



PRESENTED BY UNIVERSITY OF HOUSTON

TAMEST NATURAL HAZARDS SUMMIT

*Responding
to and
Mitigating
the Impacts*

PART I: VIRTUAL SUMMIT

10.19.2021

#NATURALHAZARDSSUMMIT

Theme Three:

LONG-TERM OUTLOOK, RISK AND MITIGATION FOR CLIMATE CHANGE

Moderated by:

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and Construction Engineering

Texas Tech University



TAMU NATURAL HAZARDS

Responding to and Mitigating the Impacts

SUMMIT

Presented by:
UNIVERSITY of
HOUSTON



Plenary:

Risk and Policies for Mitigation



HOWARD
KUNREUTHER, PH.D.

Co-Director

Wharton Risk Management and Decision
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University of Pennsylvania

TAMEST NATURAL HAZARDS

Responding to and Mitigating the Impacts

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Mitigating Risks from Future Natural Disasters: Dealing with Climate Change

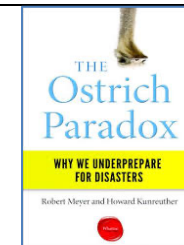
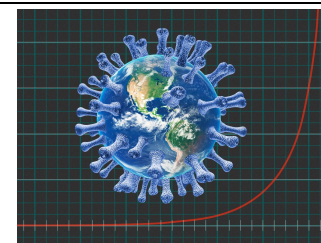
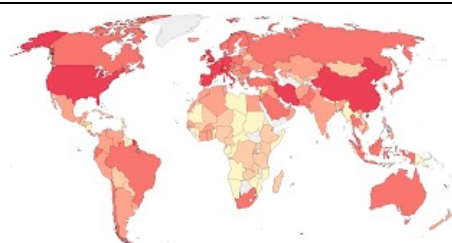
Howard Kunreuther

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James G. Dinan Professor Emeritus of Decision Sciences & Public Policy
Co-Director Emeritus, Risk Management and Decision Processes Center
The Wharton School, University of Pennsylvania

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TAMEST Natural Hazards Summit: Part I
October 19, 2021



