



Catastrophe Risk Seminar

Funding Future Resilience

Tuesday 20 March 2018 • Radisson Blu • Sydney





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Gaps

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*This presentation has been prepared for the Actuaries Institute 2018 Catastrophe Risk Seminar.
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Agenda

- Framing the issue – should we be surprised?
- A funding gap example – US flood insurance and rising sea levels
- A mitigation gap example – US hurricanes and warming oceans
- A mandate gap example – building codes
- Closing the gaps



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We keep getting surprised...





Some lessons from these surprises

- Risks should have been obvious from the historical record
 - Look at a longer time horizon
- Risks increased from interaction of development and natural hazards
 - Consider how risks are magnified by modern technology
- Risk parameters (may be/are) changing
 - Adjust risk mitigation for possible future states, think stochastically
- Powerful special interests often inhibit adaptation
 - Understand all the actors; expect them to act in their narrow self-interest
- Human behavioral tendencies are important
 - Understand human psychology and build systems to manage it



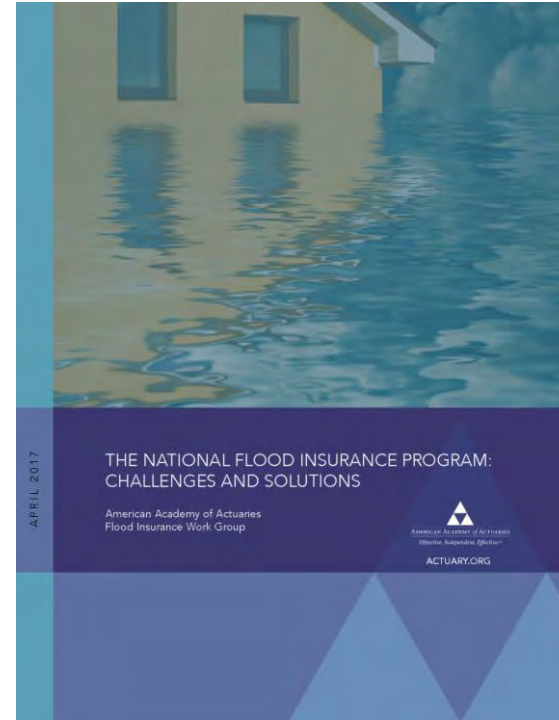
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The US National Flood Insurance Program



