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FLOOD RISK MANAGEMENT GOVERNANCE AND RESILIENCE: A SYSTEMATIC LITERATURE REVIEW

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1. INTRODUCTION

Resilience is key to managing complex social-ecological systems and reducing vulnerability to uncertainty and complexity of unexpected change. Flood is one of the most wicked and complex ecological and environmental problems. Yet, flood risk management (FRM) has emerged mainly from a culture of resistance. Research on how 'good governance' can promote resilience to flooding has increased significantly over the past few decades. Thus, practical guidance for improving FRM in enhancing resilience to floods should be available from current research. However, there is a lack of investigation of the state of FRM adaptation and resilience research as it relates to governance, nor of the key gaps in knowledge that need to be addressed to improve resilience to flooding. This paper examines current academic conversations and trends on how flood management relates to flood resilience. The inquiry is based on the argument that understanding how the scholarly community relates resilience in FRM research to governance, policy, and actions will help in identifying and prioritizing research needs that enable FRM policy and process enhancements. This is done by examining how the scholarly, peer-reviewed journal literature has attempted the subject of FRM governance and resilience to flooding, the dominant lines of inquiry, and the gaps in knowledge and understanding.

2. METHODOLOGY

The analysis of the FRM literature focused solely on what resilience scholars are addressing in their research. Using the Scopus database, the search string (TITLE-ABS-KEY (flood*)) identified 187,663 papers addressing some aspect of flooding. Journal papers published up to December 2020 were included, with no lower date limit set. Of these papers, 51,281 included 'flood' in the title, suggesting that it was likely a key focus. When resilience and related concepts like 'governance', adapt*, resilience, resiliency was added to refine the search, only 1,255 papers were identified that study directly issues concerning FRM resilience, governance, and adaptation. A seven-step process was then adopted to complete the search process (Figure 1). The 1,255 papers were screened using the search string "(TITLE (flood*)) AND (KEY(adapt OR governance OR resilience OR resiliency))" to identify papers that are self-identified by the authors as addressing flooding and governance, resilience, or adaptation. Of the 871 resultant papers, many were not relevant to the scope of this review. The list of papers was then narrowed first to peer-reviewed journal articles in English, and then further restricted to subject areas considered most likely to contain research relevant to flood governance and resilience. The final set of papers was thematically analysed (Braun & Clarke, 2006) using NVivo v.12 to code papers into research themes.

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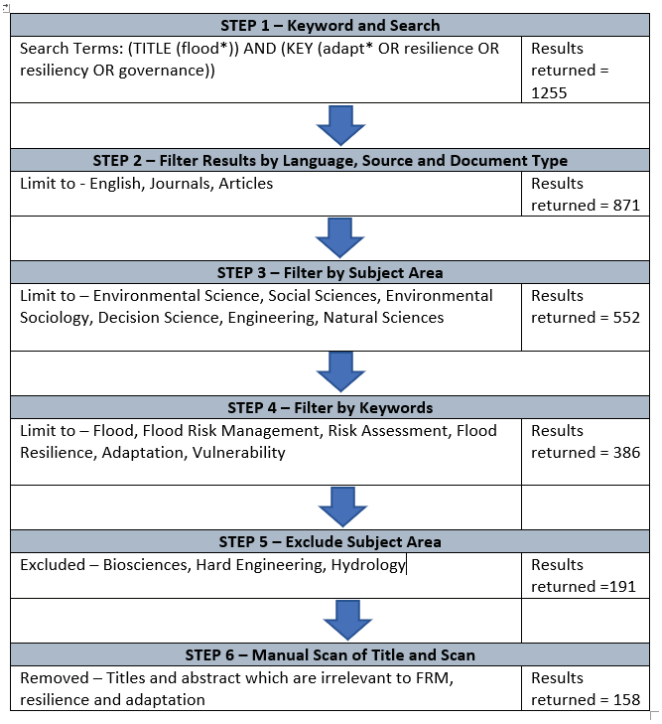

Figure 1: The Six Process in Identifying FRM, Resilience, Governance and Adaptation Literature

3. RESULTS AND DISCUSSION

A total of 158 journal articles were identified that met the search criteria. 91% of all papers identified were published between 2008 and 2020. Research discussing various aspects of FRM, governance, and resilience are not necessarily limited to this timeframe. Results however do indicate that flooding has only recently been addressed in these contexts. Five key thematic areas relevant to FRM governance for resilience emerged from the coding. These themes include policies and action, stakeholder engagement, research on practice, frameworks, and tools.

