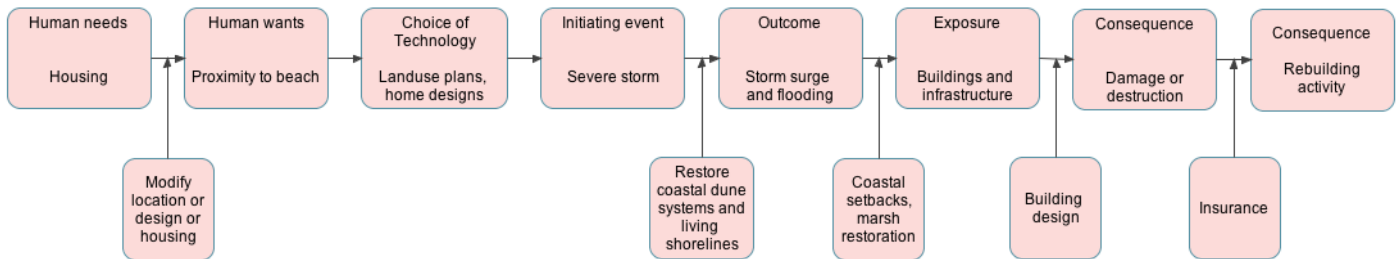


The causal structure of hazards

Kates, Hohenemser, Kasperson and colleagues (Bowonder et al.1985, Kates et al. 1985) conceptualized the causal structure of hazards. They understood hazards (threats to people and what they value) as generally emerging from causally linked series of events, choices, and consequences – a causal chain. While hazards may have natural (hurricanes) or anthropogenic (oil spills) origins, impacts and consequences are dependent on societal and individual choices and actions. For instance, pursuing development along the shoreline may increase adverse economic consequences to home and business owners. Consequences can include both direct effects from an event (e.g., flood damage) and higher order consequences that result further “downstream” from the event (e.g., inability to purchase insurance after hurricanes). The stream of choices and activities that culminate in undesirable consequences can be interrupted and blocked at various stages by management activities. Upstream, economic develop can be directed elsewhere and downstream homes can be elevated insurance can be supported by the government.

A causal structure of a coastal hazard is illustrated in the Figure on this page. It begins, for example, with “human needs” and “human wants” and then moves to the “choice of activity” (or technology, such as flood control). Once an activity is chosen (e.g. culvert or other flood control barrier), an initiating event or condition is needed to create dynamics leading to consequences. This can be something as simple as a storm, but it may also be a change in sea level, change to local transportation infrastructure, local zoning, or changes in landuse. There are many possible initiating events and part of coastal management planning is to foresee and minimize the occurrences leading to adverse consequences while promoting beneficial consequences.

A causal model related to a coastal hazard.



Once an event is begun or condition created, the next steps in the chain are outcomes and exposures to them. Exposure requires identifying the entities, objects, sectors, or ecosystems or other risk management priorities. Then, it can be examined at multiple scales, from the individual, household, community, and up. Harm can result from direct exposure to the event/condition or through indirect pathways, called secondary or tertiary consequences in this model. Attention to pathways of consequences is particularly important for coastal communities where impacts have repercussions beyond coastal hazard management to long term planning for landuse, community social services, transportation, insurance, and community bond ratings. Of course, there may also be beneficial consequences, such as economic benefits of job creation after a hazard or revised landuse plans that improve stormwater management.

A key insight highlighted by this representation of hazards and their consequences is that management (regulatory) actions can be represented as interrupting the causal chain at any point, reducing exposure or mitigating consequences. They can be implemented by, for example, government agencies or by private groups and individuals.

This conceptual representation of hazards has been widely used to explore differences in understandings of risks among laypeople and technical experts (Clark et al. 1998, Golding et al. 2002, Ratick et al. 2004, Webler et al. 1995). To put flesh on the causal structure's generic skeleton, we supplement the causal chain with information about *vulnerability* in order to inform the scope and priorities of actions to mitigate exposures and consequences.

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