Outline of Talk

A New Era of Catastrophes

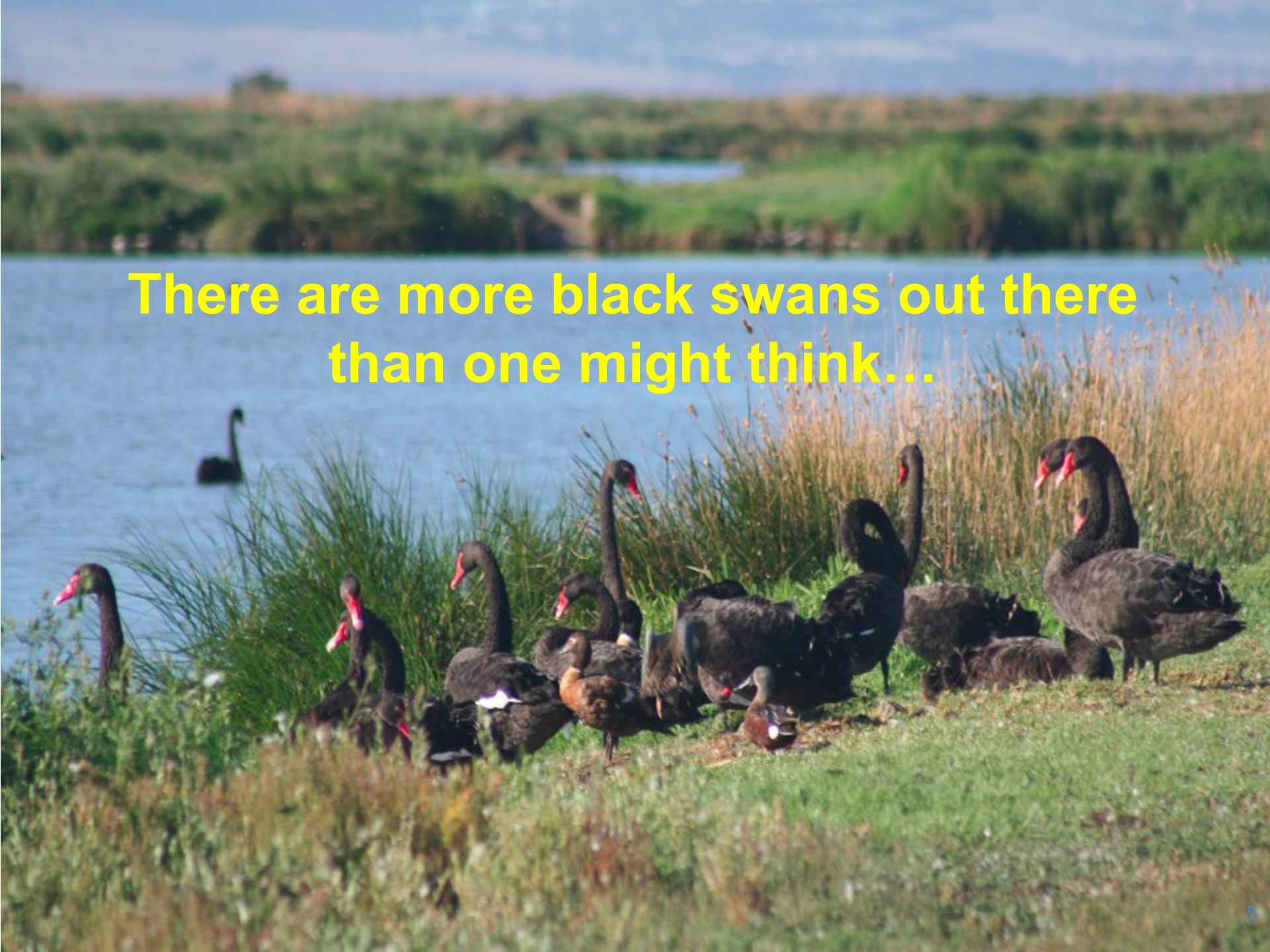
Impact of Biases on Behavior

Dealing with Climate Change and Flood Hazards Now

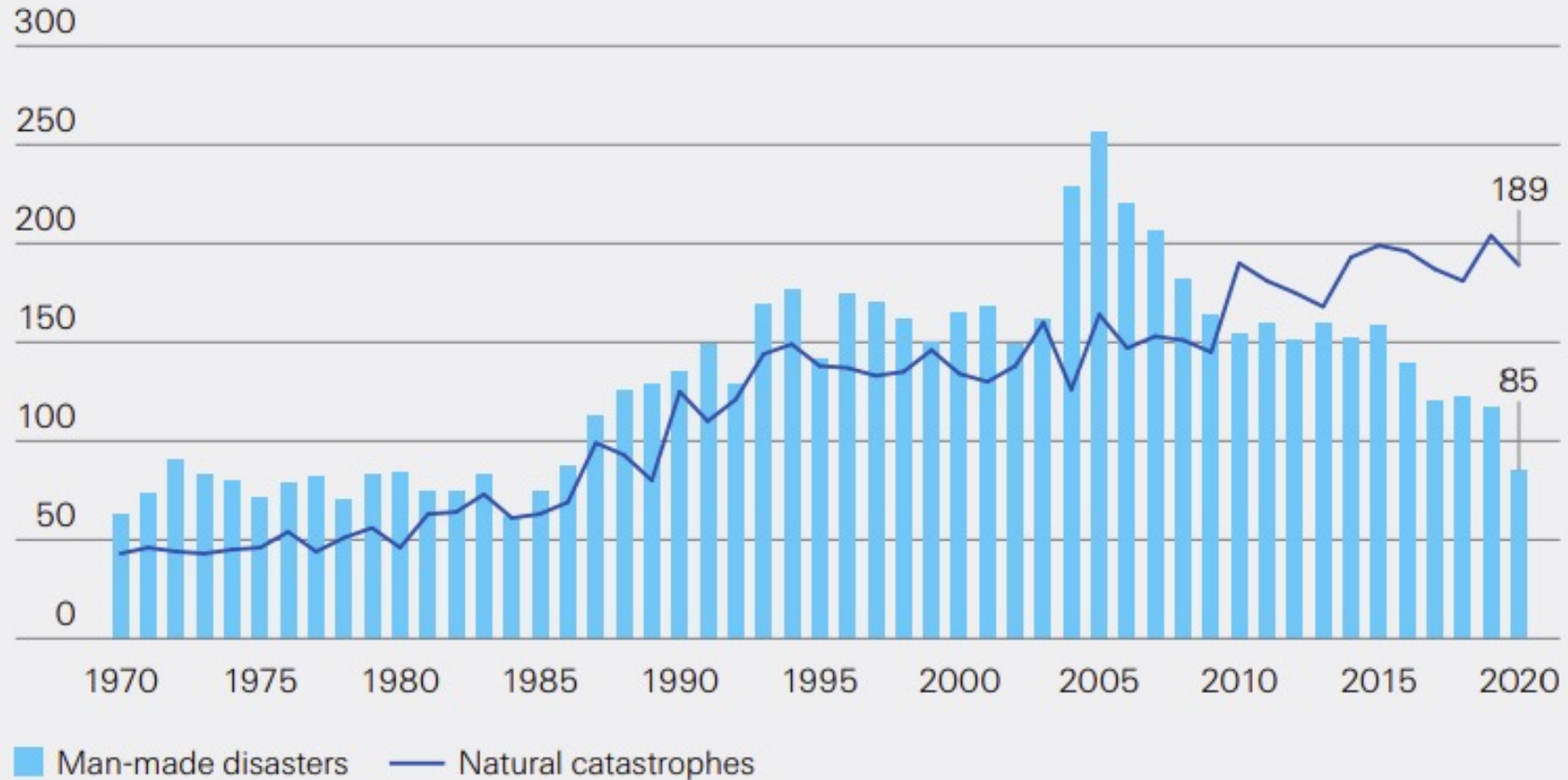
Role of a Behavioral Risk⁴ Audit

