https://doi.org/10.5194/egusphere-2025-2509
Preprint. Discussion started: 23 June 2025

Brief Communication: California wildfires highlight institutional capacity as key to community resilience

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Abstract. The 2025 California wildfires exposed significant shortcomings in the implementation of wildfire-adapted land use policies and the application of fire-resilient architectural and urban design principles. This Brief Communication examines four key constraints on progress: stakeholder awareness and capacity building; the absence or inadequacy of incentives; and governance barriers, such as regulatory fragmentation, misalignment between agencies, and insufficient integration of risk into spatial planning processes. The text emphasises the need for coherent, cross-sectoral policy frameworks that foster adaptive capacity at multiple scales, enhance compliance with and enforcement of building codes, and align risk reduction with long-term sustainability and climate resilience objectives.

1 Introduction

The 2025 California wildfires damaged or destroyed approximately 18,300 structures and resulted in 29 confirmed deaths (State of California, 2025). One case widely discussed in the media and academic publications focused on a residential building that withstood the flames. The architect attributed its resilience to a design specifically adapted to withstand the effects of wildfire (Namkung, 2025). This case is notable because (1) wildfire-adapted design has been studied and applied in the US and globally for decades (Syphard and Keeley, 2019; Editorial, 2020), and (2) similar design adaptations have been successfully implemented in many land use regulations for other hazard types (Iglesias et al., 2021), such as floods (Proverbs and Lamond, 2017; Mannucci et al., 2022) and earthquakes (Bankoff, 2015; Freddi et al., 2021). The problem is not a lack of knowledge of design principles, but rather their inconsistent and inadequate implementation in land use (Anu Kramer et al., 2021), leaving structures and communities vulnerable to natural hazards. As White et al. (2001) observed in their seminal article, 'Knowing Better and Losing Even More', persistent failure to apply knowledge effectively often stems from conflicting interests and a lack of political will. These are issues that have long been recognised, yet remain unresolved in natural hazard and risk management. Several factors, some of which strongly intervene, contribute to this implementation gap, which are presented below.

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2 Awareness building

A lack of risk awareness among property owners significantly lowers their risk perception, leading to inadequate preparedness and insufficient protective measures. This phenomenon can be attributed to a combination of cognitive biases, short-term economic interests that prioritise immediate costs over long-term safety, and an overreliance on governmental intervention rather than the adoption of personal responsibility. These factors collectively hinder proactive risk management at the individual level. To counteract these barriers, effective and continuous risk communication is essential. Such communication must go beyond generic messaging and instead involve targeted, accessible and context-specific messages designed to raise awareness and motivate behavioural change. Raising risk awareness requires not only the dissemination of information but also its translation into actionable knowledge. This demands the development and implementation of communication strategies that are transparent, consistent, and tailored to the demographic and socioeconomic context. Public education campaigns should be complemented by accessible risk assessment tools that allow individuals to understand their specific exposure and vulnerability. These tools must be user-friendly and adapted to different levels of technical literacy to ensure usability across diverse audiences. Authorities must ensure that information reaches diverse audiences, including vulnerable populations, through multiple channels such as digital platforms, community meetings and early warning systems. Strengthening this communication process will improve the ability of individuals to understand and implement necessary protective measures, ultimately reducing overall vulnerability to hazards (Wachinger et al., 2013).

