



## Pre-disaster planning and preparedness for floods and droughts: A systematic review



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### ABSTRACT

Increasing intensity and frequency of climate-related disasters such as floods and droughts challenge existing governance models of disaster risk reduction. This paper systematically reviews 147 articles on pre-disaster planning and preparedness for floods and droughts in developed countries. The results show: 1) the formal adoption of an integrated system of disaster risk reduction and human development remains fragmented due to a lack of legislative and policy frameworks; 2) there is a trend toward the privatization of risk management by devolving responsibility for disaster liability to landowners; 3) planning and preparedness is more common for floods than droughts in the disaster literature; and 4) flood management is increasingly risk-oriented, whereas drought management in the disaster literature remains dominated by a crisis management framework. Integration of pre-disaster planning and preparedness with human development initiatives requires further investigation to achieve Sustainable Development Goals (SDGs) at local, national and international scales.

### 1. Introduction

Climate- and weather-related extreme events, such as floods, droughts, heat waves, and bushfires, are increasing in frequency and intensity in many parts of the world [1]. Climate change, rapid urbanization and urban migration, and environmental degradation expose populations to greater risks to events and their impacts [1–5]. The World Economic Forum [6] states that extreme weather events and natural disasters are two of the likeliest global risks with the largest impacts. Floods, which have accounted for nearly half of all disasters<sup>1</sup> from 1995 to 2015, and droughts, which have affected the most people globally, are two of the most common events with which governments must deal [7].

How communities and countries prepare for anticipated events is important to the development of resilient systems [8–11]. In 2015, 197 countries agreed to the Sendai Framework for Disaster Risk Reduction – the follow-up agreement to the Hyogo Framework for Action 2005–2015 (HFA). The Sendai Framework for Disaster Risk Reduction emphasizes the importance of addressing disaster risk through four

priorities: (i) understand disaster risk; (ii) strengthen disaster risk governance; (iii) invest in disaster risk reduction; and, (iv) enhance preparedness for response and to “Build Back Better” in recovery and rehabilitation [12]. While disasters disproportionately impact lower income countries more than higher income countries, the Intergovernmental Panel on Climate Change (2014) notes that countries at all levels of development lack significant preparedness to manage the impacts of future events.

Also in 2015 was the formal adoption of 17 Sustainable Development Goals by UN Member States, which embodies “human development” as a core objective – i.e. “enlarging freedoms so that all human beings can pursue choices that they value. Such freedoms have two fundamental aspects – freedom of well-being, represented by functionings and capabilities, and freedom of agency, represented by voice and autonomy” [13]: p. 1). Of relevance to pre-disaster planning and preparedness is the interaction with human development in governance and management [8,10,11]. As the UNISDR [5] notes, investment into capacities to strengthen disaster management has increased; however, the application of policies, norms, standards and regulations

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<sup>1</sup> The intergovernmental community defines disaster as “a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts” [14]; p.1).

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on disaster risk reduction and the integration with human development continues to challenge existing governance models in many countries.

Disaster management requires consideration of governance and management. Governance refers to “the system of institutions, mechanisms, policy and legal frameworks, and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy” ([14]: p. 15; see also [15]). Management refers to “the organization, planning and application of measures preparing for, responding to and recovering from disasters” ([14]: p. 16). Responses can be structural (e.g. dams, flood levies, evacuation shelters) or non-structural (e.g. building codes, land-use planning laws and regulations, public awareness programmes), and could be reactive (i.e. response-oriented) or pro-active (i.e. risk reduction). Understanding the variety of responses is important because of the implications that those responses and systems have on pathways for development [16,17].

The purpose of this paper is to assess the governance and management of pre-disaster planning and preparedness for climate-related floods and droughts in developed countries through a systematic review of peer-reviewed literature from 2005 to 2018 (i.e. since the inception of HFA). Specifically, this review addresses priorities (ii) and (iv) of the Sendai Framework for Disaster Risk Reduction. Given that developed countries are in a better position to enact disaster preparedness based on financial and technological capacities and a wider acceptance and understanding of pre-disaster planning and preparedness, this review focuses on literature regarding developed countries to seek evidence of good practice. We aim to: (i) present an overview of the disaster risk governance landscape from the literature sample and identify differences between flood and drought governance; (ii) identify common barriers to pre-disaster planning and preparedness within existing governance models; and, (iii) assess the trajectories of disaster governance and identify knowledge gaps in relation to the global development agenda (i.e. the Sendai Framework for Disaster Risk Reduction, the 2030 Agenda for Sustainable Development, and the Paris Agreement).