Challenges and Questions for Discussion

**There are more black swans out there
than one might think...**



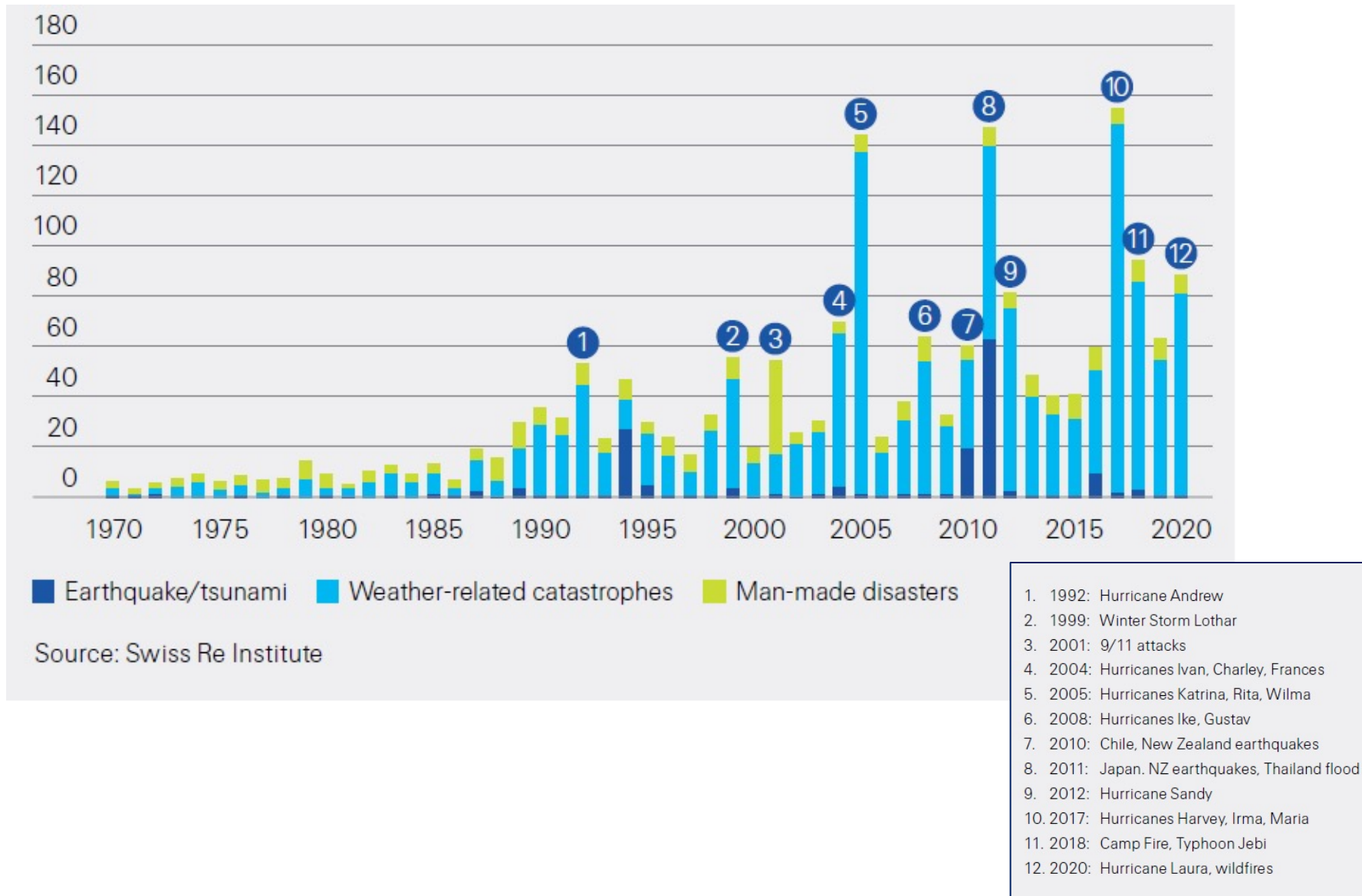
Natural Catastrophes and Man-Made Disasters: Number of Events 1970-2020