3 Capacity building

Capacity building extends beyond individual societal capabilities (Kuhlicke et al., 2011) to encompass the broader institutional frameworks required to effectively manage and mitigate the consequences of natural hazards. This involves not only enhancing the capacities of individuals and communities but also reinforcing the organizational, legal, and procedural systems that underpin risk governance. While standards, rules, and regulations are in place, their effectiveness depends critically on how well they are translated into actionable and enforceable policies, such as land-use planning principles, disaster-resistant infrastructure guidelines, enforceable building codes, and other prescriptive measures (Rauter et al., 2020). However, this translation is often impeded by institutional fragmentation, overlapping mandates among agencies, financial constraints, and limited technical expertise, particularly at the local level. These systemic barriers compromise the coordination and implementation of meaningful adaptation and resilience-building efforts. In many cases, a lack of clarity regarding roles and responsibilities, coupled with poor inter-agency communication, undermines the coherence and effectiveness of risk reduction strategies. Strengthening institutional capacity, therefore, requires sustained investment in education and training programmes, knowledge-sharing networks, and cross-sectoral collaboration to ensure that risk management strategies are not only well designed but also effectively implemented at all levels of government. In addition to technical and structural enhancements, institutional capacity building must be grounded in inclusive decision-making processes. Engaging local communities, private sector actors, civil society organizations, and scientific experts helps to

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ensure that risk management strategies are informed by local knowledge and social realities, thereby increasing their legitimacy and effectiveness. Participatory approaches also contribute to the development of adaptive, context-specific solutions that are better aligned with the needs and capacities of diverse stakeholders. Ultimately, a strong institutional foundation enhances societal resilience by ensuring that risk governance is both robust and responsive in the face of increasing hazard complexity and climate uncertainty.

4 Strengthen incentives

Strengthening incentives and building motivation are essential for translating adaptive capacity into concrete action (Sánchez et al., 2022; Schubert et al., 2025). Without sufficient motivation, even well-developed institutional and individual capacities may remain underutilised. A variety of intrinsic and extrinsic factors influence the willingness and ability of individuals, particularly property owners, to implement adaptation measures at the local and household levels (Attems et al., 2020). Intrinsic motivators include elements such as an access to relevant information, participation in communication networks, the presence of policy entrepreneurs who champion adaptation agendas, and active community engagement in risk reduction initiatives. Extrinsic motivators include financial, regulatory, and technological incentives that make adaptation both feasible and attractive. These may involve subsidies or tax credits for retrofitting buildings, streamlined permitting processes, or the availability of innovative risk-reducing technologies. Property market mechanisms also play a key role, as risk-informed property valuation and disclosure practices can drive private investment in resilience-enhancing measures (Egbelakin et al., 2017). Additionally, the establishment of mandatory insurance schemes can reduce moral hazard by ensuring that risk is priced and managed appropriately, encouraging risk-aware decision-making among property owners. Furthermore, an important and often underutilized source of motivation is the desire for active involvement in decision-making processes related to climate adaptation and disaster risk reduction. This necessitates the incorporation of participatory approaches that enable citizens to contribute their knowledge, values, and preferences to the design and implementation of adaptation strategies. Transdisciplinary knowledge co-creation – bringing together stakeholders from science, policy, practice, and civil society – can facilitate mutual learning, foster innovation, and build trust between actors. Such participatory processes not only enhance motivation by increasing perceived ownership of adaptation measures, but also contribute to more context-sensitive, equitable, and effective outcomes.

5 Removing governance barriers

Effective management of natural hazards requires the systematic identification and removal of institutional and structural barriers that impede resilience and preparedness. These barriers often stem from a combination of administrative fragmentation, misaligned political incentives, and insufficient integration of risk considerations into broader policy frameworks. Key challenges include accountability gaps, where unclear mandates and responsibilities across institutions

