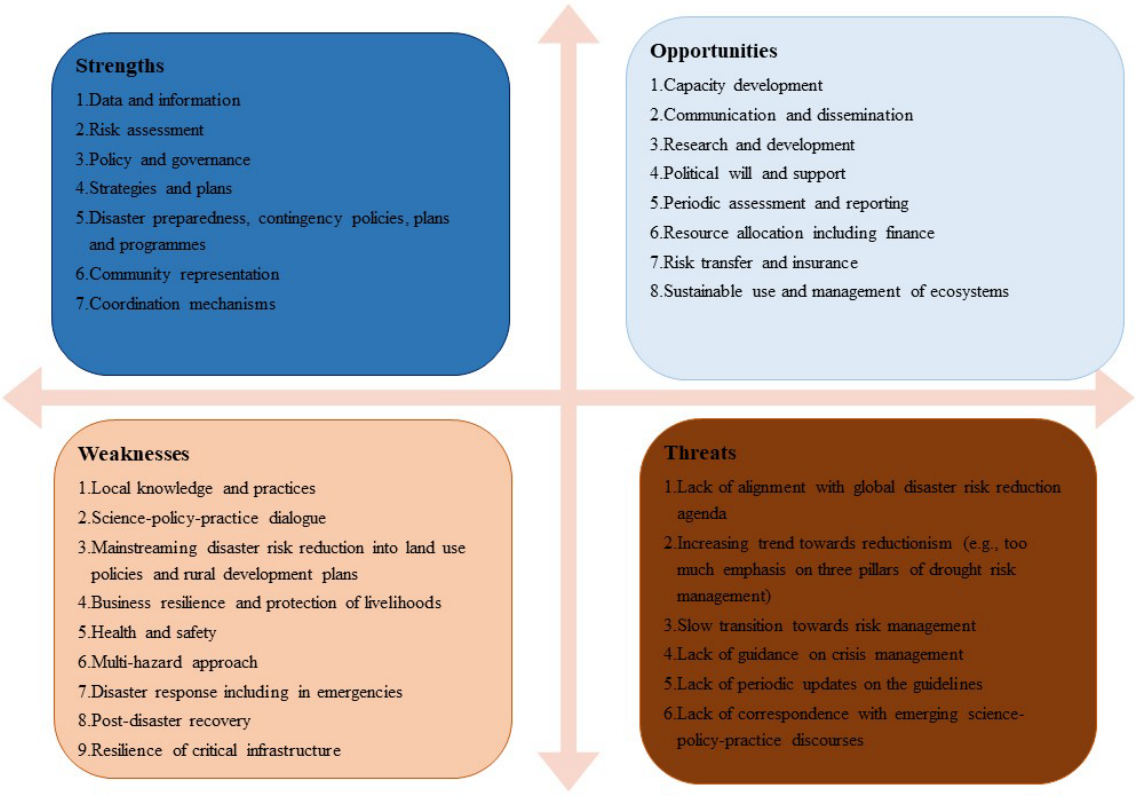

Figure 2. The summary of the SWOT analysis conducted on the drought guidelines examined.

ered very well by the 10-step process, MEDROPLAN guidelines, UNISDR framework, UNCCD technical guidelines, and World Bank assessment guide. The concepts, methods, and data to assess drought hazard, exposure, impact, and coping capacity are explained very well in most of these documents. Moreover, combining various factors in assessing drought vulnerability and risk is clearly outlined. These guidelines also provide good to very good coverage of the aspects related to data and information, policies and plans, coordination, and stakeholder participation and can, therefore, serve as an excellent reference for future work updating the guidelines or applying them in practice. For example, WMO and GWP (2014) provide a synthesis of core elements of drought risk management policies and plans (Box 1), which is based on the recommendations from various guiding documents (e.g. the 10-step process, UNISDR framework) and consensus from the HMNDP held in 2013 (Sivakumar et al., 2014). The Drought Resilience +10 Conference held in 2024 took stock of the progress made and challenges faced during the past decade and issued key recommendations for the future (IDMP, 2024). These recommendations are highly valuable and are instructive for making contemporary drought risk management policies and plans in the future (Box 1).