## 2. Methods

Systematic reviews are common approaches to literature reviews involving a structured technique to data collection and analysis. While this approach has origins in the health sciences, it is increasingly being used in social science research [18–21]. For the purpose of this review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach [22,23] for searching and selecting the literature sample (Fig. 1).

Using the following search string, we compiled a list of articles and reviews to be considered for full-text review through Scopus and Web of Science, importing all references into EndNote on 19 June 2018:

(TITLE-ABS-KEY (“disaster risk reduction” OR “disaster management” OR “disaster governance” OR “crisis management” OR “emergency management”) AND TITLE-ABS-KEY (prepar\* OR plan\*) AND TITLE-ABS-KEY (flood\* OR drought OR water)) AND DOCTYPE (ar OR re) AND PUBYEAR > 2004.

The literature sample was limited to published articles and reviews in English from the HFA's inception (2005) to 2018. We recognize that some relevant literature may be excluded from the study based on the search string adopted and/or the language of publication. This may result in some geographic regions being underrepresented in the analysis.

All titles, abstracts and keywords were reviewed against a set of inclusion criteria defined by location (i.e. developed countries), engagement with disaster risk governance or disaster risk management for floods and/or droughts, and with a focus on government interventions, given that governments are primarily the responsible authorities for managing disaster risk [12]. Gaillard & Mercer [24] and others note a significant gap in translating disaster risk reduction knowledge into

action. As Straus, Tetroe & Graham [25] state, knowledge translation needs to take into consideration “the various stakeholders involved or the actual process of using knowledge in decision-making” (p. 165). Therefore, publications were required to focus on how practitioners operationalize disaster risk reduction knowledge in a pre-disaster context, rather than how that knowledge can be produced. For example, how do countries interpret the European Union's Flood Directive and apply it to their local and/or national contexts? What government interventions are applied at different political and spatial scales? And what are the implications of current policy and practices for disaster risk? In addition, developed countries were standardized using the United Nations' *World Economic Situation and Prospects 2018* report which identifies 36 countries as having ‘developed economies’ ([26]: p. 48).

905 of 1062 publications were excluded from full-text review based on location, topic and language. These studies generally focused on decision-making support tools, such as vulnerability and risk assessments methods. While they are relevant tools for decision-making, the lack of engagement with flood and/or drought governance, or the politics of decision-making, necessitated their exclusion for full-text review. A further 10 articles of the 157 articles were excluded from analysis during the full-text review for not meeting the same inclusion criteria. The result was 147 articles representing 77 different journals, the most frequently represented journals being the *Journal of Flood Risk Management* (5%), and *Natural Hazards, Disasters, and Ecology and Society* (4% each).

The review process for the remaining 147 articles that underwent a full-text review involved three rounds of coding: open coding, axial coding, and selective coding. Open coding involved identifying small segments of data that were considered in detail and compared with one another [27]. Findings of studies relating to disaster governance or management for floods and/or droughts were coded. This was followed by axial coding which took the initially coded data and labelled them based on similarities and differences [27]. In this case, axial coding involved placing each coded segment from the open coding process under one of the following three themes: i) governance features of disaster management; ii) shortcomings of current disaster governance and management; and, iii) disaster governance trends. Within theme (i), sub-nodes based on country origin, institutional arrangements, and frameworks relating to flood and drought management were used to further disseminate all coded material. Comparative studies that focused on multiple countries were double-coded to the country origin and institutional arrangements sub-nodes to avoid misappropriating findings to different contexts. The third and final phase of coding, selective coding, revisited the coded material, identifying themes, concepts and relationships, which is a common process for qualitative assessments [27–29]. In this final round of coding, coded material in each of the three themes were re-visited and disseminated into themes, concepts and relationships. The results of this process are presented below under the following headings: institutional frameworks; institutional arrangements and the shift towards risk management privatization; complacency in decision-making; and, the separation of disaster risk reduction and human development in governance and management.

While the purpose of the systematic review is to assess existing literature on the governance and management of pre-disaster planning and preparedness for floods and droughts in developed countries, results of the selection and coding process resulted in many more flood event articles than droughts with comparisons drawn where applicable.

