

Adapting to climate change to maintain the insurability of people and property against extreme weather and sea level rise

Bob Ward

Director, Public Policy

Risk Management Solutions

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Coping with extreme weather events

- When faced with the risk of damage to a home or business from extreme weather events, there are the following choices:
 - Accept the risk and absorb any losses (ie self-insure)
 - Accept the risk and hope to receive compensation for any losses (eg *ex post*, disaster relief)
 - Accept the risk and transfer it (eg *ex ante*, public or private insurance)
 - Eliminate or reduce the risk (ie risk mitigation)
- These choices are not mutually exclusive

Climate change and insurability

- In order to transfer the risk of losses from extreme weather events, people and their property need to be considered insurable by a public or private insurance system.
- But, climate change and associated sea level rise are likely to alter the frequency, intensity and geographical distribution of extreme weather events in many parts of the world...
- ...so what does this mean for the future insurability of properties, particularly in coastal areas, and how should we respond?

Climate change and insurability

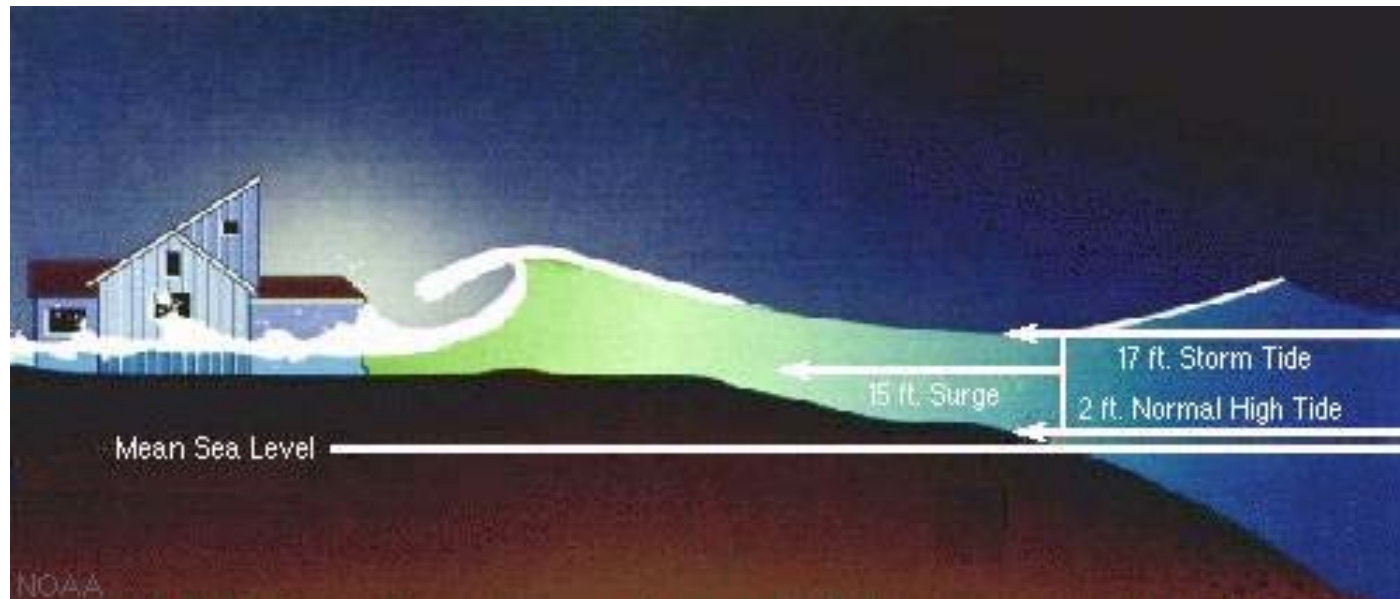
Category	Criterion	Characteristic	Impact?
Actuarial	Risk/uncertainty	Measurable	Yes
	Loss occurrences	Independent	Possible
	Maximum loss	Manageable	Likely
	Average loss	Moderate	Yes
	Loss frequency	High	Yes
	Moral hazard, adverse selection	Not excessive	Unlikely
Market-determined	Insurance premium	Adequate, affordable	Yes
	Insurance cover limits	Acceptable	Possible
	Industry capacity	Sufficient	Yes
Societal	Public policy	Consistent with cover	Likely
	Legal system	Permits the cover	Unlikely

Potential impact of climate change and associated sea level rise on insurability (after Table 1, 'Innovating to insure the uninsurable', Swiss Re, 2005)

Adaptation to the impacts of climate change to mitigate the risks of weather-related losses is the only way to maintain the future insurability of exposed homes and businesses.

Case study: storm surge flood risk

- Storm surge caused by two factors:
 - Low pressure sucks up surface of water
 - Storm winds push water ahead of them
- Biggest problem when storm surge coincides with high tide
- Threat to coastal areas that are exposed to storms, particularly low-lying areas exposed to tropical cyclones eg Caribbean, coasts of Gulf of Mexico, western Atlantic, western Pacific



Storm surge from Hurricane Katrina



**Water overflowing the 15.5 ft north levee of the MRGO/GIWW, directly under the Paris Road bridge
(Photos: Don McClosky, Mike Collins, IPET)**

Climate change impacts on storm surge hazard

- Rise in global sea levels increases potential height of storm surge events
- Changes in frequency of storms, including tropical cyclones, will increase/decrease the number of storm surge events
- Changes in the intensity of storms, including tropical cyclones, will increase/decrease the magnitude of storm surge events
- Changes in tracks of storms, including tropical cyclones, will alter the number of storm surge events occurring at particular locations
- If all else remains equal, increases in sea level, and storm frequency and intensity, will raise storm surge risk for some coastal locations – threatening insurability