3.2.2 Weaknesses

Nine areas were identified as weaknesses (Fig. 2), which require urgent attention. Making progress in these areas will require an inquiry beyond the drought guidelines available, which provide limited information on these aspects. For example, the drought guidelines examined lacked good coverage of people-centred multi-hazard, multi-sectoral forecasting and early-warning systems. For example, the GWPCEE guidelines briefly mention the need for an integrated approach that focuses on managing risks from droughts, floods, and climate change. The measures could be assessed using a multi-criteria approach. While multiple sectors impacted by drought are mentioned, tailoring early-warning systems to cater to the needs of various sectors is not yet well developed and remains poorly covered. Additionally, the guidelines examined lacked sufficient focus on establishing linkages between drought and other natural and/or human-made hazards such as wildfires, heatwaves, desertification, water scarcity, and floods. However, the available scientific research and some practice documents can contribute to the transformation of the outlined weaknesses to strengths. For example, the available literature can be helpful to understand the linkages between drought and other hazards, such as drought and desertification (Stringer et al., 2009; UNCCD, 2022; Oswald and Harris, 2023), floods and droughts (Ward et al., 2020;

Five policy goals recommended by HMNDP held in 2013 (Source: WMO and GWP, 2014):

1. Proactive mitigation and planning measures, risk management approaches, and public outreach and resource stewardship.
2. Enhance collaboration between national, regional and global observation networks and developing information delivery systems that improve public understanding of, and preparedness for, drought.
3. Create comprehensive governmental and private insurance and financial strategies.
4. Recognize the need for a safety net of emergency relief based on sound stewardship of natural resources and self-help at diverse governance levels.
5. Coordinate drought programmes and response efforts in an effective, efficient and customer-oriented manner.

A **key recommendation from Drought Resilience +10 Conference held in 2024 (Source: IDMP, 2024):**
"All governments and other relevant stakeholders around the world are encouraged to manage drought risks in an integrated, proactive and prospective manner, shifting from the current reactive crisis-oriented approach, develop and strengthen drought policies and turn them into action by considering inter alia the recommendations of the DR+10 workstreams."

Box 1. Core elements for drought policies and plans aimed at reducing risks and building resilience.

Browder et al., 2021), droughts and water scarcity (El Kharraz et al., 2012; Van Loon and Van Lanen, 2013; IDMP, 2022), droughts and wildfires (Littell et al., 2016; Brando et al., 2019; Nones et al., 2024), and compound events in general (Zscheischler et al., 2018). Similarly, available studies can provide useful guidance to strengthen information on multi-hazard early-warning systems (e.g. Aguirre-Ayerbe et al., 2020; Hemachandra et al., 2021; UNDRR and WMO, 2023).

Understanding, assessing, and reducing the underlying causes of disaster risk in a systematic manner; considering hydrological, ecological, and social system dynamics; and comprehending the inter-linkages, feedback mechanisms, and compound and cascading impacts would contribute to building resilience to drought and related (multiple) hazards (Hagenlocher et al., 2023; Van Loon et al., 2024). For instance, sustainable land and water management practices can contribute to the fight against both drought and desertification. Additionally, these measures, including nature-based solutions, may also help maintain (or enhance) soil saturation, infiltration capacity, and water storage in the catchments, which could contribute to a reduction in flood risk during and after drought when high and intense rainfall event may occur and cause flash floods. However, these and other strategies and measures would require a sound understanding of the social and technical aspects of the local natural and human systems. A well-informed and proactive social and political response could greatly contribute to the successful implementation of drought response, mitigation, and preparedness measures, including sustainable land management practices, people-centred multi-hazard forecasting, and early-warning systems.

3.2.3 Opportunities

Seven opportunities were identified (Fig. 2). These areas can be enhanced, capitalizing on the information already available in the examined guidelines. For example, the UNISDR framework provides a good description of investments for prevention, mitigation, and preparedness measures, underpinning them with examples of and references to various investment sources. Similarly, the 10-step process and UNCCD DRAPA framework recommend innovative financial mechanisms alongside funding from various sources such as public and private investments, while the MEDROPLAN guidelines, UNISDR framework, and UNCCD technical guidelines contain some useful insights into risk transfer and insurance and safety nets, alongside a few good examples. Additional insights from multiple sources could provide useful material to strengthen these aspects of future drought guidelines (see, for example, Tadesse et al., 2015; Kron et al., 2016; World Bank, 2022; ADB and IDMC, 2024; IDMP, 2024; World Bank and European Commission, 2024). A quotation is provided below as an example to highlight recent insights into and recommendations for drought finance and risk transfer (Box 2).

