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From Epic Fires to Epic Floods: Safety and Financial Implications for California

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In January 2018, post-fire debris flows in Montecito (California) killed 23 people and caused over $1 billion in damage. The sudden and shocking nature of the tragedy, along with the high profile of some of Montecito's residents drew attention to debris flow hazards in the state. Montecito is not unique. Climate change is increasing the frequency and magnitude of such extreme events in California, but even more important is the increase in exposure to flooding is increasing faster because of population increases in high hazard zones. Looking more closely at the Montecito case reveals much deeper challenges related to how risk is assessed in the US, and policy constraints to managing risk in a sustainable and equitable way. Our work highlights the opportunity to learn from international examples and innovative approaches whose application in California could potentially reduce flood risk.

Findings for Montecito (Serra-Llobet et al. 2023)

- Exposure in high hazard zones has increased substantially in Montecito in the last 50 years despite policies discouraging developments. This is consistent with trends observed elsewhere in the US.
- Floods after fires are common in Montecito (15 events in the last 200 years) (figure 1). However, the vulnerability of many Montecito residents to flood hazard has increased due to the lack of understanding of the context where they live, ahistoricism, and a barrier in local government information transfer.
- The risk from relatively frequent, low to medium magnitude debris flows might have been reduced in some areas of Montecito due to the construction of debris basins, but catastrophic risk has increased due to the "levee effect" (dams, levees, debris basins, etc. generate a false sense of security among downstream residents, which encourages developments in high hazard zones). This ´residual risk´ is commonly overlooked but has big financial and safety implications for the community and state and federal tax payers.
- The risk of floods after fire is increasing in Montecito. This is due to both climate-change-induced increased frequency and magnitude of extreme events, and to (re)building in high hazards zones despite their history of repetitive impacts from destructive debris flows.

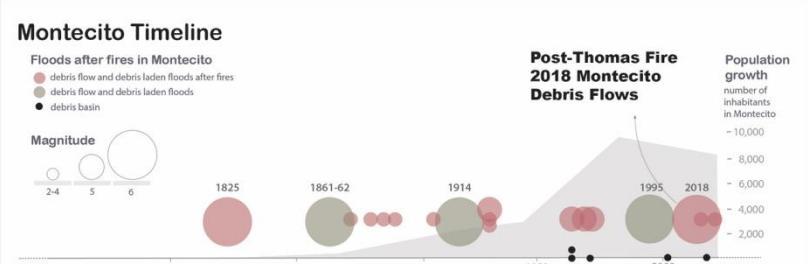

Figure 1. Montecito timeline showing 15 post-fire debris floods in the last 200 years. (Serra-Llobet et al. 2023).

Implications for California

- To build a more resilient California **we need to learn from past disasters** (Figure 2). Systematic gathering of information, for example in a California Map Portal, **is critical to understand trends**: the short- and long-term financial magnitude of these disasters (which is not yet systematically tracked), and the short- and long-term ecological and equity implications of our current actions and how they will affect future flood risk.
- We need **to rethink our policy framework**. The National Flood Insurance Program (NFIP) and related California policies have to be reframed to make maps actionable, and ultimately to create resilient territories and cities. For example, we can use debris flow maps to better manage debris flows, as countries like Austria do (rather than only maps of conventional fluvial flooding).
- Safety and final implications of floods after fires are big in California, especially in a context of **"environmental" change**. The problem is bigger than climate change. While climate change is intensifying the magnitude and frequency of these events, exposure in high hazard zones is increasing at unprecedented rates, infrastructure is aging and ecosystem loss is compromising the ability to take advantage of the positive aspects of floods (e.g., groundwater recharge) which is critical in times of droughts (Figure 3).

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Figure 2. (Serra-Llobet et al. 2023).

