What Does a Business Need to Know about the Likely Impacts of Climate Change?

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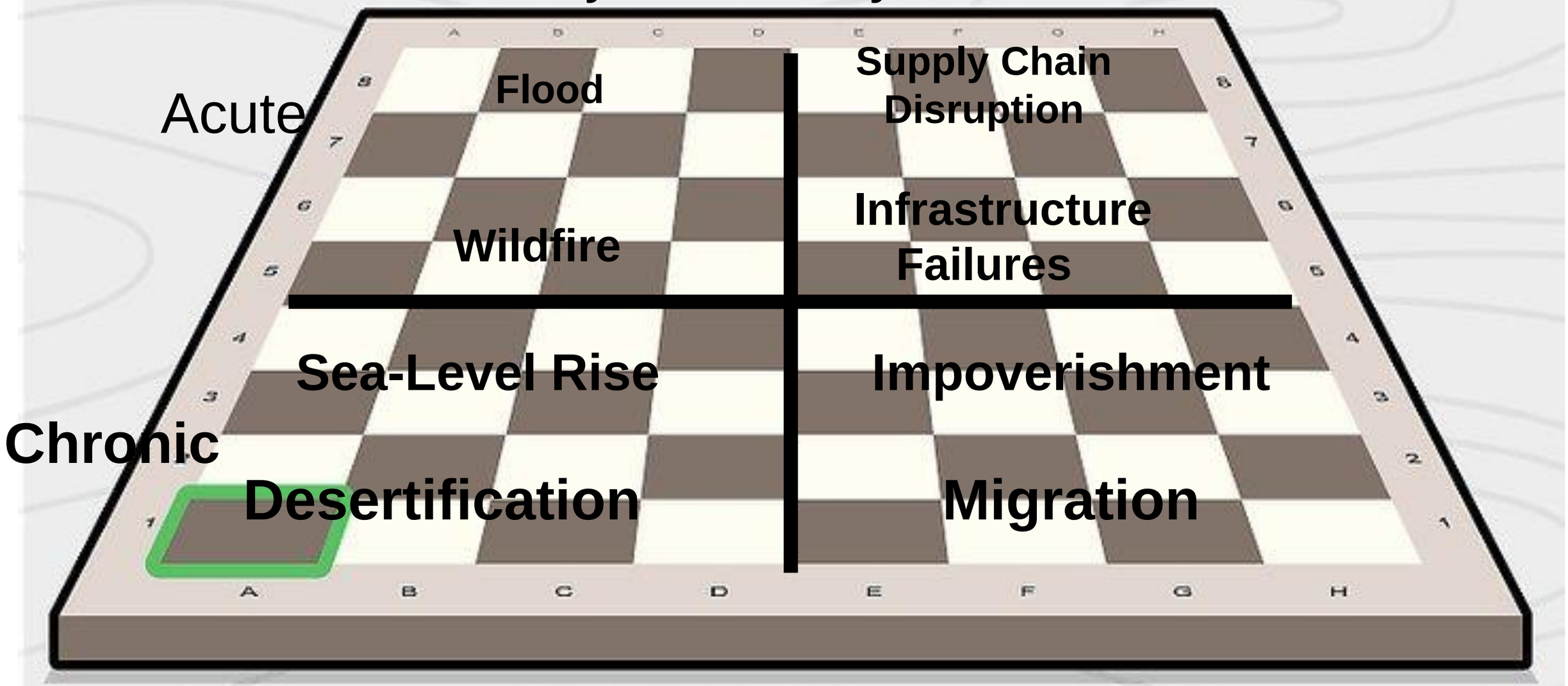
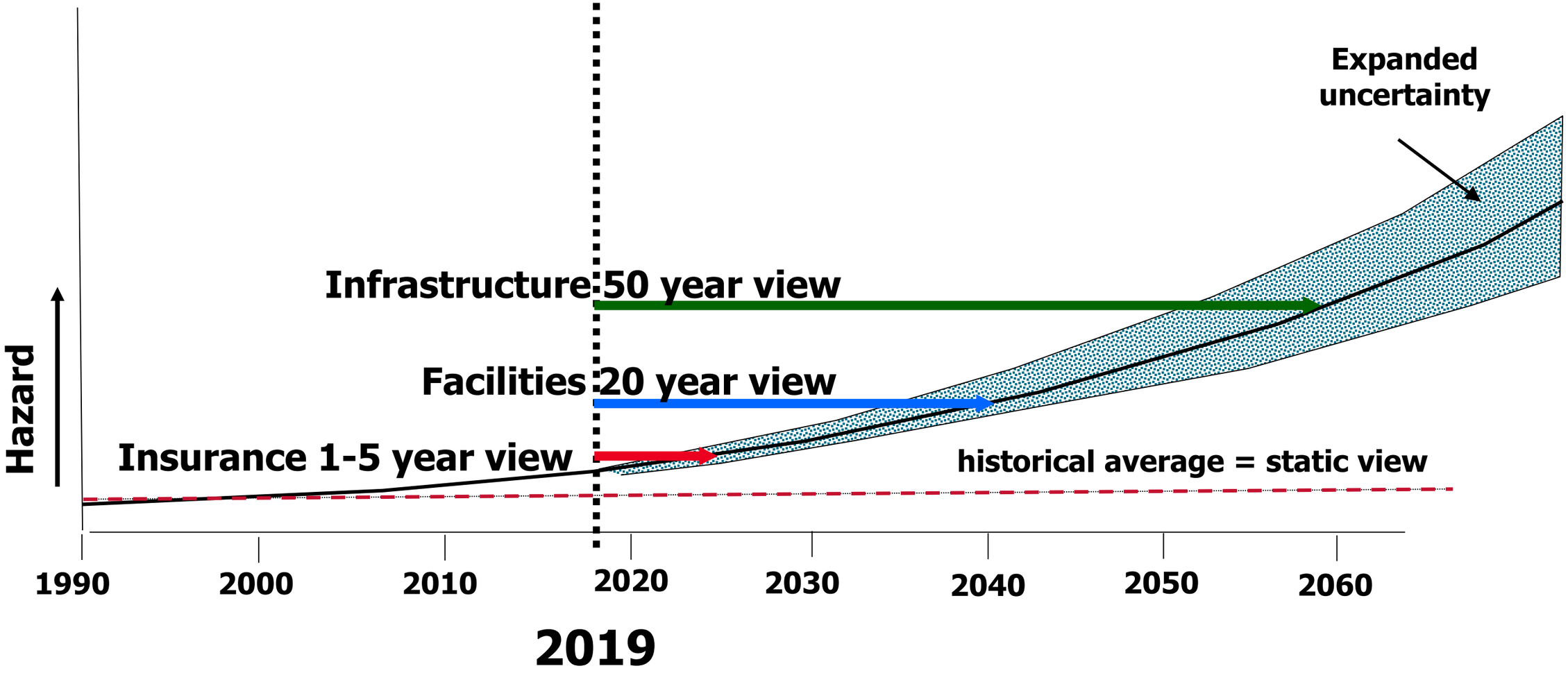
THE CONSEQUENCES OF CLIMATE CHANGE