3.1 Theme 1: Policies and Action

Policies and action-themed papers examined the effectiveness of existing or past FRM policies and actions or proposed alternative policies. The 43 papers addressed three main topics: separating the paradigms of FRM, combining the paradigms of FRM, and post-flooding studies and analysis. A total of 40% of papers in this theme presented post-flooding studies that analysed specific flood events to assess their financial, and human impacts (e.g. Wedawatta et al., 2019; Smith & Lawrence, 2018; Coulthard & Frohstick, 2014)

3.2 Theme 1: Stakeholder Engagement

The theme *stakeholder engagement* includes those papers that discuss organisations and their structures, interactions among stakeholders, and stakeholder perspectives about FRM. A total of 37 papers were identified as primarily addressing FRM stakeholder engagement issues, and these papers were coded into five major research topics. Approximately 30% of papers under this theme addressed individual and group perceptions and behaviours related to flood

risk and governance effectiveness and how these influence FRM, and the development and acceptability of FRM strategies and policies (e.g., Ingirige & Wedawatta, 2018; Jeffers, 2016; Thorne, 2014). Next, 30% of *stakeholder engagement*-themed papers focused on collaboration and communication; addressing the communication of ideas, experiences, and information between organisations; why communication is important; and providing examples of collaborations and the effectiveness of different types of collaborations (e.g., Head, 2018; Osberghaus, 2015; Thaler, 2014).

3.3 Theme 3: Research on Practice

Papers grouped under the *research on practice* theme focused on how FRM governance and policies operate, often proposing or critiquing new or alternative strategies, policies, or options for FRM. The 33 *research on practice*-themed papers focused heavily on barriers and solutions (63%) and less often on how to put principles or theory into action (37%). Barriers and solutions papers concentrated on identifying barriers to successful FRM strategies and proposing potential solutions. Examples of identified barriers include path dependency, where policy approaches have become entrenched through repetition; hierarchical governance, which stifles local decision making (Hasse, 2013; Jeffers, 2013); and differing priorities between stakeholder groups (Butler & Pidgeon, 2011).

3.4 Theme 4: Frameworks

The final research theme, *frameworks*, consisted of 23 papers focused on supporting frameworks for FRM research, practice, and policy addressing practical or applied frameworks, which discussed processes for developing FRM strategy and implementing policies. Gersonius et al. (2012), for example, addressed adaptation processes for resilient flood infrastructure, which sets strategy, monitors performance, and allows for adjustment and response about knowledge gained through monitoring while Sendzimir et al. (2019) examined the use of adaptive environmental management and assessment as a framework for integrated FRM.

3.5 Theme 4: Tools

20 papers focused primarily on FRM tools. *Tools* included programs or prescribed procedures and processes that can be used for forecasting, modeling, and in aid of FRM planning. These tools generally involved data and information for planning decisions as well as mapping applications for flood risk planning and communication. Three topics emerged in this theme, with prediction and modeling tools garnering the most attention at 53% of the papers.

4. CONCLUSION

The findings from this paper suggest that research relevant to flood resilience is not carried out in a way that incorporates the principles underlying a strategic and adaptive approach to FRM. There is diversity in the themes present in the research, however, some themes receive higher attention compared to others. It is also found that research lacks coordination and integration across disciplines. There is also concern that research into frameworks for coordinating research, practice, or both is largely missing. In addition, there is a clear divide between the research and practice communities, thus it is difficult to see how current trends and approaches to research are progressive and responsive to changing

conditions and societal needs. Hence, there is a clear need and opportunity to improve the academic contribution to flood resilience. Flood risk management is a complex challenge and, by definition, comprises many interacting scientific, practical, and political dimensions. Expanding the FRM resilience research agenda requires interdisciplinary and transdisciplinary research that integrates across the physical and social sciences, supported by government funding programs that transcend the physical-social science boundary. For this research to be significant, a firmer FRM research-for-policy agenda is needed to better direct both research needs and policy advances. This means that researchers must not only continue to improve physical science but also advance social science tools that aid collaborative FRM policy development processes. This is best achieved through the development of collaborative frameworks both within and between the researcher and policy/practitioner communities.

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