Source: Swiss Re Institute

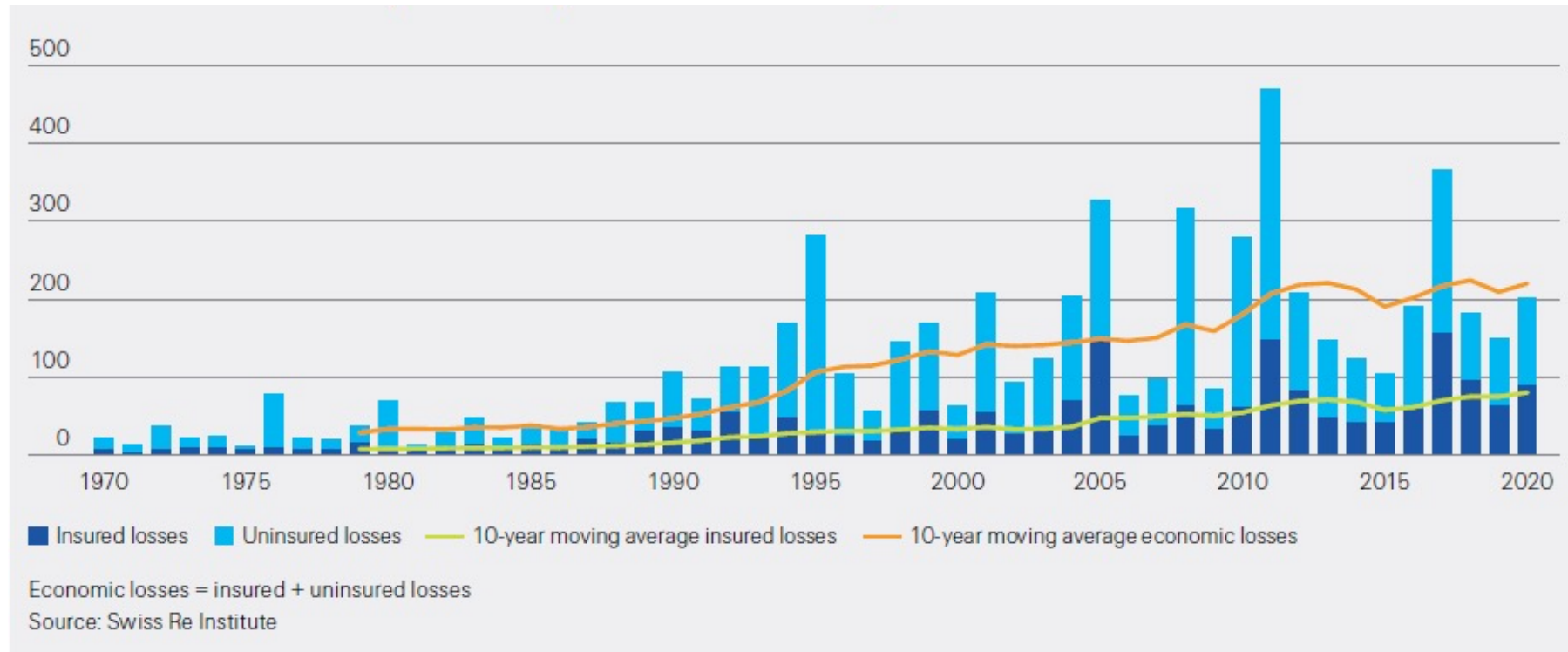
Insured Catastrophe Losses, 1970-2020

in USD billion, at 2020 prices



Insured vs Uninsured Losses, 1970-2020

in USD billion, at 2020 prices



What's Happening?

The Question of Attribution



Higher Degree of Urbanization



Huge Increase in the Value at Risk

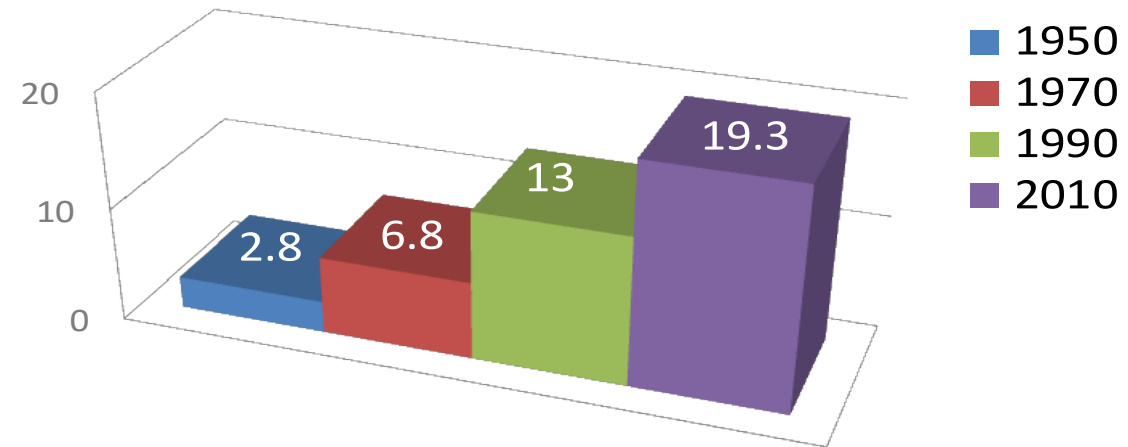


Weather Patterns and Sea Level Rise

- Changes in climate conditions and/or return to a high hurricane cycle?
- Sea level rise will cause more flood damage
- More intense weather-related events coupled with increased value at risk will cost more...much more