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hinder coordinated action, as well as a pervasive lack of transparency in decision-making processes. Political constraints also play a significant role, with policy directions sometimes shaped by short-term populist agendas or illiberal leadership, such as the rollback of disaster preparedness regulations observed during the Trump administration in the United States. Such political dynamics can erode established norms of precautionary planning and diminish institutional commitment to long-term risk reduction. Weak enforcement of existing regulations, legal ambiguities, and fragmented sectoral responsibilities further exacerbate different dimensions of vulnerability. The absence of coherent mainstreaming of disaster risk management across sectors results in siloed interventions that fail to address the systemic nature of risk. Moreover, mismatches between the spatial and temporal scales of risk and those of policy implementation can hinder the effectiveness of adaptation and resilience strategies. Financial limitations and persistent knowledge gaps further restrict the ability of institutions to engage in proactive disaster preparedness. Limited funding for prevention measures often leads to reactive, crisis-driven responses rather than long-term planning (Biesbroek et al., 2013). Meanwhile, rushed and poorly executed infrastructure and construction projects – often driven by political or economic expediency – can inadvertently increase exposure to hazards, particularly in rapidly urbanising areas or regions undergoing post-disaster reconstruction. Addressing these multifaceted governance challenges requires a multilevel, multidisciplinary approach to strengthen governance, improve enforcement and promote sustainable development practices (Biesbroek et al., 2013).

6 Conclusion

Achieving sustainable economies and resilient societies requires the systematic removal of behavioural and institutional barriers that hinder transformative change. Behavioural barriers are often rooted in psychological and socio-cultural dynamics, including cognitive biases such as the normalcy bias, overconfidence, and the discounting of future risks. These biases, combined with short-term economic thinking, a preference for immediate gains over long-term security, and resistance to behavioural change, can limit proactive engagement in risk reduction strategies. At the same time, institutional barriers – such as fragmented governance structures, poor horizontal and vertical coordination between administrative bodies, and weak regulatory enforcement – significantly undermine the development and implementation of coherent and effective disaster risk reduction (DRR) policies. The complexity of DRR lies not only in the unpredictability and variability of natural hazards, but also in the socio-political and institutional contexts in which risk is managed. As a multifaceted challenge, DRR requires interdisciplinary and transdisciplinary collaboration that cuts across policy sectors and levels of government. This includes the integration of knowledge from the natural sciences, engineering, urban planning, economics, and the social sciences, as well as active engagement with civil society and the private sector. Institutional inertia and policy fragmentation often act as critical constraints, making cross-sectoral collaboration both necessary and difficult. To contribute meaningfully to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), DRR must be mainstreamed into broader sustainability and spatial development agendas. This includes embedding risk considerations into land use planning, environmental regulation,

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infrastructure development, and social protection policies. Coherent land use strategies that account for hazard exposure, ecological integrity, and socio-economic vulnerabilities are vital for building systemic resilience and reducing long-term risks.

Institutional capacity plays a central role in enabling or constraining such efforts. Recent extreme events, such as the widespread wildfires in the United States, have exposed the severe consequences of institutional weaknesses, including delayed responses, insufficient preparedness, and poorly coordinated interventions. These cases highlight the urgent need to enforce existing regulations more effectively, improve inter-agency coordination, and strengthen governance mechanisms at all levels. Effective DRR must also address structural and systemic vulnerabilities, including not only physical exposure to hazards but also deeper social issues such as inequality, marginalisation, and access to resources (Doorn et al., 2021). Furthermore, diversity in terms of perspectives, experiences, and knowledge systems must be recognised as a valuable asset in developing inclusive and context-sensitive resilience strategies (Papathoma-Köhle et al., 2021). Without addressing these deeply embedded governance challenges, efforts to build hazard-resilient societies will remain fragmented. What is needed is a more integrated, equitable, and inclusive approach that aligns DRR with the broader sustainability agenda and acknowledges the interdependencies between environmental and social systems. This approach must support long-term resilience for all communities in the face of escalating climate-related risks. Science is called upon to move beyond sectoral adaptation toward transformative approaches; only then can it meaningfully contribute to strengthening community resilience under changing conditions. As White et al. (2001) argued, this requires shifting from uncoordinated, sector-specific responses to a more coherent and integrated form of risk management that addresses underlying structural issues and political inertia.

Author contributions: SF prepared the manuscript with contributions from all co-authors.

Competing interests: Some authors are members of the editorial board of Natural Hazards and Earth System Sciences.

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