## 3. Results and discussion

### 3.1. Overview of the literature sample

The results show a difference in the number of floods versus drought papers (Fig. 2) – droughts only account for 6% of the literature sample,

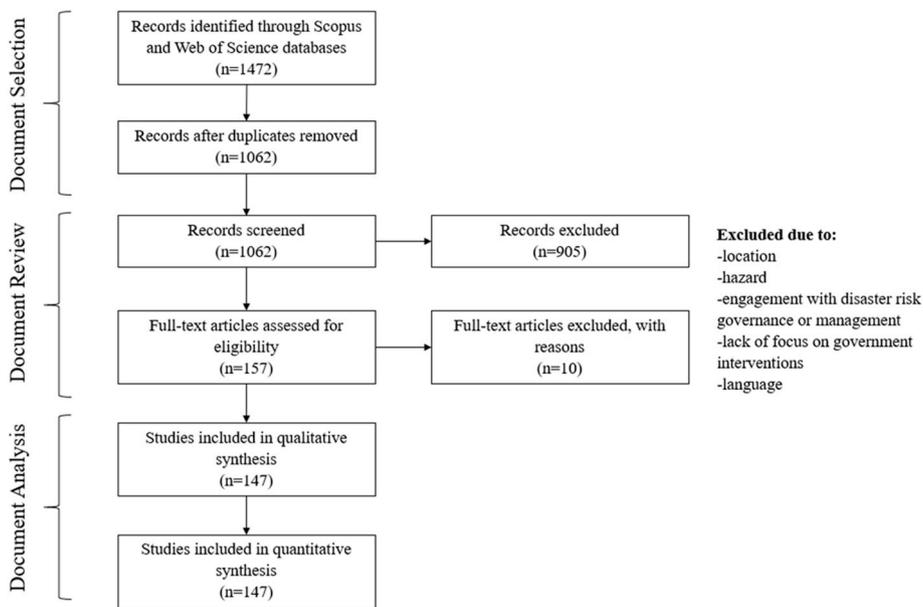


Fig. 1. Flowchart outlining Protocol of Review.

and only two articles (< 1%) discussed both droughts and floods (i.e., [30,31]. Publications on pre-disaster drought management and its governance remain relatively low due to the adopted search string. The underlying assumption of the adopted search string is that drought is classified as a disaster or emergency and that interventions for both types of hazards are government-based; however, a secondary search post-review conducted in Scopus on *drought AND (management OR plan\*)* produces more than 10,000 results. While the post-review search did not undergo the same coding and dissemination process, it indicates an important finding on the conceptualization of droughts as a ‘disaster’ within literature. Intergovernmental definitions of drought often associate it with disasters. As the International Strategy for Disaster Reduction [32]: p. 1) states:

Drought is a normal part of climate; an extreme climatic event, often described as a natural hazard. Drought by itself does not trigger an emergency. Whether it becomes an emergency depends on its impact on local people. And that, in turn, depends upon their vulnerability to such a ‘shock’. Drought results in substantial impacts in both developing and developed countries, although the characteristics of these impacts different considerably.

Under the definition of disaster, drought can constitute a disaster when there is a significant impact on lives and livelihoods [14]; however,

given the limited results on drought from this review, it raises important questions on the conceptualizations and applicability of long onset events in literature and practice.

In addition, the focus on government-based interventions assumes that the interventions for pre-disaster planning and preparedness for floods and droughts is under government jurisdiction. By widening the scope of the review to include other stakeholders, such as the private sector, more articles may be captured in the review process. For example, the use of dams as a control mechanism to mitigate drought impacts may be operated by private stakeholders. It raises another important question and consideration in research as to the authority or authorities that oversee drought management interventions – i.e. is it under private sector or government jurisdiction?

The second finding of this review is that the number of flood-related publications increased over time, with a spike in 2016 (26.5% of the literature sample). This increase in publications corresponds to the timing of three international agreements in 2015 on disaster risk reduction, sustainable development and climate change: The Sendai Framework for Disaster Risk Reduction 2015–2030 [12]; the 2030 Agenda for Sustainable Development [33]; and the Paris Agreement [34]. The Sendai Framework succeeded the HFA, petitioning for better understandings of underlying drivers of risk. Publications related to drought management also increased over time, particularly from 2013

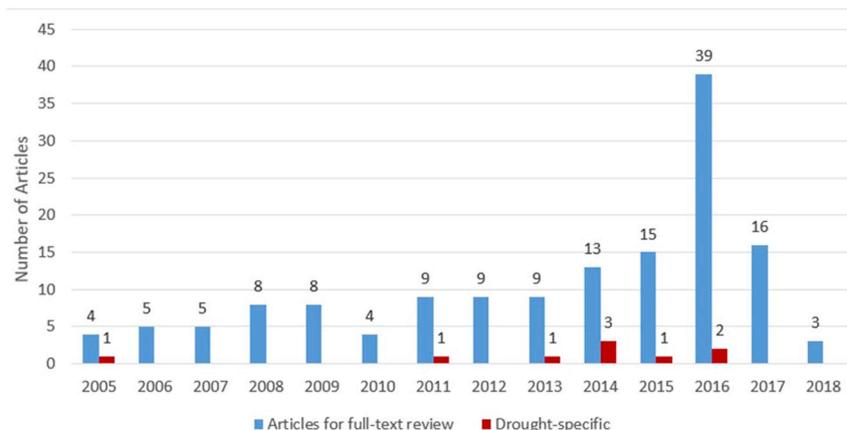


Fig. 2. Full-text sample distribution by publication date.