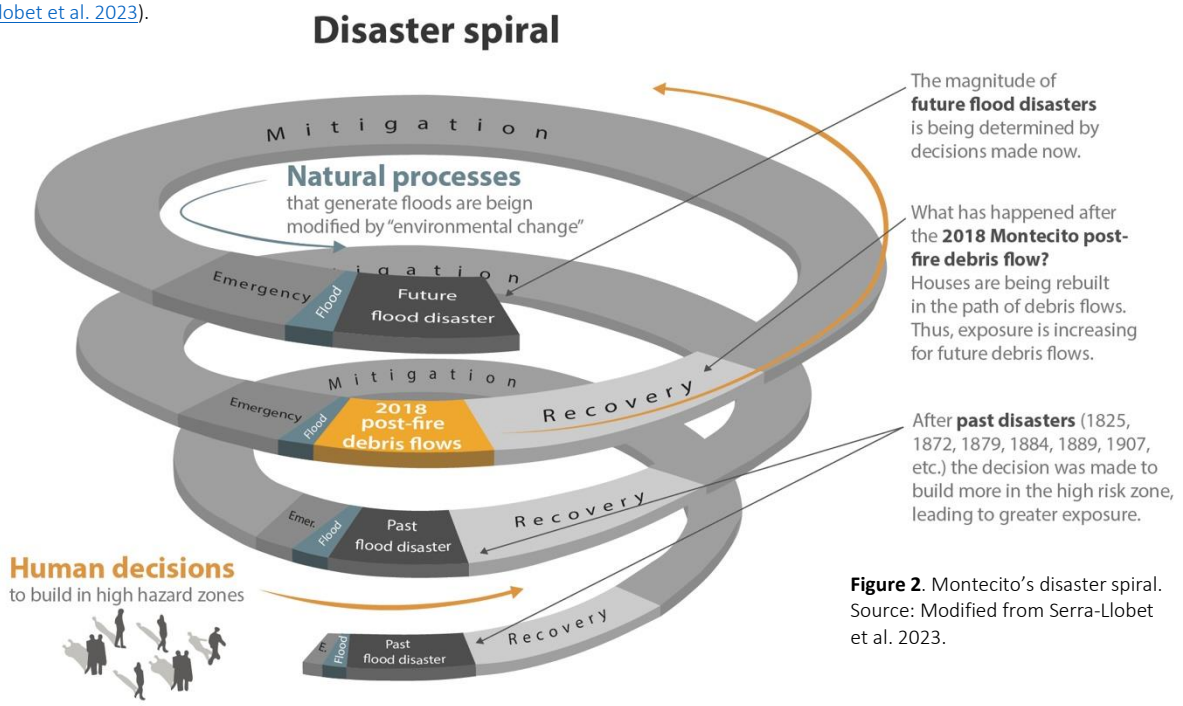

Figure 2. Montecito's disaster spiral. Source: Modified from Serra-Llobet et al. 2023.

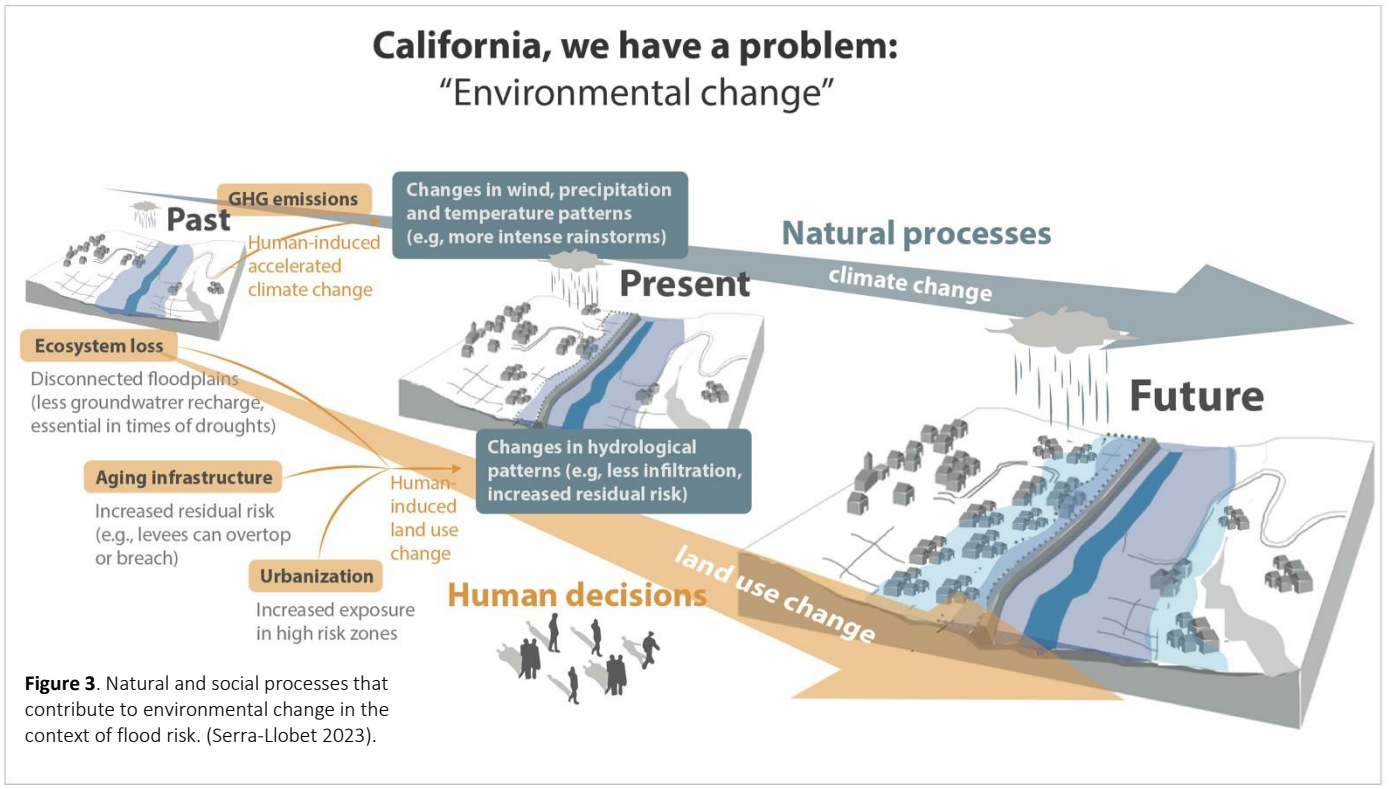

Figure 3. Natural and social processes that contribute to environmental change in the context of flood risk. (Serra-Llobet 2023).