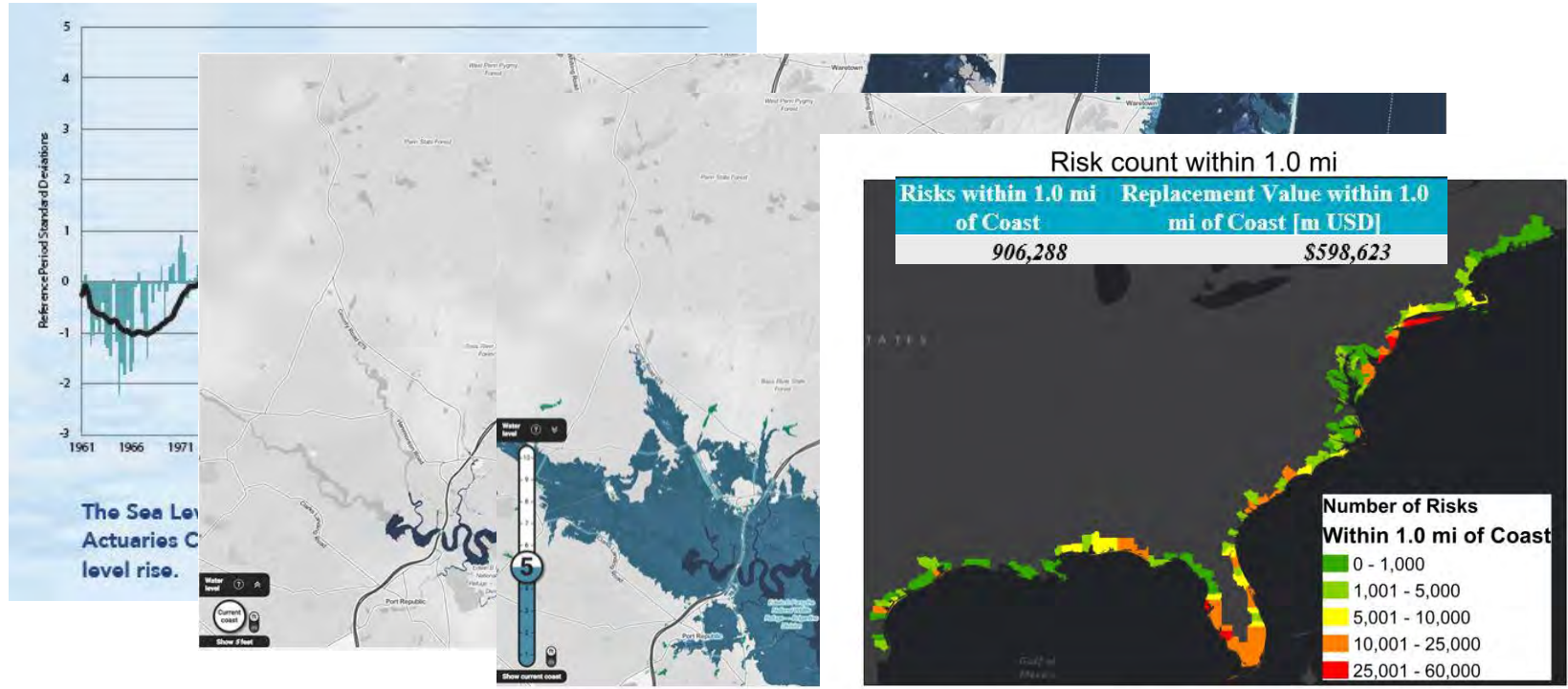


NFIP reform ideas

- Congress:
 - Expand the private sector flood market
 - Increase the use of reinsurance and other private sector risk transfer tools
 - Modernize flood mapping and rating
 - Invest more in pre-flood mitigation
 - (Post Harvey) forgive debt
- Academy of Actuaries:
 - Adopt a holistic view of program value beyond insurance results
 - Clarify financing options for losses from mega-storms
 - Make sure private sector flood coverage does not distort market
 - Prepare for impact of rising sea levels