MANAGING A BUSINESS THROUGH CLIMATE CHANGE

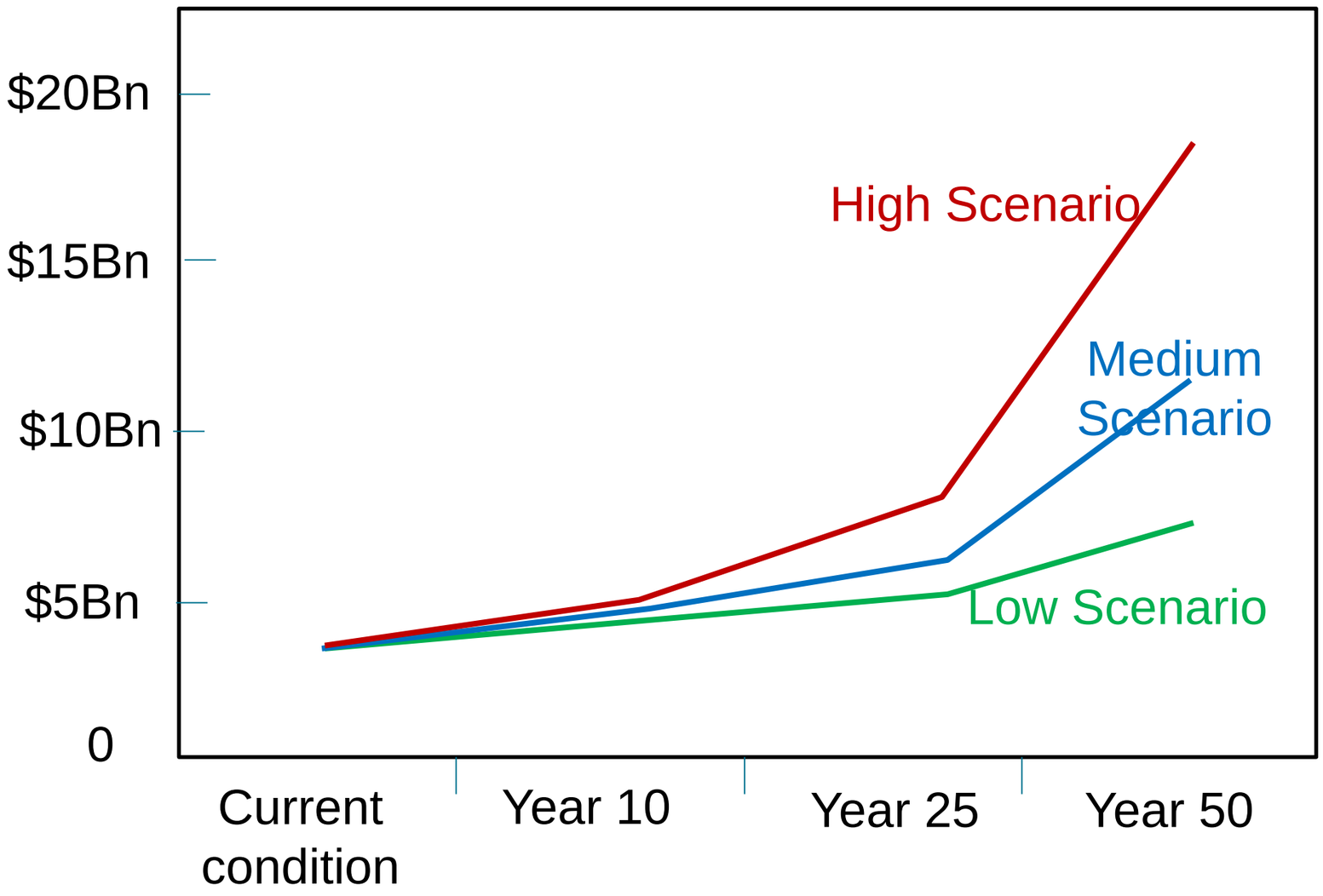
WHAT IS THE RELEVANT RISK HORIZON?