POPULATION OF FLORIDA



Millions of Inhabitants

Impact of Hurricane Laura (Aug. 27, 2020)



Highest winds 150 miles per hour

Huge storm surge and flooding in Louisiana and Texas

Estimated damage: \$19 billion

Outline of Talk

A New Era of Catastrophes

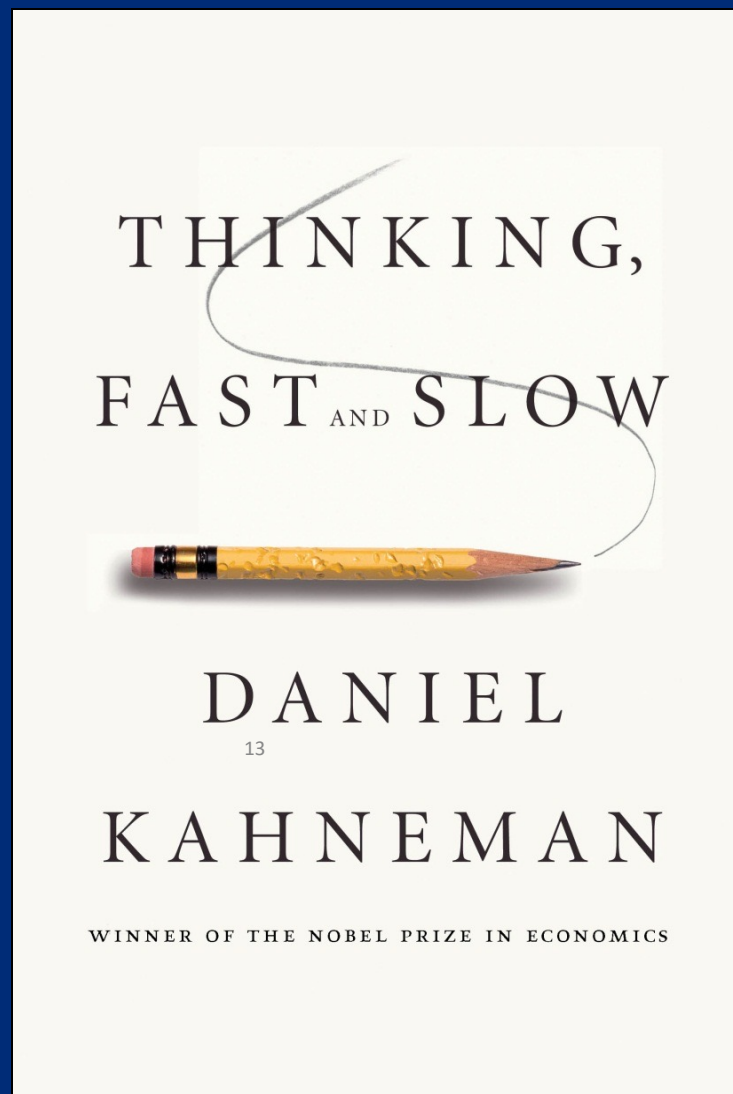
Impact of Biases on Behavior

Dealing with Climate Change and Flood Hazards Now

Role of a Behavioral Risk¹² Audit

Challenges and Questions for Discussion

Impact of Biases on Behavior



Intuitive Thinking (System 1) & Deliberative Thinking (System 2)

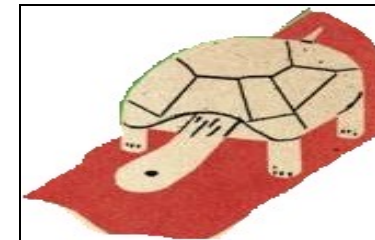
System 1 operates automatically and quickly with little or no effort

- Individuals use simple associations including emotional reactions
- Highlight importance of recent past experience
- Basis for systematic judgmental biases and simplified decision rules



System 2 allocates attention to effortful and intentional mental activities

- Individuals undertake trade-offs implicit in benefit-cost analysis
- Recognizes relevant interconnectedness and need for coordination
- Focuses on long-term strategies for coping with extreme events