Ways of limiting and reducing risk of losses from storm surge events

- Prevent storms from approaching land
- Reduce the frequency/intensity of storms
- Reduce the value of properties that are exposed to storm surge events
- Reduce the susceptibility of exposed properties to potential damage by storm surge events (ie lower the vulnerability)
- Reduce the number of properties that are exposed to potential damage by storm surge events (ie lower the exposure)

Basic structure of hurricane catastrophe model



Emerging findings: exposure

- For storm surge risk, location is often more important than vulnerability (ie risk mitigation measures have only limited use for the most highly exposed properties)
- Even without an increase in storm surge hazard, risk is rising in many coastal areas due to development of new properties
- Risk-informed development means considering how storm surge risk will evolve during entire length of existence of planned properties

Emerging findings: vulnerability

- Coastal flood defences can reduce risk up to standard of protection (eg 1-in-2000 flood event), but may only be cost-effective for concentrations of properties



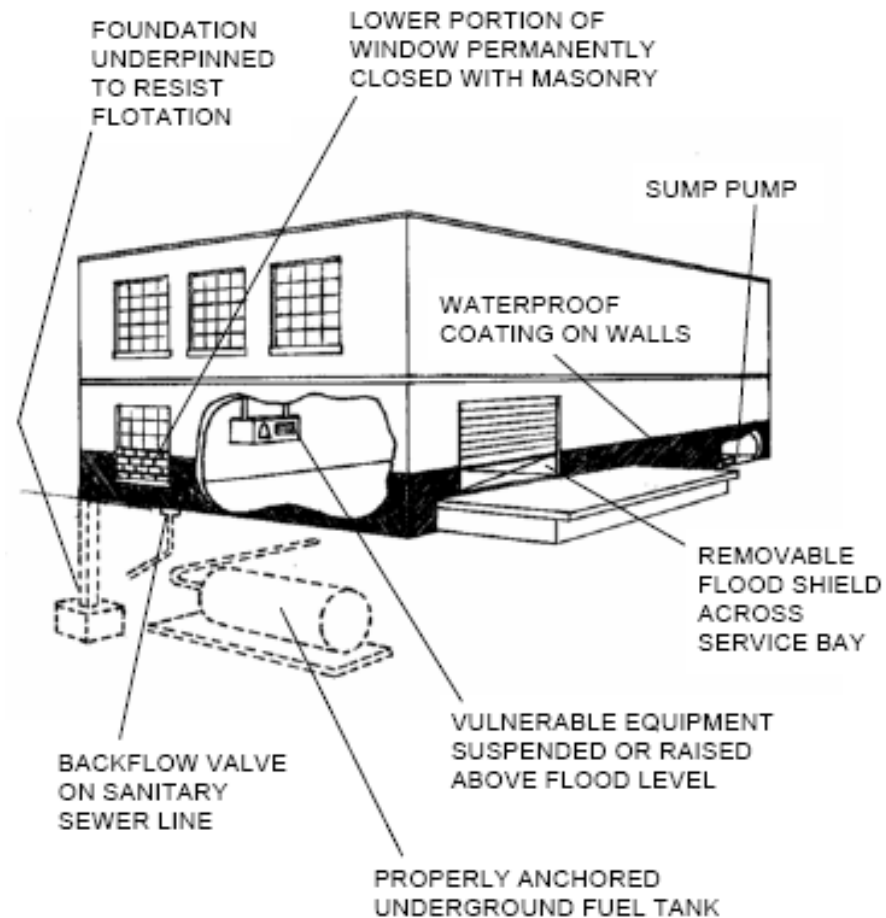
Emerging findings: vulnerability

- Elevating properties (eg stilts) can reduce risk, but often costly for individual properties



Emerging findings: vulnerability

- Adaptation of individual properties through flood-resistance and flood-resilience measures (eg dry floodproofing) can be very effective in reducing potential damage



Emerging findings: vulnerability

- Most effective risk mitigation strategy usually combines flood defences and adaptation of individual properties
- But often considered as alternatives because costs are borne by different parties (ie governments vs property-owners)

Challenges for adaptation

- Mismatch between who bears the cost and who gains the benefit (eg publicly-funded coastal flood defences)
- Cost often needs to be borne upfront to accrue benefits in the long term – but counter to most individuals' natural instincts
- In the most extreme scenarios for sea level rise, it will not be feasible to adapt individual properties or provide coastal flood defences

Implications for future insurability

- Properties in many coastal locations will become uninsurable if storm surge risk rises significantly (ie insurance unaffordable or unavailable)
- Without compensating risk mitigation measures, insured losses will rise, and so will premiums
- Risk-based premiums should incentivise individuals to invest in risk mitigation measures to limit or reduce premium levels
- Affordability issues should be addressed without removing the link between magnitude of premiums and risks (eg tax cuts)
- Incentives required for property-owners to invest in risk mitigation measures

Major challenges for future insurability

- Private market insurance has track record of withdrawing when losses become unmanageable (eg correlated losses along Mississippi led to collapse of US flood insurance market)
- Many publicly funded insurance and reinsurance systems have track record of not being 'actuarially sound' (ie premiums do not cover losses)
- Property-owners may be reluctant to invest in separate policies for different weather-related risks (eg flood and wind)
- Many policy-holders want to pay low premiums, even when exposed to high risks
- Markets and regulation do not always incentivise desirable behaviour through risk-based premiums

To maintain future insurability of homes and businesses in the face of climate change, we need to design insurance systems that incentivise both risk transfer and risk reduction (ie adaptation to the impacts of climate change).