Over the past few decades, several countries have made drought policies and plans using global, regional, and/or local guidelines (Guido et al., 2023; IDMP, 2024; NDMC Planning, 2024). These policies and plans offer a great opportunity for cross-learning on the contextualized development and application of drought policy and planning guidelines. For example, several sets of guidelines enumerate potential drought risk management measures, which could serve as a good starting point for screening, evaluating, and implement-

> "Intensify finance flows to build drought resilience at the desired pace. Increase the use of science-backed incentives in drought insurance policies. Diversify financial sources, including alternative sources such as the private sector and household contributions. Strategies to increase financial allocation, including youth-friendly funding, should be grounded in a solid understanding of the business potential of drought mitigation measures, identifying where partnerships must be established to create financially appealing, effective, and sustainable investment designs."

Box 2. A recommendation from the finance work stream of the Drought Resilience +10 Conference held in 2024 (source – IDMP, 2024).

ing suitable measures for a given context. An example case could be the drought management measures recommended in the EU Commission's guidelines (European Commission, 2007) and a critical assessment of the varying degrees of consideration of these measures in the drought management and drought-related plans and strategies developed by the EU member states (Guido et al., 2023). For instance, determining the usage priorities during drought situations is a measure recommended by EU guidelines, which is an important drought risk management measure that does not prominently feature in many guidelines. A critical analysis by Guido et al. (2023) on the status at the EU level suggests that 16 countries have established water allocation priorities at various levels (e.g. national, river basin, and local levels). In most cases, critical infrastructure use, domestic use, and the environment are among the top three priorities, followed by other uses/sectors (e.g. agriculture and industry), while navigation and recreational uses mostly receive the lowest priority. In contrast, several EU member states still need to establish water use priorities for drought. These and other such countries can learn from the examples available, even though the available cases may have some gaps. It is important to recognize that the factors considered in defining the water allocation priority may vary across countries and may include elements like the water account/balance situation, types of use, age and location of entitlements, differential profitability, severity of drought and water use restrictions, and exemptions during drought (e.g. for environmental/ecological flows as stipulated in the EU's WFD). Despite reasonably good coverage of various important factors, comprehensively considering criteria related to sustainability, efficiency and/or equity of water use is recommended in establishing water use priorities.

3.2.4 Threats

The major threats include a lack of alignment with the global disaster risk reduction agenda, an increasing trend towards reductionism, a slow transition towards risk management, a lack of guidance for crisis management, and a lack of periodic updates of the guidelines (Fig. 2). For example, to date, there is no set of guidelines specifically designed to align with the contemporary science–policy–practice discourses and global disaster risk reduction agenda, i.e. the SENDAI framework. Only the UNISDR framework was drafted in response to the *Hyogo framework for action 2005–2015*; hence, it aligns very well with its priority areas but requires a significant update to two of the four priority areas of the SENDAI framework (priorities 3 and 4). Furthermore, too much emphasis on risk management may be counterproductive, as the focus on crisis management receives little or no attention. This is demonstrated by the weak coverage of disaster response, including in emergencies and post-disaster recovery, rehabilitation, and reconstruction. None of the sets of guidelines evaluated provide comprehensive coverage of the key elements pertaining to the crisis management. Nevertheless, one of the 12 sets of guidelines, the British Columbia handbook published in 2004 (British Columbia, 2004), contains useful information on emergency response planning. Last but not least, the available guidelines lacked correspondence with the contemporary research and development discourses and can benefit from the available literature in these areas. Examples include but are not limited to understanding drought in the Anthropocene (Van Loon et al., 2016, 2022, Cook et al., 2022; Hall et al., 2022); the transition to sustainability and achieving sustainable development goals (SDGs), where drought management is an important contributor (Zhang et al., 2019; UNDRR, 2022; Tabari and Willems, 2023); assessing climate change impacts and adaptation options (Stringer et al., 2009; Cook et al., 2018; C2ES, 2018; Dai et al., 2018; Mukherjee et al., 2018; Iglesias et al., 2021); addressing maladaptation (Christian-Smith et al., 2015; Ward et al., 2020; Filho et al., 2022; Reckien et al., 2023; Tubi and Israeli, 2024); and managing the risk from flash (Otkin et al., 2018; Christian et al., 2021; Yuan et al., 2023) and mega droughts (Gober et al., 2016; Garreaud et al., 2020; Cook et al., 2022).