Behavior Triggered by Intuitive (System 1) Thinking

Myopia – Focus on short-time horizons



Amnesia – Forget the lessons of the past



Optimism – Underestimate the likelihood of extreme events

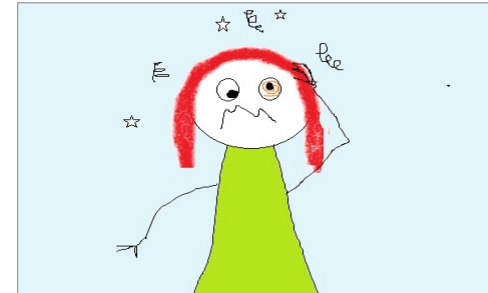


Behavior Triggered by Intuitive (System 1) Thinking

Inertia – Maintaining the status quo



Simplification – Attending to only a few factors



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Herding – Basing choices on actions of others



Outline of Talk

A New Era of Catastrophes

Impact of Biases on Behavior

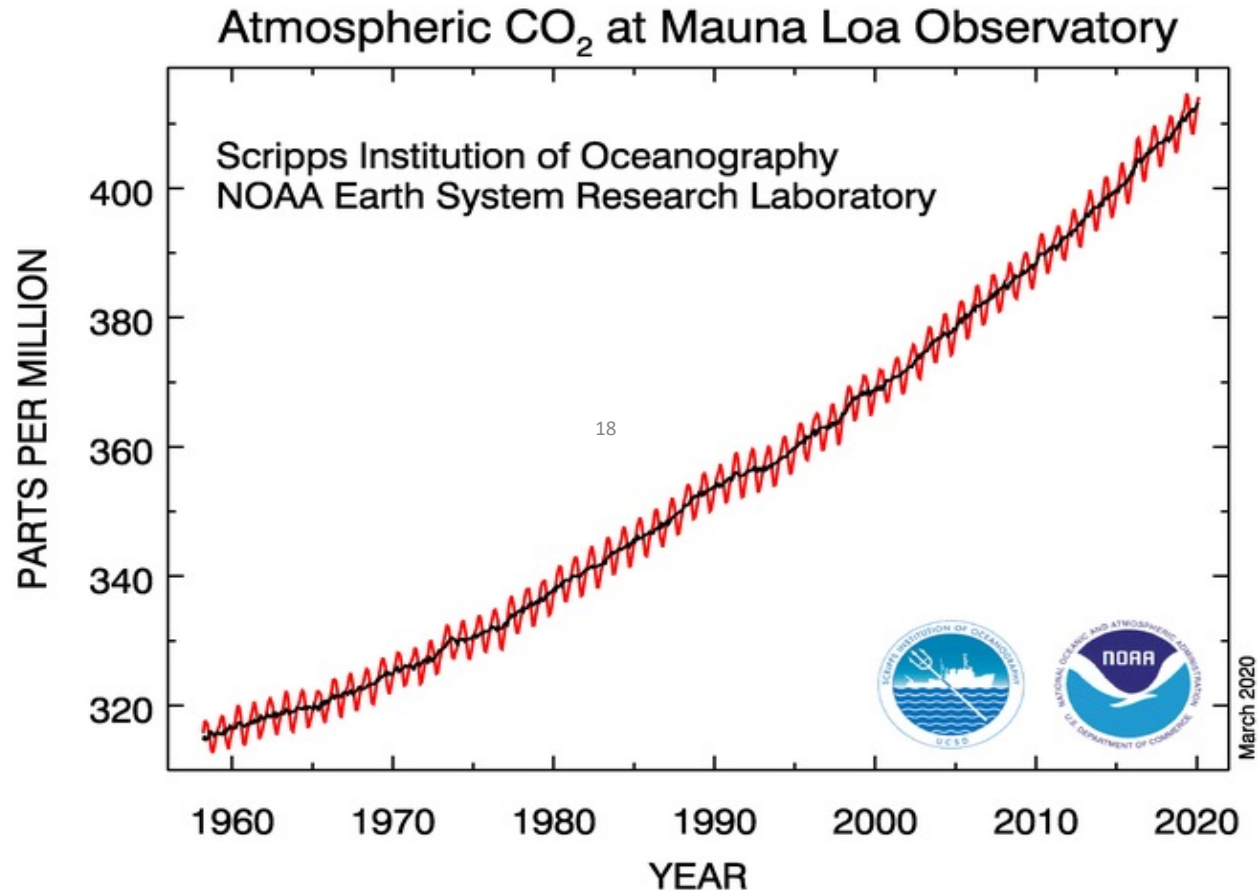
Dealing with Climate Change and Flood Hazards Now

Role of a Behavioral Risk¹⁷ Audit

Challenges and Questions for Discussion

Using Lessons from COVID-19 to Deal with Climate Change Now

Show that carbon dioxide emissions and their resulting impacts have been increasing exponentially, like COVID-19



Examples of Impacts of Increasing CO₂ Emissions

An analysis of 136 major coastal cities reveals sea level rise of 20 cm (7.9 inches) by 2050 will cause the average annual flood losses in those cities to increase to \$1.2 trillion that year, from \$52 billion in 2005.

