

# Exploring the role of risk perception in influencing flood losses over time

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<https://www.bbc.com/news/av/uk-england-leicestershire-48665694/drone-footage-captures-driver-stuck-in-flood-water>

# Why?

- What implications do societies' risk perceptions have for flood losses?
- Case studies with knowledge of detail, large N studies with lack of detail – how can we structure and categorize?
- How can social science theories be used to explain and predict human behavior and its consequences?



## How can we distinguish between different strategies that societies apply to address flood risk?

- Cultural theory: human views and behavior is clustered, shared among groups (rationality)
- We have identified 4 ideal types of societies that cope and respond to flood risk in different ways
- Myths of nature: Four ideal types of society

*Fatalist, hierarchic, individualist, egalitarian societies*

- Application on flood risk:

*Risk neglecting, controlling, downplaying, monitoring societies*



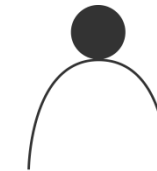
A) Risk neglecting



B) Risk controlling



C) Risk downplaying



D) Risk monitoring

# Risk rationalities and predicted action



"Nature cannot be managed, no plans for future needed."

→ No action taken.



"Risks need to be controlled by experts and governments."

→ Technological solutions (levees), government regulations



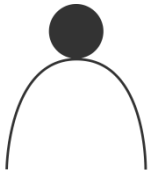
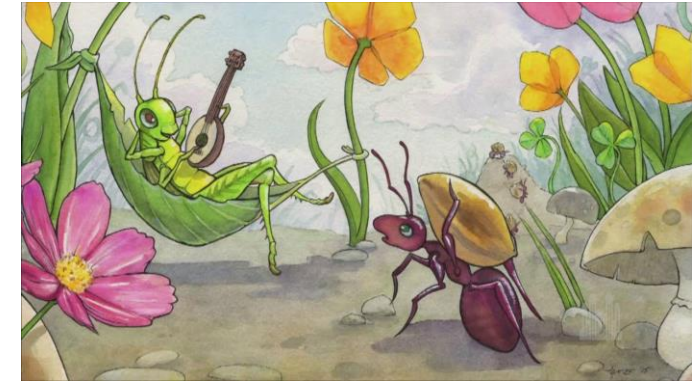
# Risk rationalities and predicted action



C) Risk downplaying

“Our environment is very robust and resilient.”

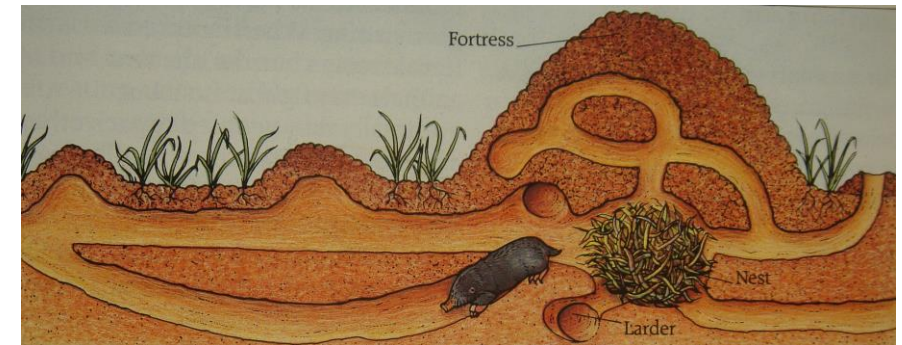
→ Insufficient action taken.



D) Risk monitoring

“All of us need to act to not to disturb the precarious balance.”

→ Participative action, increase risk awareness, relocation etc.



# Sociohydrological model

$$\begin{cases} \frac{dD}{dt} = \rho_D [1 - D(1 + \alpha_D M)] - \Delta(\psi(t)) \cdot FD_- \\ \frac{dH}{dt} = \Delta(\psi(t)) \cdot R - \kappa_T H \\ \frac{dM}{dt} = \Delta(\psi(t)) \cdot FD_- - \mu_S M. \end{cases}$$

The reduction of the population due to the relocation of people after a flood event and the contemporaneous building of societal memory

As a response to the flood event, the community may also decide to either protect the floodplain with structural measures (i.e. building or heightening levees; H), or not

As soon as the community experiences a flood event, it builds memory (M) of the flooding

The memory, built because of the occurrence of flooding, reduces to half its initial value in a time (half-life,  $\lambda$ )

$$\mu_S = \frac{\ln(2)}{\lambda}$$

Flood damage

$$F = 1 - \exp\left(-\frac{W + \xi_H H_-}{\alpha_H}\right) \text{ if } W + \xi_H H_- > H_-$$

Levee heightening

$$R = \begin{cases} \varepsilon_T (W - \xi_H H_- - H_-); & \text{technological} \\ 0; & \text{green} \end{cases}$$