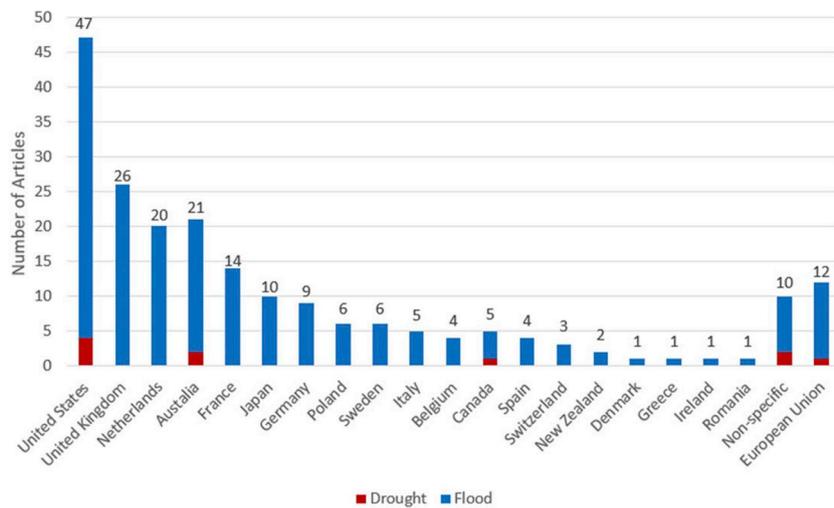


Fig. 3. Spatial Distribution of Sample based on Hazard.

to 2016, which corresponds to the 2015 agreements, as well as the High-level Meeting on National Drought Policy (HMNDP) in 2013 that was convened by several international organizations (WMO, UNCCD, FAO, etc.). The purpose of this meeting was “to provide practical insight into useful, science-based actions to address the key drought issues being considered by governments and the private sector under the UNCCD and the various strategies to cope with drought” [35]. It was designed to highlight the common issues impacting more proactive approaches to drought management and discuss a standardized approach moving forward – from crisis management to drought risk management (see Ref. [36]).

The geographical distribution of the literature sample shows that 32% of all articles included in the full-text review involves the United States as a geographical focus, followed by the United Kingdom (18%), Australia (14%), and the Netherlands (14%) (Fig. 3). Sixty-nine percent of the spatial distribution is based in countries where English is a first language.<sup>2</sup> This is expected based on the location and language criteria of this review.

Six of the nine drought publications were focused on the United States, Australia and/or Canada. The three articles outside of these countries highlighted the lack of national drought risk management policies (i.e. [31,36,37], which aligns with the HMNDP discussions on issues of drought management.

### 3.2. Institutional frameworks

Two conceptual frameworks emerged from the analysis: risk management and crisis management. Each had different interventions and capacities depending on the hazard. Risk management is largely oriented around a prevention-preparedness-response-recovery (PPRR) framework. It is characterized by a set of structural and non-structural measures<sup>3</sup> designed to prevent disasters and mitigate potential impacts across all stages of the hazards cycle – i.e. before, during and after a hazardous event [38,39]. This risk-based approach to disaster

<sup>2</sup> This represents multi-site studies which were double-counted in assessing this distribution.

<sup>3</sup> Structural planning refers to “any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems. Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education” [14]; p. 23).

management is a framework aimed at enhancing community resilience to all types of catastrophic events. It is a shift away from reactionary models of disaster management, most commonly referred to as crisis management, and towards a more proactive approach that seeks to minimize the exposure to potential disasters and mitigate their impacts – i.e. risk reduction [40–42].

Crisis management is a reactionary management style in which present conditions dictate action [37,43–47]. It is often characterized by contingency planning, particularly as it relates to providing relief to impacted populations [44,46,48]. This is a dominant model that was used in the 20th and early 21st centuries, prior to the formal adoption and shift towards risk management styles of governance [40–4249]. While risk management has become a dominant model for disaster management, this does not eliminate the use of crisis management by governments and practitioners for all hazards.

#### 3.2.1. Floods

While the PPRR framework dominates disaster literature regarding flood management, there is an uneven distribution to the investment and focus that each of the PPRR components receive. It is dependent on the local and national context under examination. For example, in the Netherlands and Poland, the focus is on flood prevention, most notably, through structural measures [38,50–53]. In France, there is greater emphasis on contingency planning for when hard engineering measures fail, thereby absorbing risk and promoting timely recovery through insurance mechanisms [51,54]. In the United States and the United Kingdom, flood risk management is more balanced across pre-disaster planning and preparedness, emergency response and post-disaster recovery [55–57].