3.3 Making a transition towards the next generation of drought policy and planning guidelines

Since the available drought policy and planning guidelines do not align very well with the contemporary disaster risk reduction agenda, there is an urgent need to revise and improve them or to develop new guidelines. This is essential to accelerate the progress of the transition towards risk reduction and management, building resilience, and sustainability. At a global level, efforts could be dedicated to revisiting the available guidelines. For example, the UNISDR framework could

Table 4. A template outlining the key steps and elements that support the development of the next generation of drought policy and planning guidelines.

Process step	Suggested elements	Link to SENDAI framework priorities
Process initiation or periodic review and update	– Triggers (e.g. changing conditions and needs, drought events) – Periodic reviewing and updating as part of the regular planning cycle – Commitment from relevant authorities – Identification of the leading authorities, organizations, and teams – Add any other points	Priority 2
Policy and governance	– Forming drought policy and governance authority/commission, if necessary also forming the lead teams/committees/groups/authorities – Analysing existing policy and governance arrangements related to drought – Analysing existing policy and governance arrangements related to other natural or human-made hazards or natural resource management (NRM) (water management, land use and forestry, environment, climate change, etc.) – Assessing organizational structure (e.g. public and private sector organizations) for drought, other hazards, or NRM – Assessing policy coherence and multi-hazard and cross-sectoral coordination – Formulating new or revised policy and governance arrangements – Add any other points	Priority 2
Drought monitoring and early warning	– Monitoring and reporting different drought types (e.g. meteorological, agricultural, hydrological, socio-economic) across relevant spatial (e.g. global to local, river basin to small catchment) and temporal (short-term/flash droughts and monthly, seasonal, annual, or multi-year) scales, including consideration of flash and mega droughts – Monitoring and reporting the linkages between drought and other natural or human-made hazards (e.g. heatwaves, wildfires, water scarcity, desertification, and floods) – Drought forecasting and early warning as part of a multi-hazard early-warning system – Climate change impact assessment and plausible future scenarios – Integrating scientific and local knowledge (where appropriate) – Forming committees/groups spearheading the work on drought monitoring and early warning – Add any other points	Priority 1
Drought risk assessment	– Assessing the impacts of drought (and linked hazards) by taking a multi-sectoral approach as well as including vulnerable communities and ecosystems – Assessing vulnerability to drought underpinned by exposure, impact, and coping capacity analyses – Assessing and mapping the risk of drought (and other multiple/linked hazards) using state-of-the art methods (e.g. by combining hazard and vulnerability assessments) – Integrating scientific and local knowledge (where appropriate) – Forming committees/groups spearheading the work on drought risk assessment – Add any other points	Priority 1
Preparedness, response, and mitigation strategies	– Selecting suitable preparedness and mitigation measures to reduce drought risk – Selecting suitable measures to respond during different stages of droughts (e.g. pre-alert, alert, and emergency or other classifications used in a specific context) – Examining preferred measures and strategies for adaptive planning (e.g. flexibility and robustness to address deep uncertainty), considering scenarios for climate change and anthropogenic developments and pressures in the future – Examining preferred measures and strategies to avoid maladaptation – Examining preferred strategies to contribute to the achievement of the local and global disaster risk reduction and sustainable development agenda (e.g. SENDAI framework goals and objectives, contribution to drought-related SDGs and targets) – Applying multi-criteria analysis to perform comprehensive evaluation of the proposed strategies – Co-developing and co-evaluating plausible strategies with relevant stakeholders (including women and the most vulnerable groups) and decision makers and revising where necessary to get the strategies approved by the relevant authorities – Forming committees/groups spearheading the work on drought preparedness, response, and mitigation strategies – Add any other points	Priority 4

Table 4. Continued.