IMPLICATIONS OF THE RISK HORIZON ON THE HAZARD



Each horizon gives a different perspective

THE PROBLEM OF HORIZONS: EXPECTED ANNUAL DAMAGE FROM COASTAL LOUISIANA FLOODING OVER THE NEXT 50 YEARS



ECONOMIC CONSEQUENCES OF DISASTERS

THE FUTURE IS ALREADY HERE – IF YOU KNOW WHERE TO LOOK!

Southern Louisiana:

Sea-level rise on steroids

Questions around what can be protected

California:

Trends for de-urbanization

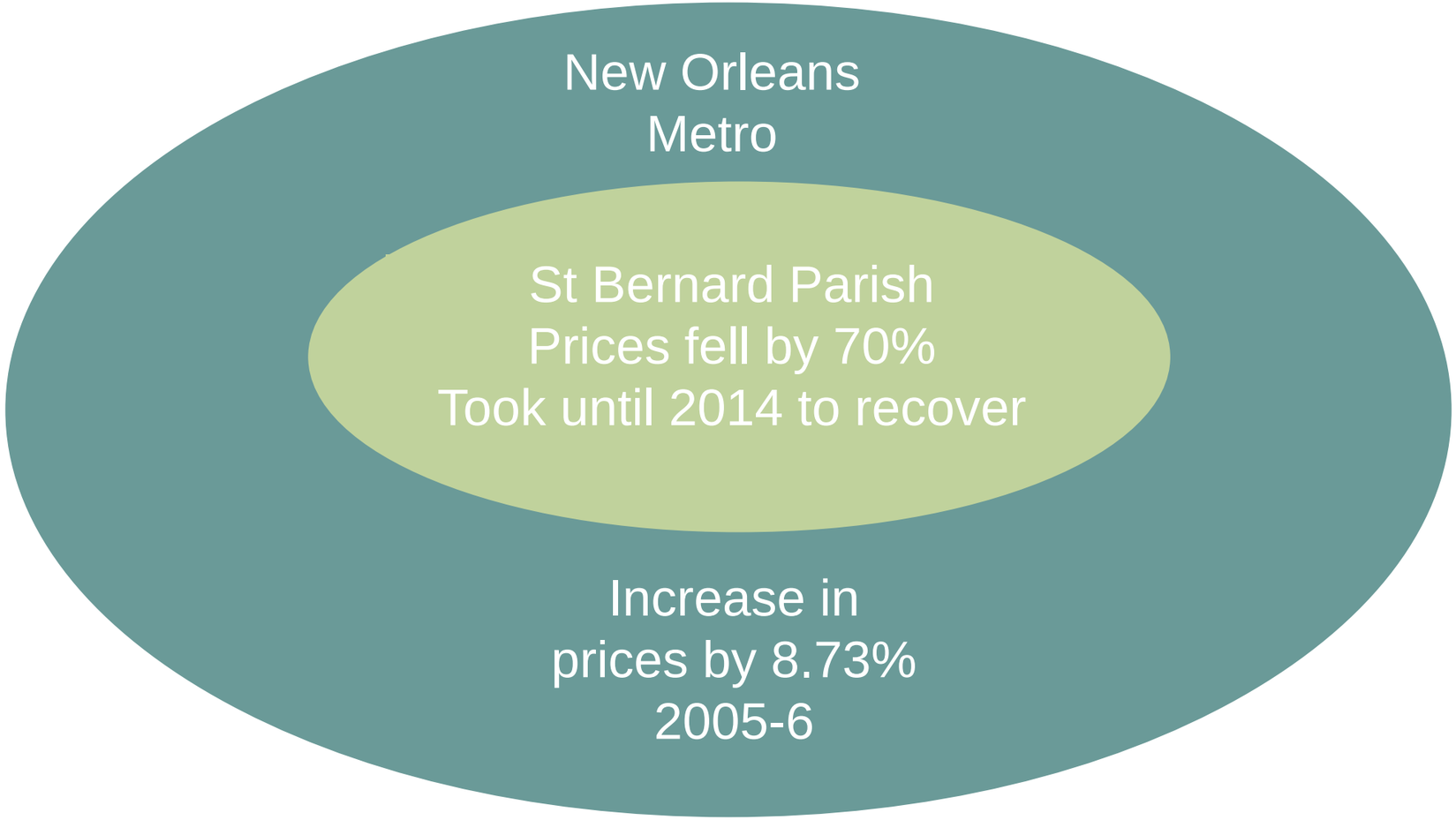
‘Whiplash’ climate and fire accelerants

Florida:

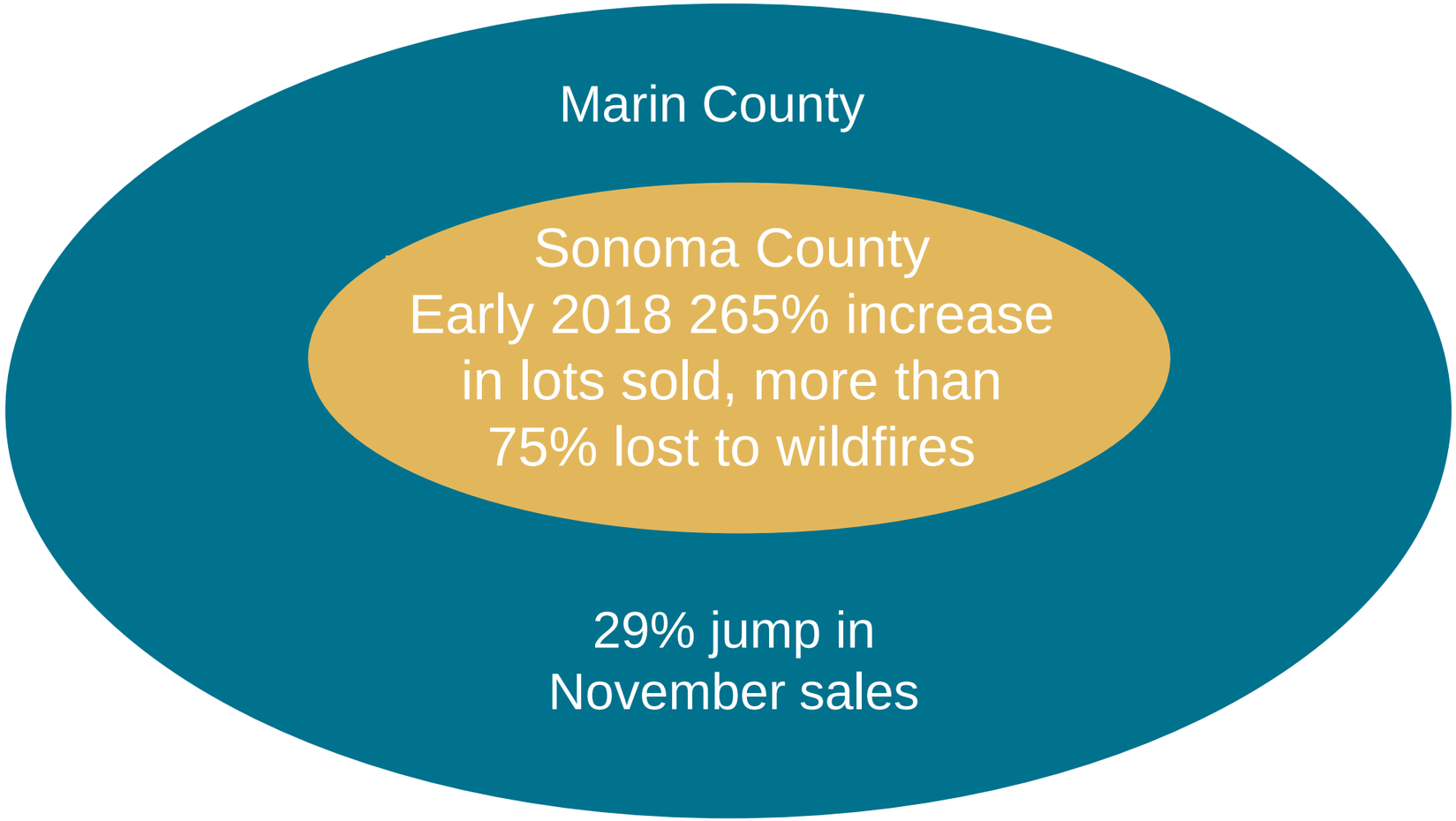
Astronomical v climate sources of flooding

Balancing response to ordinary and extreme flooding

DONUT ECONOMICS: IMPACT OF DISASTERS ON US REAL ESTATE MARKETS: HURRICANE KATRINA (LARGELY UNINSURED)