From 1980 until 2018, the population of hurricane-prone counties in Florida increased by 163%, from 3.7 million people to 9.8 million, compared with a 61% increase in U.S.¹⁹ population. Florida residents are likely to experience increased damage from more intense hurricanes coupled with sea level rise.

Dealing with the Flood Hazard Now: A Scenario

The Lowland family resides in Houston and is considering whether to invest \$1,500 in installing hurricane shutters to reduce storm damage to their house from future hurricanes.

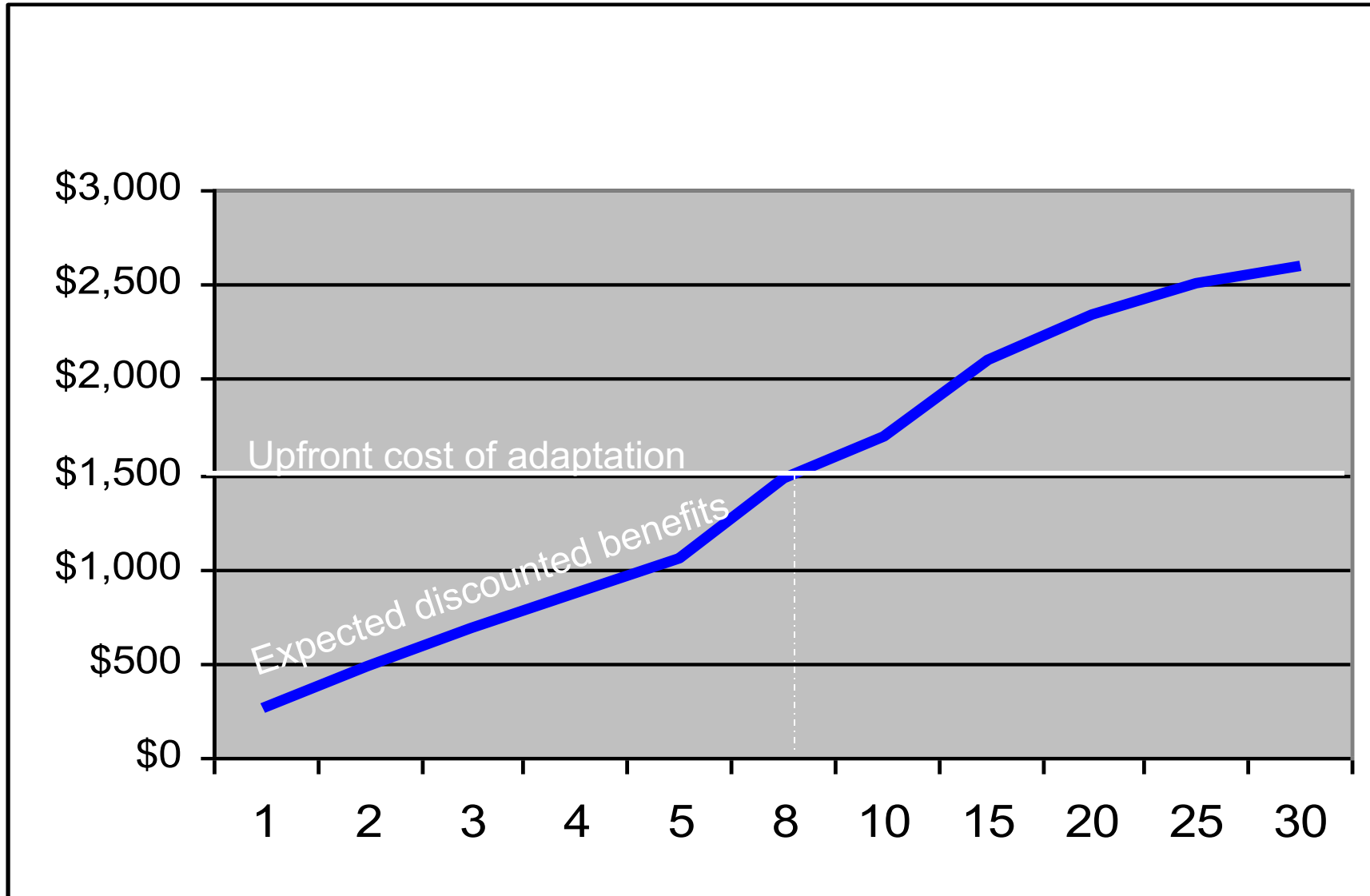
Hydrologists have estimated that the chances of storm surge affecting their home is $1/100$, and that if it occurs, the savings from flood proofing will be \$27,500.

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If premiums reflect risk their annual insurance cost will be reduced by \$275 (i.e., $1/100$ \$27,500) if they undertake this investment.