The range of activities across the PPRR framework is important to note because there is no standardized ‘best practice’ approach to effectively manage all stages of the hazards cycle. Institutions, like individuals, are limited in capacity. In some cases, such as the United States and the United Kingdom, the administrative capacity to access additional resources for any one of the three major components of the hazards cycle can be restricted based on the size of the community – i.e. its administrative capacity (see Refs. [58–60]). The question becomes how to use those resources to optimize the performance of the disaster management system.

Historically, most governments focus on flood prevention [51–53,56,61–63] – with the use of structural solutions over non-structural planning interventions such as land use planning and insurance mechanisms. As such, a technocratic approach to flood risk management has been adopted in many countries, including in the

Netherlands, United States, Australia, Japan, Poland, and the United Kingdom [64–68]. Research and policy reform have highlighted the importance of developing a more integrated risk management approach that includes non-structural planning in pre-disaster planning and preparedness. In particular, Pardoe, Penning-Rowswell & Tunstall [66] note the shift from technocratic management to a more diverse portfolio that includes spatial planning interventions as a means to reduce resource-people conflict. It is a push away from the command-and-control approach over water resources to one principled on holistic and catchment-based flood risk management [61].

Some authors note that the progression from crisis management to risk reduction resulted from large-scaled disasters that had profound impacts on the population – an admission that the existing arrangements and approaches are ill-suited to protecting people and property during these events [61,69–72]. Birkland [73] and others refer to these types of events as ‘focusing events,’ where changes result from operational deficiencies exposed by a disaster. It is when system weaknesses are exposed that investment into corrective measures occurs. The literature reaffirms this conclusion, highlighting the historical changes to disaster governance and management following events, often large-scale flooding. It is the catastrophic events, such as Hurricane Katrina in 2005 in the United States, that facilitated change around the world. Kolen & Helsloot [52,53] note that Dutch flood management policies and practices became a focus in response to Hurricane Katrina. The Dutch government sought to diversify their flood management portfolio away from the predominantly technocratic approach characterizing their system; however, the argument can be made that such a transition has yet to occur in the Netherlands [51,65]. In France, Storm Xynthia in 2010 aided in the assessment of French regulations and institutional arrangements, leading to stricter regulations and stakeholder oversight [70]. More broadly, the European Union's Flood Directive was adopted in 2007 following major flooding in Europe in 2002. The Flood Directive has widened the focus of flood management to consider non-structural planning, communication, evacuation, and emergency response. It is a shift away from the command and control of water's relationship with people to living with risk and recognizing the complexity between the two [50,74].

At the local level, Brody et al. [69] show that processes of governance learning are expedited by events. As the authors state: “Hazard events can act as triggers to the policy system and become catalysts for adaptation” (p. 914). Heintz, Hagemeyer-Klose & Wagner [61] argue that this system of learning reinforces reactive management; it is only after an event where significant change occurs. Others affirm the position that it is only after a disaster that the effectiveness of the system can be accurately assessed. Therefore, it appears that major system changes mainly occur with a corresponding trigger [75,76].

### 3.2.2. Droughts

There is less evidence in this review of the PPRR Framework being applied to drought management. Where comprehensive plans for drought risk management exist, they emphasize crisis management and relief over prevention and mitigation [30,36,37,44–46,48]. For example, Fu et al. [46] note that 32 of 44 US State drought management plans are framed as crisis management and only 10 of these 44 plans include water conservation measures during droughts.

The crisis management approach is due, in part, to the lack of structural measures available to mitigate or prevent droughts from occurring [30,37,45]. Where flood prevention measures exist, structural measures preventing droughts or mitigating their impacts, such as water-efficient infrastructure and early warning systems, are largely absent in this disaster-oriented literature. The absence of such mechanisms and tools minimizes the abilities of disaster management institutions to adopt a risk management approach that incorporates pre-disaster planning and preparedness that is operational. In these cases, emphasis is placed on drought response and relief. A shift to a risk management approach for droughts involves enhancing “monitoring,

mitigation, and response mechanisms that enable decision-makers to detect a drought early, respond in a timely manner, and implement measures to reduce impacts while not in active response mode” ([45]: p. 253). Willhite, Sivakumar & Pulwarty [37] emphasize the importance of developing stronger early warning systems, comprehensive water conservation plans, and reservoirs and social capital outside of the disaster portfolio as requirements to making this shift away from crisis management.