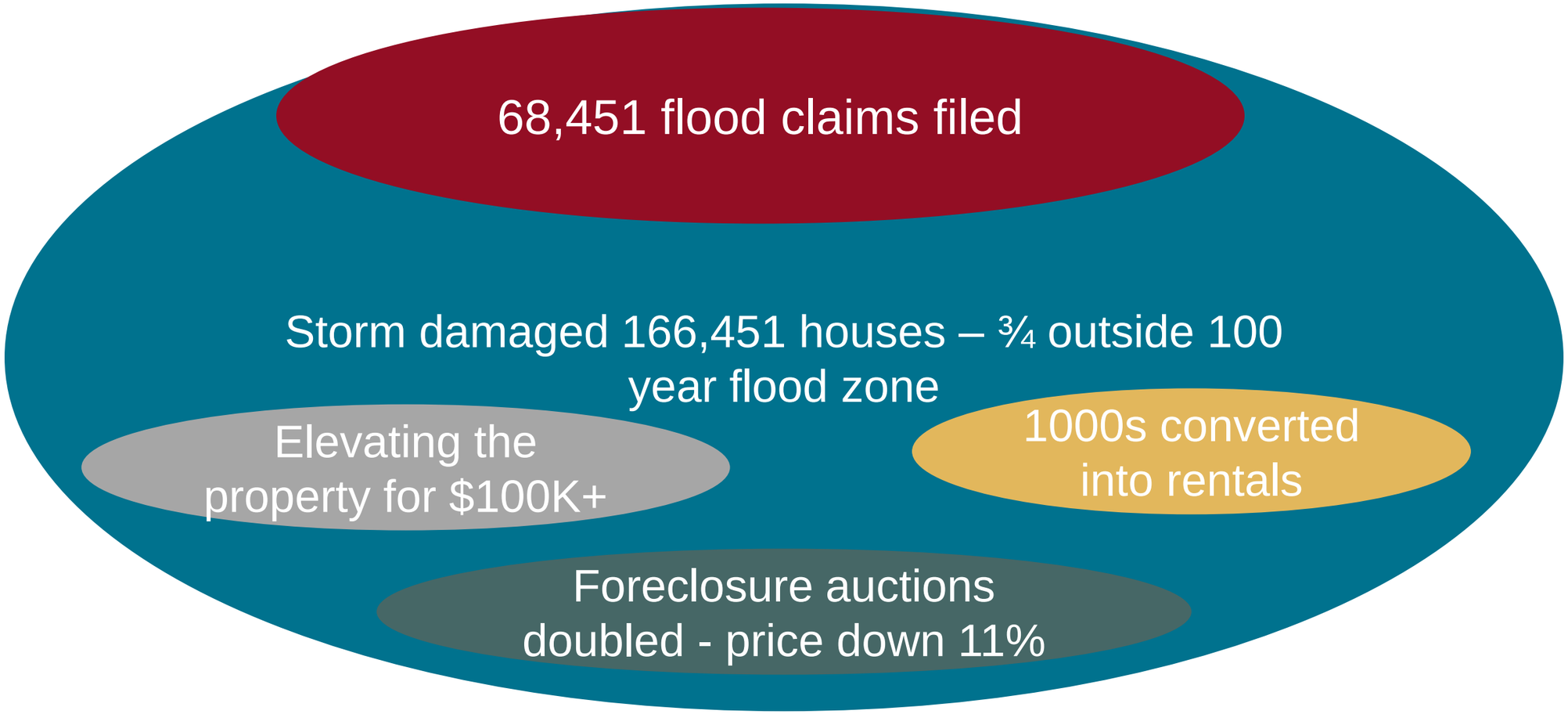


DONUT ECONOMICS: IMPACT OF DISASTERS ON US REAL ESTATE MARKETS: 2017 TUBBS FIRE CALIFORNIA (HIGHLY INSURED)



Read more at: https://www.bisnow.com/san-francisco/news/multifamily/effects-of-fires-on-housing-market-evident-in-year-since-wine-country-fires-95772?utm_source=CopyShare&utm_medium=Browser

