



Fragility and societal vulnerability in watersheds: Managing for resilience and risk reduction of linked hydrologic hazards

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GOAL

Watershed decision makers should seek to:

- Promote healthy and sustainable watershed processes
- Support the needs of communities and ecosystems
- **Reduce undesirable outcomes for the entire system** using an integrated approach

CHALLENGE

Maladaptive Management Strategies

Maladaptation:

Where a management strategy has the result of directly increasing vulnerability of an actor or actors¹

Management strategies that address risk from a specific hazard (e.g. flood, drought) often have unintended consequences that may worsen watershed outcomes when exposed to a different hazard.

- Flood management strategies
 - Reduce acute risk from flooding
 - Increase chronic risk under drought conditions
- Drought management strategies
 - Reduce chronic risk from drought
 - Increase acute risk from flood conditions²

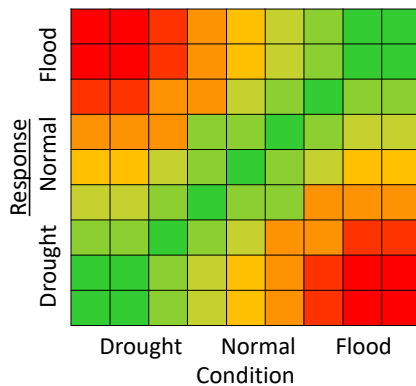


Fig 1. Risk matrix - Hydrologic hazard management strategies under different operating conditions

FRAGILITY & VULNERABILITY VS. ADAPTIVE CAPACITY & RESILIENCE

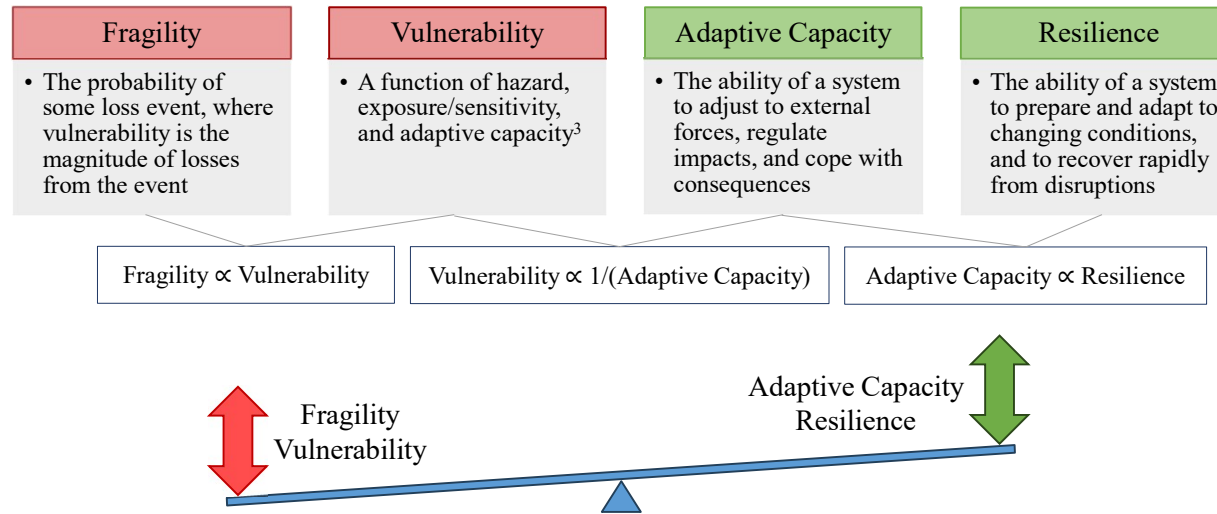
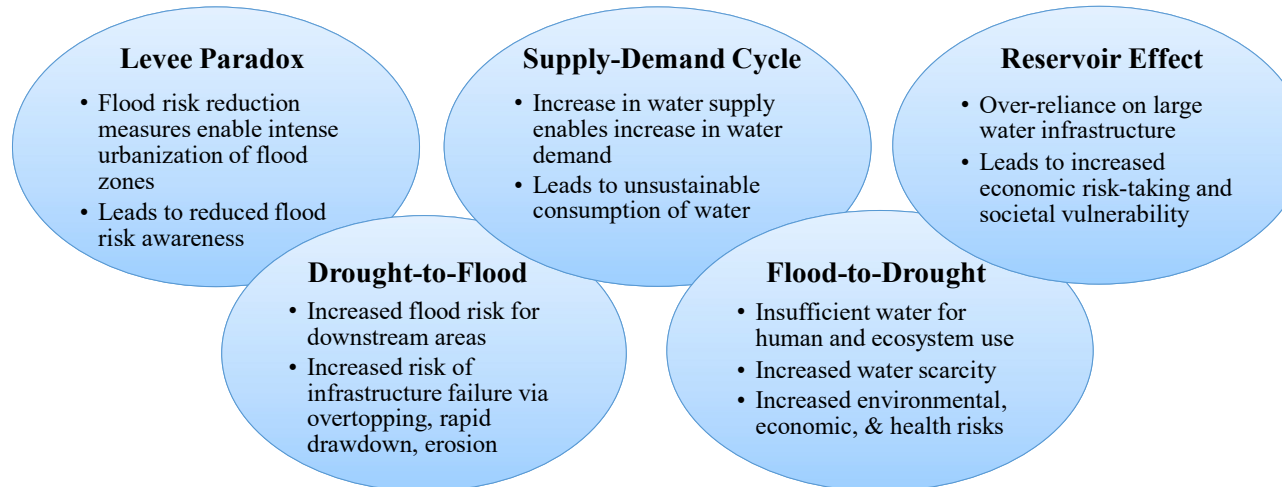


Fig 2. Conceptual representation of the relationship between the watershed characteristics

LESSONS FROM LINKED HYDROLOGIC HAZARDS

Management strategies that guard against one hazard can worsen exposure to the other hazard, resulting in increased vulnerability. The following phenomena result from linked flood and drought conditions and lead to maladaptive watershed outcomes^{4,5}.



RECOMMENDATIONS

Watershed decision makers should:

- Consider hazards as linked processes, not independently
- Acknowledge that multiple risks can occur (sequentially, in parallel, overlapping, etc.)
- Examine decisions for potential maladaptive outcomes under various conditions

These ideas are aligned with the multi-risk approach⁶, where hazards and risk are assessed cumulatively and managed in an integrated and holistic fashion.

CONCLUSION

To increase resiliency in a watershed and reduce vulnerability, decision makers must consider linked flood and drought processes.

Strategy performance should be evaluated using a multi-risk approach to identify and mitigate maladaptive outcomes.

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