Planning for droughts, as opposed to simply responding to them, is complicated due to their relatively slow onset and seen as part of a natural cycle, and spatial and temporal characteristics (i.e. typically affecting a larger area and lasting longer). Furthermore, disagreement among practitioners and decision-makers as to when a drought begins and ends was noted [30,45]. This creates a conceptual dichotomy on droughts which reinforces crisis management by making it difficult to ascertain when a disaster has occurred and the corresponding actions required based on the degree of impacts during events.

### 3.3. Institutional arrangements and the shift toward risk management privatization

In many countries, disaster management is decentralized involving a multi-level and multi-sector network of stakeholders at all stages of the hazards cycle. Primary responsibility for disaster management falls onto government agencies and individual action tends to be voluntary. In the Netherlands, the maintenance of flood defenses is entirely under government jurisdiction. In Australia, disaster management responsibility is shared between three levels of government [77] and similarly in Japan, no single authority has sole responsibility for disaster management [78]. In the United States and the United Kingdom, government agencies are required to prepare for disasters through law, but individuals are not [55,79]. Conversely, in France, landowners are required to contribute to the maintenance of flood prevention structures on their property by contributing to the financial costs [56]. Within these arrangements, jurisdictional authority can depend on the type of disaster and its designation. For example, in the Netherlands, there are two different designations for flooding: ‘waterlogged events’ and ‘big floods’. Responsibility for response during waterlogged events are under local jurisdiction, whereas the national government is the primary authority for big floods; however, the national government and regional Water Authorities have a responsibility for flood prevention. In this case, prevention is a senior government responsibility and response is dependent on the type of disaster. It is when local capacity to manage floods effectively and efficiently is impeded that jurisdictional authority is transferred to more senior levels of government [53]. This is common for disaster management practice, where local authorities are first responders with support coming from senior levels of government which have greater institutional capacities [46,48,58,80,81]. In most cases, while disaster management involves multiple stakeholders operating at multiple levels, there has been an increased shift towards ‘localism’. Localism – a form of decentralization favouring local decision-making – reflects a devolution of responsibility onto lower levels of government [80]. Huq [82] notes that in the United Kingdom, decentralization of disaster management positions responsibility across multiple governance tiers at different levels; however, primary responsibility for disaster management remains with local government. This decentralization of responsibility across multiple governance tiers and the devolution of responsibility to local government further emphasizes the importance of coordination across stakeholders at all governance levels.

Where the Dutch and Polish take a more centralist approach to flood management, the United Kingdom, the United States and Canada take a more decentralized and balanced approach where individuals have a role and responsibility in flood risk management. With the decentralized approach, while emergency response remains largely localized, prevention, mitigation and preparedness for hazards involves multiple stakeholders operating at multiple levels. The importance of

coordination, collaboration and communication between all stakeholders are stressed in all stages of the disaster management framework adopted [72,81,83].

Recent institutional arrangements have shifted towards the privatization of risk management. This devolves responsibility for disaster security onto landowners. This is the case in the United States. The pressure for urban expansion has resulted in building in flood-prone areas [54]. The rising costs of natural disasters is exceeding government capacities to effectively supply relief; however, of issue is that insurance mechanisms, in some cases, stunt resilience by excusing urban expansion and settlement in flood-prone areas [84,85]. As flooding becomes more frequent and intense, the costs to supply relief to victims exceeds the financial capabilities of the programs in place. For example, the National Flood Insurance Program of the United States was designed to create a self-supporting system whereby premiums would cover the costs of annual flooding throughout the United States; however, the program was designed to cover expenses and losses based on the historical average and not for catastrophic events, such as Hurricane Katrina [71]. The lack of anticipatory components to the programs based on a moving average that is increasing with climate change is a barrier to adequately costing future disaster relief.

There is a growing shift towards the privatization of risk management, particularly as it pertains to flood insurance. Responsibility to be protected against the impacts of a disaster is shifting to the individual. Unlike the Netherlands and Poland, the United Kingdom, the United States and France place greater responsibility onto the individual to take preventative action for flooding. Landowners are increasingly responsible to ensure their properties are protected, usually in some form of insurance mechanism [54,80].

While disaster management is largely a government responsibility, it is not a security right under the law – the individual does not have the right to absolute protection. As Bean, Staddon & Appleby [79] state, “just because public authorities may have the legal power to act does not mean that they also have the duty to act” (p. 61). In other words, the duty of care owed to landowners by government authorities is such that there is no specific right to be protected against flooding through preventative measures; the protection against flooding involves discretionary decision-making. This awareness of roles and responsibilities for disaster management by the individual and the expectation to be protected against all natural disasters can hinder government-public relations. As Kano, Kelley & Hashemi [86] note, a pressing concern among residents is each government's role in providing mitigation prospective of an event (see also [60]). As floods and droughts become more frequent and intense because of climate change, how that duty of care owed to the general public changes is particularly noteworthy. The legal responsibilities for disaster prevention and preparedness of individuals and landowners and the rationale for government interventions on pre-disaster planning comes into question.