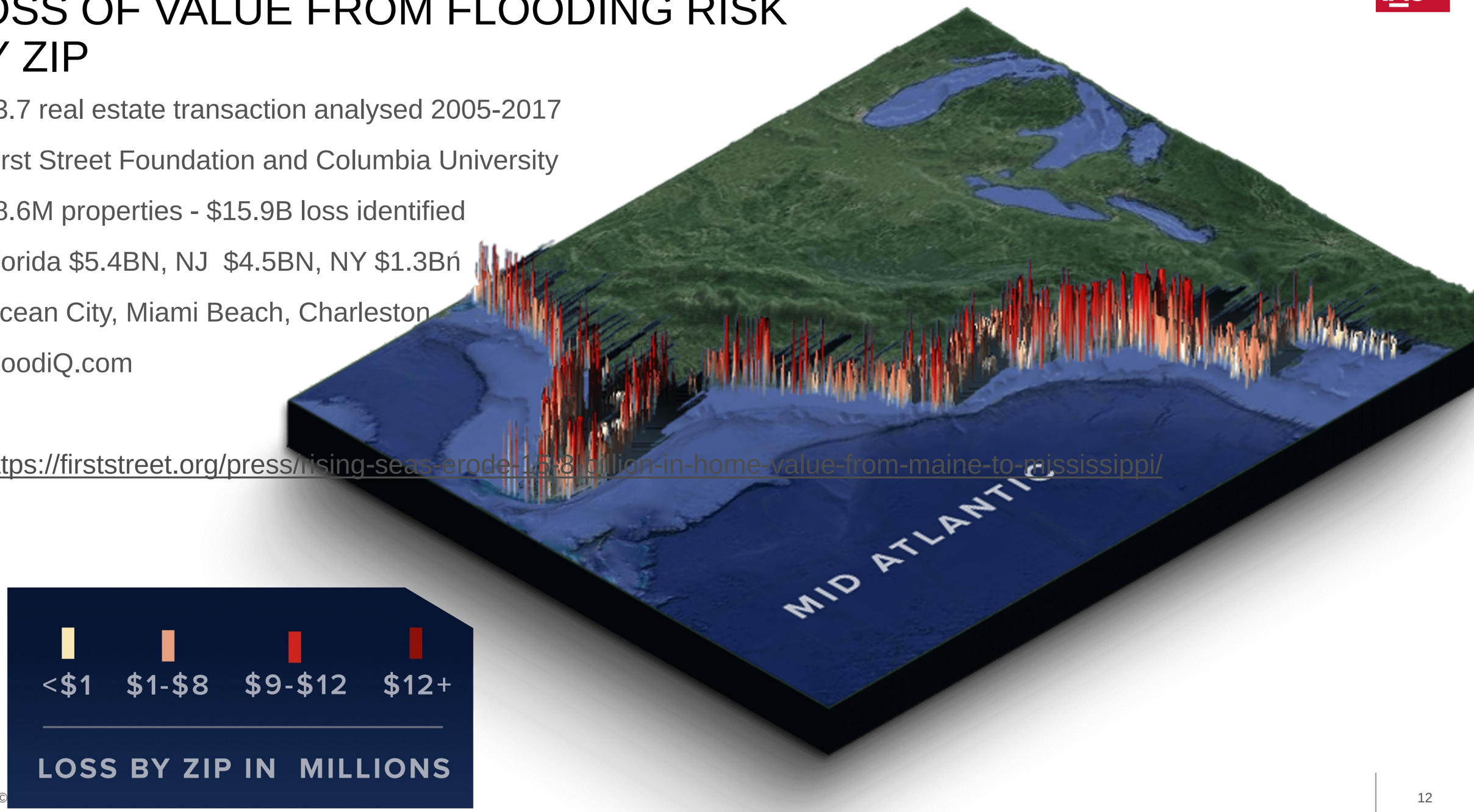
AFTER 2017 HARVEY IN HOUSTON: PARTLY INSURED



LOSS OF VALUE FROM FLOODING RISK BY ZIP

- 13.7 real estate transaction analysed 2005-2017
- First Street Foundation and Columbia University
- 28.6M properties - $15.9B loss identified
- Florida $5.4BN, NJ $4.5BN, NY $1.3Bń
- Ocean City, Miami Beach, Charleston
- FloodiQ.com

- https://firststreet.org/press/rising-seas-erode-15-8-billion-in-home-value-from-maine-to-mississippi/



UTILITIES: WATER AND POWER

UK FLOODS IMPACT ON BUSINESS

- In the 2007 floods, utility losses were £397 million, 10% of total damages
- Loss of power affected 750,000 people and 350,000 people had their water supply interrupted for 17 days

Table 2: Comparison of economic costs by flood event by impact category (2015 prices)

Impact category	2007 (summer floods) (£ million)	2013 to 2014 (winter floods) (£ million)	2015 to 2016 (winter floods) (£ million)
Residential properties	£1,500	£320	**£350**
Businesses	£910	£270	**£513**
Temporary accommodation	£120	£50	**£37**
Vehicles, boats, caravans	£98	£37	**£36**
Local authorities (excluding roads)	£170	£57	**£73**
Emergency services	£5	£3	**£3**
Flood risk management infrastructure and service	£24	£147	**£71**
Utilities (energy and water)	£398	£30	**£104**
Transport (roads, rail, air, ports)	£310	£295	**£341**
Agriculture	£59	£19	**£7**
Health	£340	£25	**£43**
Education	£14	£2	**£4**
Other (wildlife, heritage and tourism)	–	£13	**£19**
Totals	£3.9 billion	£1.3 billion	**£1.6 billion**

PROTECTING WATER AND POWER SUPPLIES

- The Pitt Review recommended improving the protection and resilience of critical national infrastructure.
- **Estimating the economic costs of the 2015 to 2016 winter floods January 2018 Environment Agency**