Process step	Suggested elements	Link to SENDAI framework priorities
Formulate and implement drought plan	– Drafting a drought plan including policy; governance; drought risk; and preferred preparedness, response (including in emergencies), and mitigation strategies – Outlining implementation aspects such as resource allocation, including finance; institutional roles and responsibilities; and the time frame and (sequence of) measures under pre- and post-drought situations such as pre-alert, alert, and emergency situations – Discussing the drought plan with relevant stakeholders and decision makers and revising where necessary to get it approved by the relevant authorities – Publicizing the drought policies and plans – Add any other points	Priority 3
Post-drought or periodic evaluation and feedback	– Regularly monitoring and evaluating the implementation of drought policies and plans – Conducting special post-drought evaluations after every drought event – Providing feedback to improve the drought policy and plans – Add any other points	Priorities 1, 2, and 4
Cross-cutting elements	Selecting cross-cutting elements, including but not limited to – Stakeholder participation – Capacity development – Communication and dissemination – Add any other cross-cutting elements (e.g. gender and inclusivity)	May cover priorities 1–4

be improved to better align with the SENDAI framework priorities. Moreover, the 10-step process could be updated, as it is very valuable and is the most widely recommended drought guide, but it has not been significantly updated since the work of Wilhite et al. (2000). Similarly, regional or local guidelines need considerable improvements in several areas. On the one hand, some guidelines may be a result of dedicated projects, and it may be difficult to revisit them after the project finishes. On the other hand, just like policies and plans need periodic evaluation and revision, so do the guidelines underpinning them. Thus, the drought guidelines are not meant to be static. Therefore, making concerted efforts at global, regional, national, and local levels to dynamically update the guidelines is highly recommended so that these correspond well with contemporary thinking and changing needs. There are several institutions and groups (e.g. UN agencies, academia, research groups, donors, and public- and private-sector organizations) that can (naturally) play a leading role in taking up this urgent call, as these institutions have a mandate and have made significant contributions to guiding drought policy, planning, and practical implementation in the past.

The information presented in this research can provide useful insights for both the developers and the users of the drought guidelines to move towards the next generation of drought policy and planning guidelines. Developing guidelines requires large investments and collaborative efforts from multiple stakeholders. Therefore, developing new or updated guidelines is beyond the scope of this research. Nevertheless, a contemporary framework is provided to facilitate this process (Fig. 3). The proposed framework is underpinned by the valuable information available in the existing sets of guidelines and by the new insights generated from this study. The framework contains seven main steps and a few cross-cutting elements linked to each step. Additionally, the process steps, potential thematic elements, and linkages with the SENDAI framework priorities are briefly mentioned in Table 4. In general, the proposed framework is flexible and could be adapted to the users' needs, for example, by adding another step or a cross-cutting element or by establishing linkages with relevant global, regional, national, and local policies.

4 Conclusions and recommendations

A number of sets of drought policy and planning guidelines have been developed and used over the last few decades. However, there is a lack of understanding of the alignment of these guidelines with the contemporary disaster risk reduction agenda. This study evaluated 12 sets of drought policy and planning guidelines for their alignment with the four priority areas of the *SENDAI Framework for disaster risk reduction 2015–2030*. The study shows that the available guidelines stress the need for a transition from crisis to risk management. However, despite providing useful instructions, transitioning towards risk management and building resilience is still a global challenge. While global disaster risk reduction agendas have attempted to keep pace by addressing emerging challenges, the drought policy and planning guidelines have not responded sufficiently to these new developments.