### 3.4. Complacency in decision-making

Another theme that emerged in the systematic literature review was that risk perception is affected by a multitude of factors, including: the history and experience of disasters [58,87,88]; access to information and comprehension of decision-making tools [89]; uncertainties of disasters and the potential impacts to future response [52,53]; ignorance towards risk [90]; and, misconceptions of exposure [91,92]. In some cases, individuals are unaware of their risk(s) or their responsibilities for risk reduction [90,93,94]. The result is often complacency among residents and decision-makers for emergency planning [87,89,90,95] under the auspice that the area is safe or at low risk of a disaster [88,91,92,96]. In part, this is due to their access to information and trust of that information [90] and a comprehension of the instruments designed to support decision-making, both at the institutional levels and the individual/household [58,78].

In some cases, the information is not necessarily desired by

residents. Barraqué [54] notes that not knowing if their property is in a flood-prone area is actually preferred because of the consequences to property value if that knowledge becomes public. In such cases, potential financial reward outweighs risk. Burningham, Fielding & Thrush [90] expand on this noting that many households are unaware of their risk to floods when purchasing property – they felt that their community was ‘risk-free’ to flooding.

The most notable influence on risk perception, particularly as it pertains to flooding, is the over-reliance on structural measures for prevention of all events. Scholars [88,91,92,96] note that there is a false sense of security associated with structural measures. This fosters development in flood-prone areas under the auspice that the probability of flooding has been averted or, at least minimized, if certain engineered solutions are in place. Making a decision to provide a flood defense is likely to be affected by the capacity of the responsible institution(s) to absorb the cost of maintenance over the long term [93,97,98]. Given the broad legislative duties of government and the uncertainties of disasters in terms of timing and severity, the maintenance of disaster prevention measures may be ignored or pushed over to later fiscal years to accommodate other priorities [60,63,85,97–99]. Therefore, while exposure may be mitigated, it is not eliminated.

### 3.5. The separation of disaster risk reduction and human development in governance and management

Recalling that human development refers to enlarging freedom of choice through well-being and agency, governments have recognized the importance of adopting a more integrated approach to human development which incorporates disaster risk and risk reduction and vice versa; however, there are few policy and legal frameworks which explore or are foundational of the synergies between disaster risk reduction and development [80,100]. Historically, disaster risk reduction and human development have operated under separate policy arenas. Of issue is that pathways for development and economic growth often did not include considerations of disaster risk within their governance or management. In the absence of a disaster, the pursuit of economic growth and human development would occur irrespective of disaster risk.

Moreover, there is a belief that structural measures can prevent disasters, thereby excusing urban expansion in highly exposed areas. This technocratic approach to disaster risk management has fostered a false sense of security with policy- and decision-makers and among residents [56,61–63]. The argument being that all disasters are preventable, as opposed to the more risk-based approach that refutes this but notes that they are all manageable (see Ref. [79]); eliminating risk is not possible, but minimizing it is [75].

This reliance on hard infrastructure and the separation from non-structural planning interventions which includes human development as a core objective for disaster risk management policy and practice persists today [56,61–63]. Furthermore, spatial planners and engineers often work separately from each other [101]. Notably, regulations are in place to prevent certain types of development (i.e. residential) in high-risk locations in most countries; however, there is a lack of regulatory enforcement and political will [84,102]. This inevitably increases risks to natural disasters as populations are more exposed to potential impacts, which is counterproductive to human development, as previously noted.

Despite institutional frameworks and arguments by practitioners for a more mainstreamed approach that integrates disaster risk management and human development, competing priorities including ambiguous policies and applications, in part, have constrained this integration [63,101]. The complexities of local politics and decision-making force decision-makers to choose one over the other. This is not to say that the two cannot work hand-in-hand; rather, the immediacy of human development and pursuit for economic growth outweigh the uncertainties associated with floods and droughts in decision-making. Jupner [103]

discusses the need to diversify flood management portfolio away from the purely technocratic management style which dominates. Instead of focusing on prevention, greater investment is required into preparedness in order to mitigate the consequences of extreme weather events and climate-related flooding.