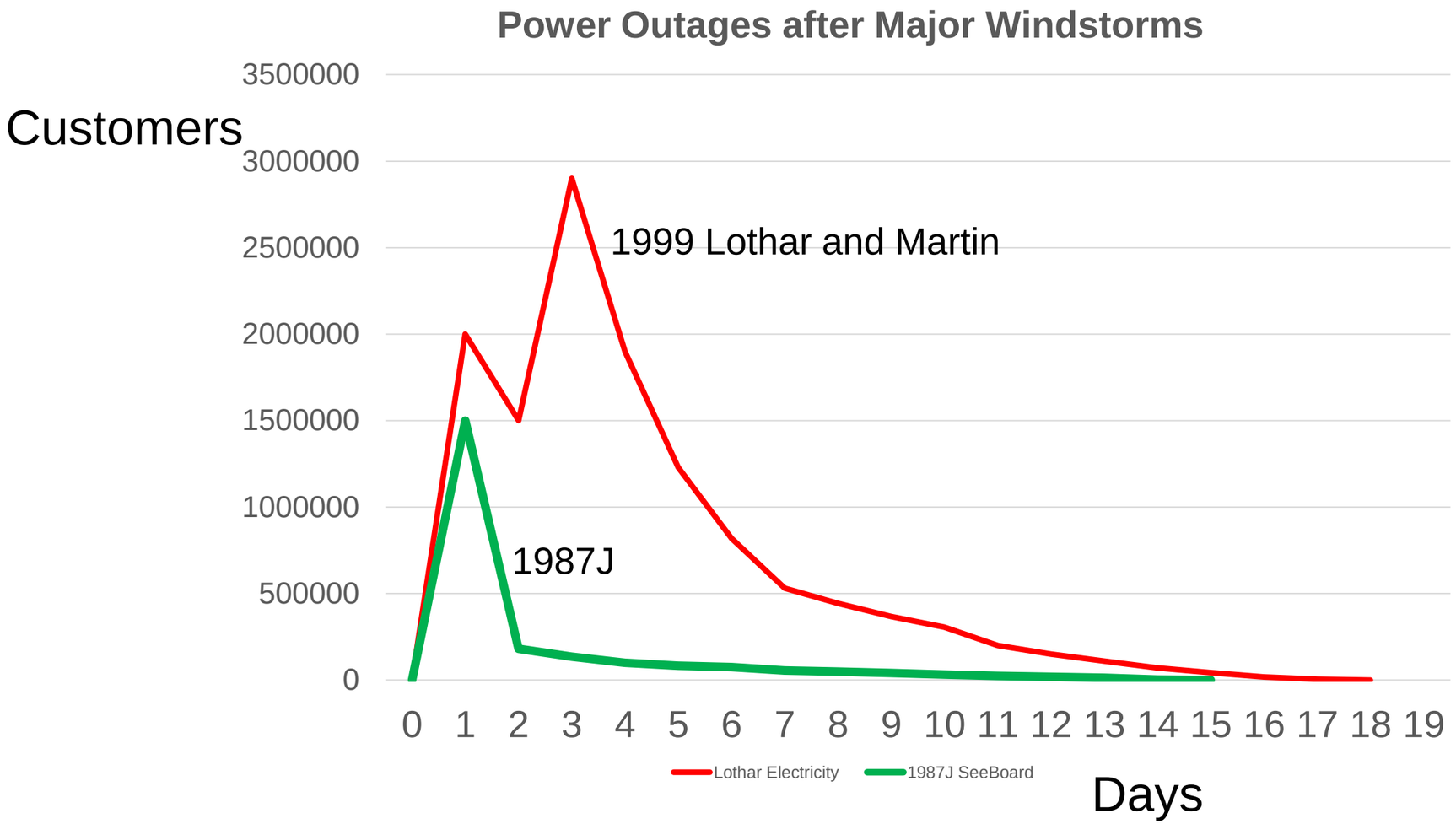
Table 15: Comparison between flood events of costs incurred by utilities and loss of utility services

Flood event	Economic cost (capital and welfare) (£ million)	% of total costs	% of property costs
2015 to 2016 (winter)	£104	7%	12%
Water	£83	5%	10%
Electricity	£21	1%	2%
2013 to 2014 (winter)	£30	2%	5%
Water	£29	2%	5%
Electricity	£1	0.1%	0.1%
2007 (summer)	£397	10%	17%
Water	£227	6%	10%
Electricity	£169	4%	7%

THE EXPANDING IMPACT OF PROLONGED POWER OUTAGES

- Because electricity is always there, we have come to rely on it without question and have allowed it to infiltrate all aspects of our lives. The gas central heating in our houses relies on electrical controls and circulating pumps; our cordless phones, computers, Wi-Fi routers and some door locks all need a mains supply. And increasingly we have migrated the way we live from paper to electronic systems – we pay for a coffee with a contactless card, read our bank statement online, keep our address book in ‘the cloud’ and send emails rather than letters.
- In December 2015, life for more than 100,000 people in Lancaster reverted to a pre-electronics era. A flood at an electricity substation resulted in a blackout over the entire city that lasted for more than 24 hours. Suddenly people realised that, without electricity, there is no internet, no mobile phones, no contactless payment, no lifts and no petrol pumps. Although these dependencies were not difficult to see, few had thought through the implications of losing so many aspects of modern life at once.
- 'Living without Electricity', a report from the Royal Academy of Engineering, Lancaster University and the Institution of Engineering and Technology about the experience of the city of Lancaster (Kemp 2016).Foreword by Sir Mark Walport, Chief Scientific Adviser

DON’T FORGET THE WINDSTORMS



BUSINESS CONTINUITY PLANS

BUSINESS CONTINUITY PLANS IN A WORLD OF CLIMATE CHANGE

- Survey full range of potential disruptions, understand their spatial scale and expected impacts
- Plan for events beyond previous extremes (at least 1% annual probability events)
- Note classic ‘banana skins’ : – putting all the servers in the floodable basement, having back-up systems vulnerable to the same disaster, assuming that staff will be able to get into work.
- Deliver Resilience: restoration of functions within ‘72 hours’

THE 8O% POST DISASTER FAILURE RATE ‘MYTH’