Sea Level Rise and the US NFIP



NFIP data as of May 1, 2017

Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community



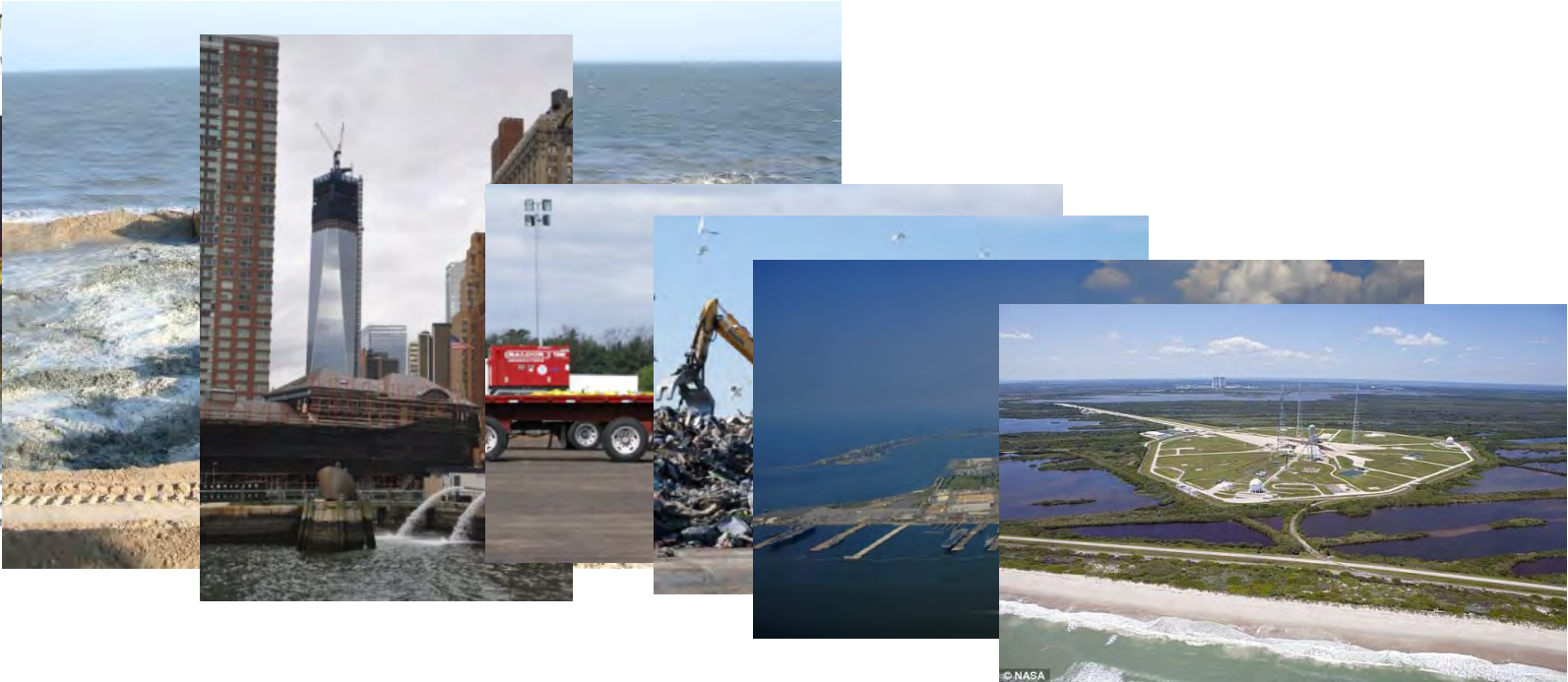
Other US government fiscal exposures

Funding crisis looms for \$14 billion hurricane protection

By Bob Marshall, Staff



U.S. Army Corps of Engineers
Among post-Katrina improvements
the Gulf Intracoastal Waterway





Conclusion: the US is exposed to huge unfunded risk

- Enormous inventory of coastal property exposed to flooding
- Building codes and elevation standards do not contemplate future sea level rise
- Process for making difficult decisions does not exist (rebuild, protect, abandon, etc.)
- Government has large exposure to costs for insurance, recovery, rebuilding, and infrastructure
- Currently, almost none of this is budgeted for
- Government routinely makes long term estimates of cost from social programs like Social Security and Medicare, could similar methods be applied to rising sea levels?



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US coastal population

The Bottom Line

POPULATION DENSITY IS GROWING AT THE COAST

Regardless of how the coast is defined, it is **substantially more crowded** than the U.S. as a whole, and population density in coastal areas will continue to increase in the future.

In 2010: **Out of the 3 million mi² of land in the US**



or 275,351 mi² comprise
Coastal Shoreline Counties



or 511,971 mi² comprise
Coastal Watershed Counties

In 2010: **Out of the 313 million people living in the US**

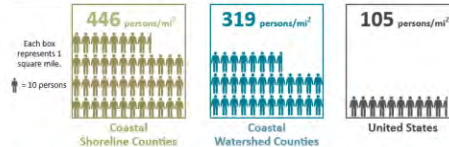


or 123.3 million people lived in
Coastal Shoreline Counties



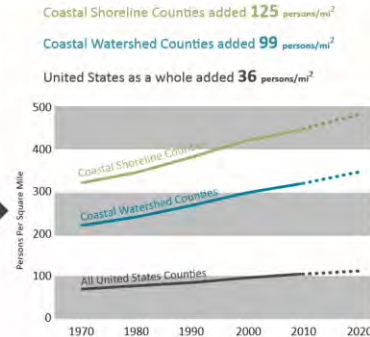
or 163.8 million people lived in
Coastal Watershed Counties

In 2010: **A small amount of land and a large number of people means high density**



Within the limited space of the nation's coast, population density far exceeds the nation as a whole, and this trend will continue into the future. This situation presents coastal managers with the challenge of protecting both coastal ecosystems from a growing population and protecting a growing population from coastal hazards.

In Just 40 Years: 1970-2010



Note: Land area and density values exclude Alaska. Population values include Alaska and US Territories.

Source: U.S. Census Bureau, 2010; NOAA, 2012; Crowell et al., 2010



Mitigation gap

- Ocean temperatures are rising, and warm water is being transported northward by the gulf stream off the eastern US
- Research indicates large hurricanes hit the northeastern US in previous periods of warmer oceans
- The northeast US has very old housing stock which has not been fortified to withstand severe hurricanes
- Even if strong codes were enacted today, it would take decades for the housing stock to be strengthened
- This could lead to a mitigation gap, where wind hazard changes faster than the housing stock can be fortified



Conclusion: the US is exposed to huge losses

- While there is significant uncertainty, there is a high likelihood of future hurricanes impacting housing stock not designed for them
- When this happened in Florida:
 - Private insurance markets went into meltdown
 - Government created underfunded pools
 - Building codes had to be strengthened
 - Significant effort was needed on retrofit
- The problem in the northeast US is potentially much larger
 - Older housing stock
 - Larger population
- Will action be taken, or will this be another surprise?