#### 4. Conclusions

Floods and droughts are two events which pose serious risks to communities and countries around the world. While such events disproportionately impact developed and developing countries, developed economies are not excused from the exposure to future events. Moreover, the European Union and scholars in Europe, have argued for the increased diversification of flood protection policies and the need to develop governance models for drought management which is structured similarly to that for floods [36,45,104]. Of issue is the transition to and optimization of management systems which minimize and mitigate risks to individuals and communities – both in pre-existing built environments and areas undergoing urban expansion. The often-technocratic management system, while reducing exposure to potential flooding, is limited in that risk to events and their impacts are misconstrued to be eliminated as opposed to mitigated, thus fostering a system of urban expansion into high risk areas, or complacency. The governance of disasters is, therefore, not centered on risk reduction; rather, embedded in a complex system of competing priorities.

This review synthesizes current literature from 2005 to 2018 on disaster governance associated with pre-disaster planning and preparedness for floods and droughts in developed countries. In our presentation of the findings, several important themes emerged. First, the literature sample brings into question how long onset events are treated within disaster literature and practice versus rapid onset events. As this review has highlighted, the responsibilities for action is in part directed by how issues are framed within existing policy. While rapid onset events, like floods and heat waves may pose a greater risk to the immediate impact to public safety in developed countries than slow onset events, slow onset events such as drought have significant economic implications. How policies and policymakers treat such events is important to understanding whether the concepts of preparing for drought and other slow onset events (i.e. desertification) are served best within the disaster risk reduction framework.

Second, there is a disconnect between policy and practice when pre-disaster risk reduction interacts with other institutional responsibilities. As Tierney [105] describes, “state-civil society relationships, economic organization, and societal transitions have implications for disaster governance” (p. 341). Literature on flood and drought management show that the application of risk reduction policies and practices occurs side-by-side other priorities, but institutional responsibilities for other policy issues, such as economic growth, may impede the actual adoption of risk reduction practices.

Third, governance of pre-disaster planning and preparedness for floods and droughts remain largely reactive to existing conditions. A forward-looking approach to disaster risk management is needed, one which is centered on anticipatory management – i.e. which considers the changing environmental, socio-economic, and cultural characteristics of regions. In 2015, the 2030 Agenda for Sustainable Development called for the alignment of disaster governance and human development by integrating risk reduction targets and indicators of the Sendai Framework for Disaster Risk Reduction across the globally agreed Sustainable Development Goals. Instead of treating disaster risk reduction and human development separately, the two can be viewed as an interdependent system. However, governance research on this integration in a disaster context remains scarce [105]. A clearly identifiable knowledge gap exists pertaining to the governance requirements for integrated management of human development in disaster risk reduction. Integrated management of these two policy fields is the direction of future governance discourse, but there remains little evidence

as to what that looks like and how that is achievable across the hazards cycle for different types of disasters.

As increased floods and droughts become a new normal in developed and developing countries, how local authorities, regional and national stakeholders, and others plan and prepare for anticipated events is critical to both the short- and long-term resilience of areas and their future development. As stated in CRED & UNISDR [106], not expanding the disaster management and human development spaces to include one another would undermine efforts to build resilience. Building the institutional capacities to do so in an integrated manner is the next challenge to disaster risk reduction and human development discourse. Based on the findings of this review, the following recommendations are made to guide future research:

1. Studies are required on the governance of slow onset events, such as droughts and desertification. Emphasis on how such events are framed within existing disaster policy is particularly noteworthy as it may affect understandings of those events and their management. A review of conceptualisations of slow onset events within disaster literature would complement the disaster governance research and practice.
2. Studies are needed on multi-level and multi-hazard governance for pre-disaster planning and preparedness to improve opportunities to strengthen disaster governance at multiple scales. Such research is necessary for understanding the way(s) that human development and disaster risk reduction are framed in law and policy, and with the purpose of expanding disaster resilience at the local level. How disaster governance models incorporate human development could be of particular use to policy makers and practitioners which must coordinate and communicate with different levels of government and different sectors. In doing so, such research would be expanding the boundaries of the governance of disaster risk reduction and human development in theory and practice.
3. Studies are recommended on the movement of responsibilities for pre-disaster planning and preparedness and risk privatization. How individuals are expected to ensure their properties are insured for floods and droughts and the efficacy of such a shift on individual's risk aversion could be particularly useful to insurance companies and government interventions.
4. Legal studies on responsibilities and liabilities for disaster risk management in a changing climate is warranted. How the duty of care is impacted by climate change is particularly noteworthy, given the rising costs of disasters events which are becoming more frequent and intense.

The intergovernmental community has recognized the synergies between complex issues impacting development, both human and sustainable development as defined through the SDGs. Learning from experiences of blending of disaster risk reduction and development goals is paramount for sustainable development. Understanding proactive experiences with flood and drought governance modalities will be critical to understanding how to support communities to develop while addressing increasingly frequent crisis events in both developed and developing country contexts.

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## Appendix A. Supplementary data

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