Expected Benefit-Cost Analysis of Adaptation

(Annual Discount Rate 10%)



Illustrations of Intuitive (System 1) Thinking

Responses by the Lowland Family prior to Hurricane Laura

- ***Myopia:*** Failure to consider long-term benefits of flood protection
- ***Amnesia:*** Damage from previous flooding has faded from memory
- ***Optimism:*** Likelihood of water-related damage is below their threshold level of concern
- ***Inertia:*** Why change from their current behavior given their unconcern with future damage from floods
- ***Simplification:*** No attention paid to consequences from a severe flooding since perceived likelihood of water-related damage is so low
- ***Herdning:*** No other property in the area invested in flood proofing so why should we?

Outline of Talk

A New Era of Catastrophes

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Challenges and Questions for Discussion

Role of a Behavioral Risk Audit

A new approach to preparedness-planning based on concepts in behavioral economics and psychology.

Step 1: Identify the cognitive biases that impact decision making

Step 2: Accept these biases as part of our natural tendencies in making choices

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Step 3: Design strategies that address these biases

A Behavioral Risk Audit

Bias	Remedy
Myopia	Long-term mitigation loans coupled with insurance premium reductions
Amnesia	Multi-year insurance contracts so property owners don't cancel their policy if they have no claims
Optimism	Stretch time horizon so that homeowners pay attention: probability of 1-in-100 annually is 1-in-5 chance of at least one hurricane in 25 years

A Behavioral Risk Audit

Bias	Remedy
Inertia	Add flood coverage to homeowners policy as the default option with an option to cancel it
Simplification	Focus on the potential consequences of a hurricane rather than on its probability
Herding	Seals of approval with certified inspections on well-designed property to create a social norm for protection in hazard-prone areas

Addressing Myopia Using Behavioral Risk Audit: Long-term Loans Coupled with Insurance Premium Reductions

Illustrative Example: The Lowland Family

Cost to flood-proof their home: \$1,500

Expected annual benefit of partial roof adaptation:
 $\$275 \text{ (} 1/100 * \$27,500 \text{)}$

Annual payments from 20-Year \$1,500 loan at
10% annual interest rate: ²⁷\$145

Reduction in annual insurance payment: \$275

Reduction in annual payments due to adaptation:
 $\$275 - \$145 = \$130$

Outline of Talk

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Challenges and Questions for Discussion

Future Challenges and Questions for Discussion

What steps can be taken to reduce future losses from hurricanes and floods due to climate change?

How can we better communicate the risks of low-probability events, so the general public and other stakeholders pay attention to their consequences?

What role can different risk management policies such as economic incentives, insurance, well-enforced standards and regulations play in dealing with low probability events?

Conclusions

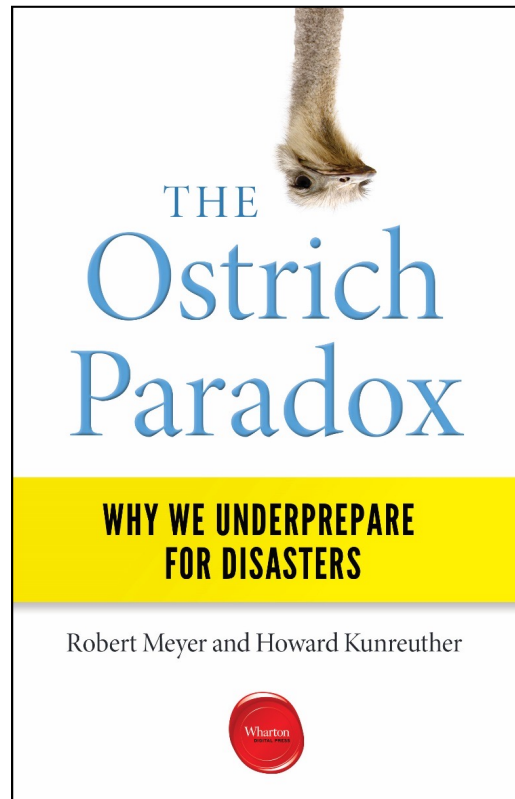
Risk perception and cognitive biases lead decision makers to ignore low-probability events until it is too late.

A behavioral risk audit can address these biases and provide guidelines for reducing losses from extreme events now.

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We need to take steps to address climate change now to reduce potentially disastrous outcomes in the future.

The Ostrich Paradox: Why We Underprepare for Disasters
(Wharton Digital Press, 2017)



Wharton School professors and co-directors of the Wharton Risk Management and Decision Processes Center **Robert Meyer and Howard Kunreuther** explore why our cognitive systems perform so poorly when dealing with low-probability, high-consequence events—from the individual to the larger communities and policy makers. Research on disasters over the years suggests that most preparedness errors can be traced to the harmful effects of six biases. They propose a behavioral risk audit for dealing with these biases.