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Current building code thinking

- Developed largely by structural engineers
- Focused on life safety
- Considers the current state (or possibly recent past state) as to demographics (concentrations) or climate
- Little consideration of macroeconomic issues or community resilience
- Lenses through which we can view the problem:
 - Life safety
 - Protection of individual properties
 - Management of overall economic impact, both near and long term



New thinking – economic mitigation

- Assume the economic value of mitigation is defined to be the present value of expected savings in insurance costs over a building's design lifetime
- Future insurance costs will reflect evolving risk concentrations, climate change, and mitigation
- Various future scenarios can be created and assigned probabilities, yielding a distribution of costs and benefits over time
- Economic capital models can be adapted to simulate various future states for an economic mitigation value
- Building code and land use decisions can reflect future conditions, uncertainty, and cost/benefit of mitigation strategies



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Are these issues relevant in Australia?

- Sea level rise and coastal inundation Yes
- Government flood pool No
- Unclear process to manage adaptation Yes
- Government exposure to large expenditures Yes
- Exposure to poleward migration of cyclones Yes
- Potential mitigation gap Yes
- Need for rethinking of building code development Yes

Generally, Australia is ahead of the US in thinking about these issues



Tackling these problems requires

- Learning lessons from recent surprises
- Adopting new mindsets:
 - Long term time horizons for government budgeting
 - Proactive building codes and land use planning
 - An “investment bank” approach to mitigation and coastal retreat
 - A stochastic perspective on future states
 - New building code paradigms
- Respecting and working with entrenched economic interests
- Understanding human psychology
- Patience and persistence

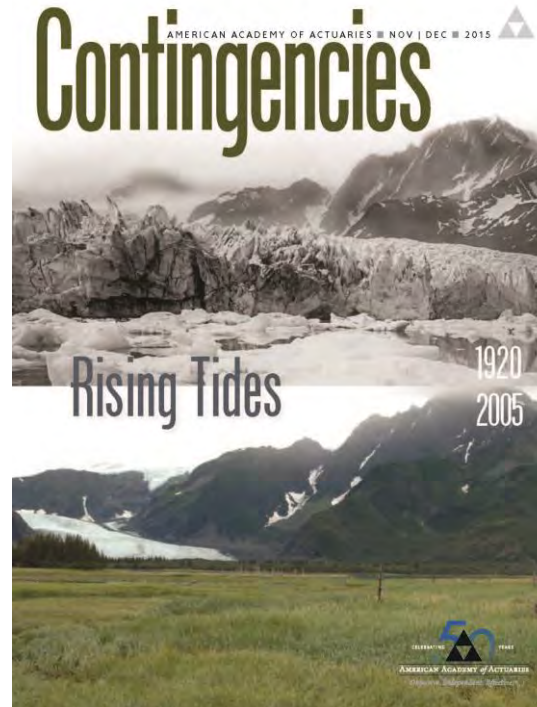
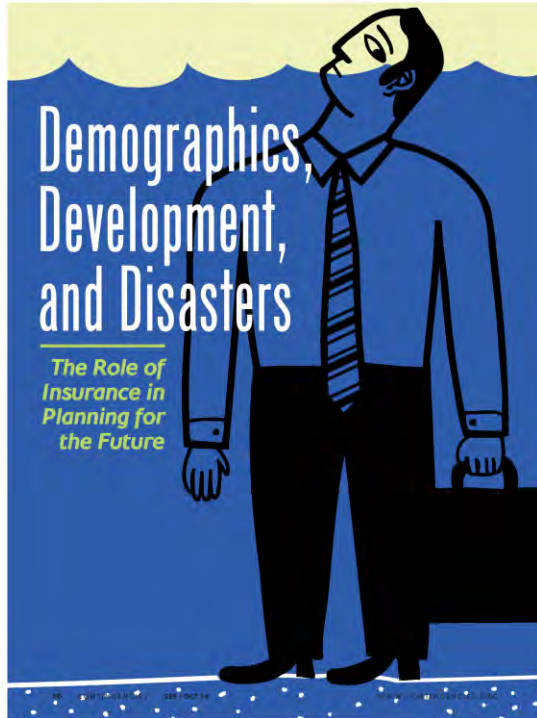


Remember

***If things we build are
designed for a century of use,
then our planning horizon
must consider conditions
during the next century.***



Further reading – www.ozgator.com



Thank you!

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