# Sociohydrological model



Parameter	Risk neglecting (fatalistic)	Risk controlling (hierarchical)	Risk downplaying (hierarchical)	Risk monitoring (egalitarian)
$\alpha_D$ (Preparedness)	0	Medium (2.5-7.5)	Low (0.5-5.5)	High (7.5-15)
$\lambda$ (Memory coeff.)	Any value (2-8 yrs)	Medium/High (5-10 yrs)	Low (2-5 yrs)	High (5-15 yrs)
Levee construction	No	Yes	No	No
$\rho_D$ (Demographic growth)	Medium/High (0.02-0.08 yrs <sup>-1</sup> )	Medium (0.02-0.04 yrs <sup>-1</sup> )	Medium (0.02-0.04 yrs <sup>-1</sup> )	Very low (0.001-0.01 yrs <sup>-1</sup> )

# Sociohydrological model



Risk neglecting



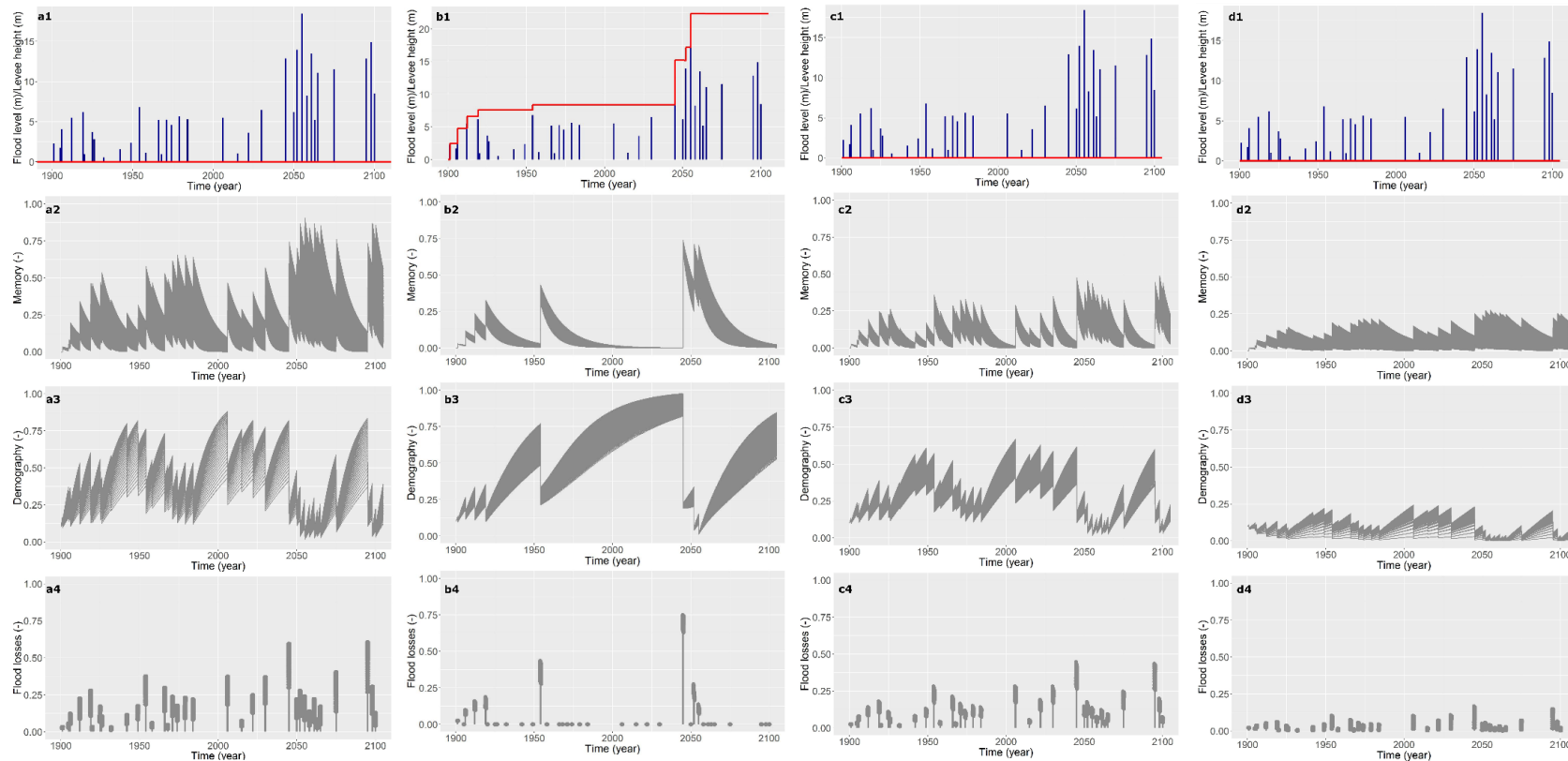
Risk controlling



Risk downplaying

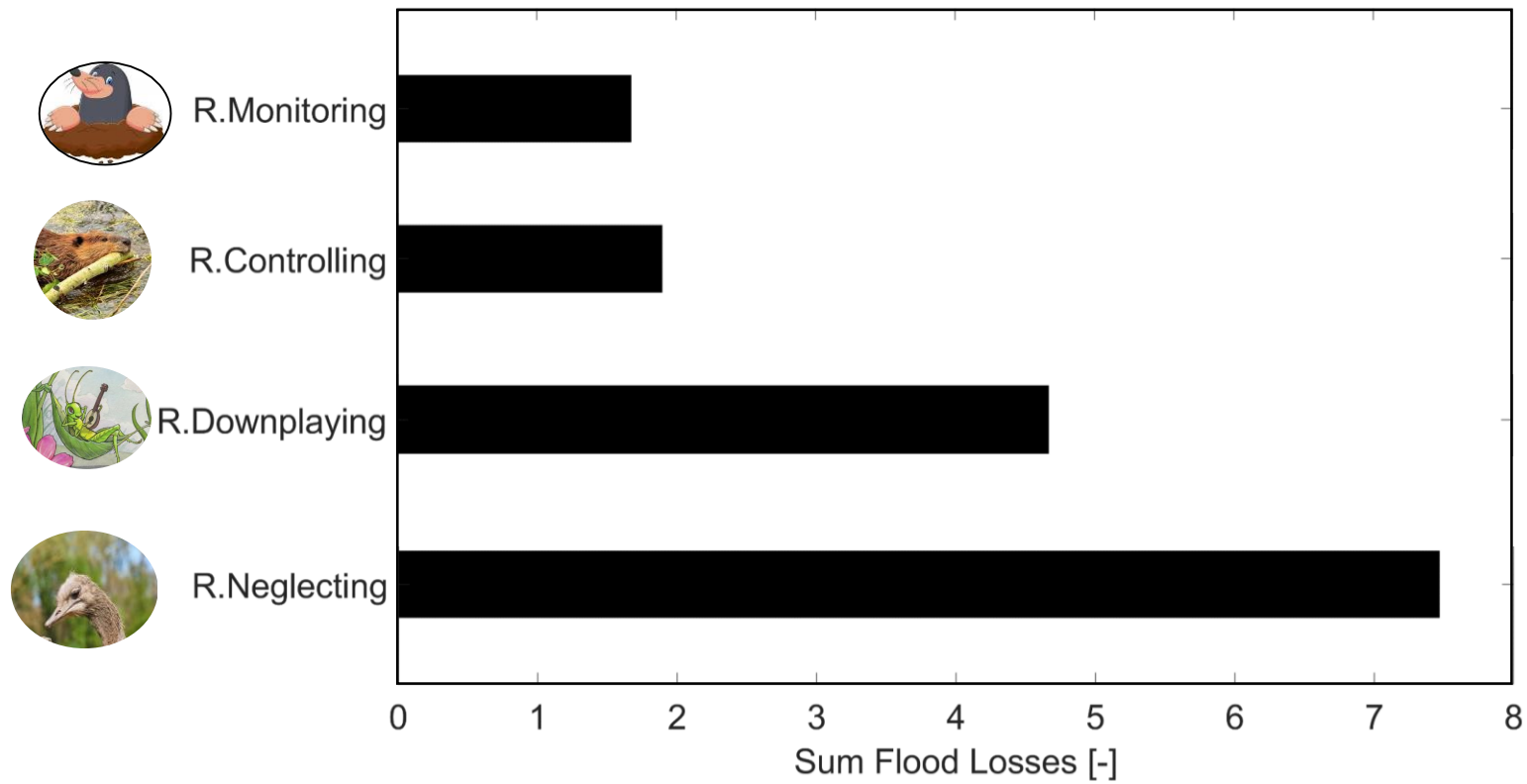


Risk monitoring





# Cumulative flood losses over time



# Take home message

- Societies that tend to neglect or underestimate risks, are in danger of experiencing high flood losses without the capacity to learn from past flood events and adopt adequate measures
- Societies that attempt to control flood risk through the construction of levees will decrease their total flood losses
- However, a dense population in the floodplain that feels safe due to the presence of a levee may experience catastrophic outcomes of a flood event if the levee system fails
- In contrast, risk monitoring societies stand out in their ability to maintain high flood-risk awareness and a memory of flood events that guides participatory preparedness measures
- Our model does not identify any catastrophic impact of floods on this type of society, not even for water levels that cause catastrophic flood damage in other societies

**Want to know more?**

**Check out the paper at**

<https://www.tandfonline.com/doi/full/10.1080/02626667.2019.1677907>

*“For in the end, it is all about memory,  
its sources and its magnitude, and,  
of course, its consequences ”*

*Elie Wiesel*

# Thank you!