This study concludes that the current drought guidelines do not align very well with the contemporary disaster risk re-

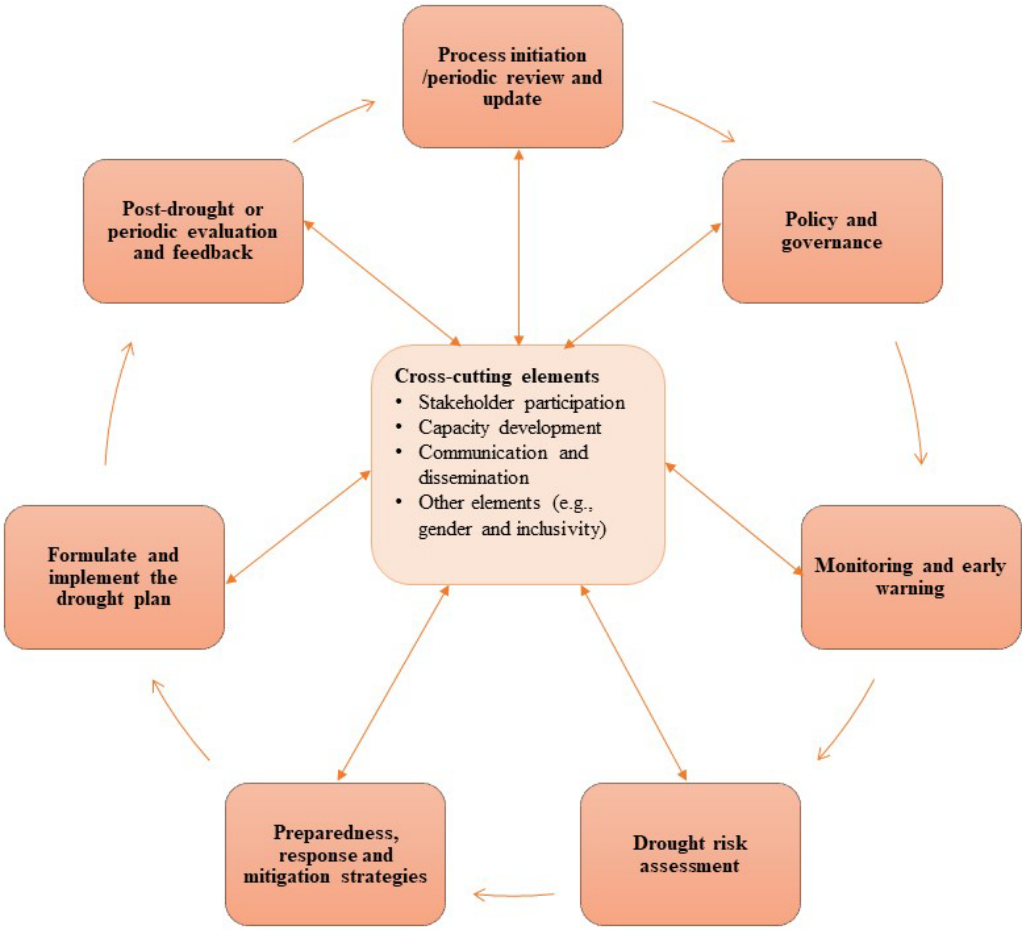

Figure 3. Schematic representation of the key steps and elements that support the development of the next generation of drought policy and planning guidelines.

duction agenda. While the available guidelines do provide very valuable instructions related to several important areas (e.g. data and information, risk assessment, coordination mechanisms and stakeholder participation, policy and governance, preparedness plans, and communication and dissemination), there are a number of key elements that require substantial improvement (e.g. local knowledge and practices; resource allocation, including finance; risk transfer and insurance; mainstreaming drought risk reduction into land use and rural-development policies; post-disaster recovery; rehabilitation and reconstruction; business resilience and protection of livelihoods; health and safety; resilience of critical infrastructure; and science–policy–practice dialogue). The drought policy and planning guidelines need periodic revisions to remain valid and able to address contemporary challenges and needs. Therefore, updating the drought guidelines after every 10 to 15 years in the light of new developments in the relevant agendas and scientific knowledge is recommended. Finally, this research calls for urgent and overdue action to make concerted efforts in developing the next generation of drought policy and planning guidelines. The wealth of information available through previous work and new insights from science–policy–practice arenas can substantially contribute to these developments, supporting the accelerated transition towards improved drought risk reduction and management and building the resilience of societies and ecosystems to droughts under changing climate and increasing anthropogenic pressures.

Data availability. The study is based on a document analysis. No datasets were used in this article.

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