- “**It’s a fact that 80 percent of businesses affected by a major incident close within 18 months, if they do not have a contingency plan in place**”. Richard FitzHugh, event programme director of Business Continuity Expo 2007.
- 'US congress publication (2007): quoted (1) 43 percent of businesses that close following a natural disaster never reopen; (2) An additional 29 percent of businesses close down permanently within 2 years of a natural disaster.” http://www.damicon.com/resources/Disaster_Survival.pdf
- “About 60 percent of businesses that experience a major disaster, such as a fire, close within two years”. Association of Records Managers and Administration
- 60 percent of companies that lose their data shut down within 6 months of the disaster.
- 93 percent of companies that lost their data center for 10 days or more due to a disaster filed for bankruptcy within one year of the disaster. National Archives & Records Administration in Washington)
- Personal and business bankruptcy filings usually reach a peak two to three years after a hurricane, (The Nevada Law Journal, Robert M. Lawless).
- US & UK studies find that 80 percent of businesses fail in the first five years, and of the survivors a further 80 percent fail in the next five years. (most without any debt or disaster). .
- https://www.continuitycentral.com/feature0440.htm

THE HIGHEST RISK AND THE HIGHEST RISK GRADIENT IS AT THE COAST

THE BUSINESS OF ELEVATING AND RELOCATING

PORTS

HOTELS & CONDOS

POWER PLANTS

AIRPORTS

REFINERIES

MARINAS

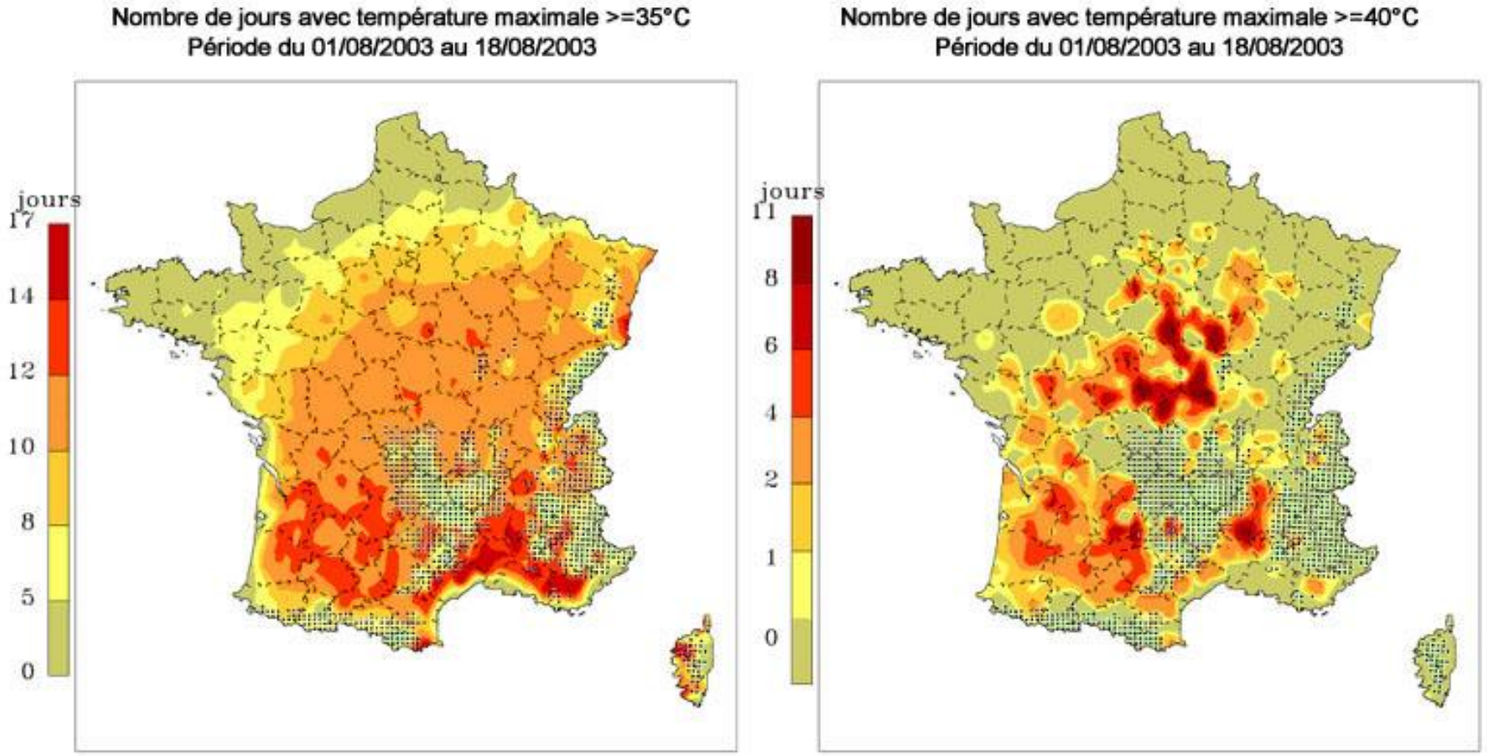
More than $2 Trillion within 1m of sealevel

SEA LEVEL RISE: ‘YOUR FLIGHT HAS BEEN CANCELLED BY HIGH TIDE’

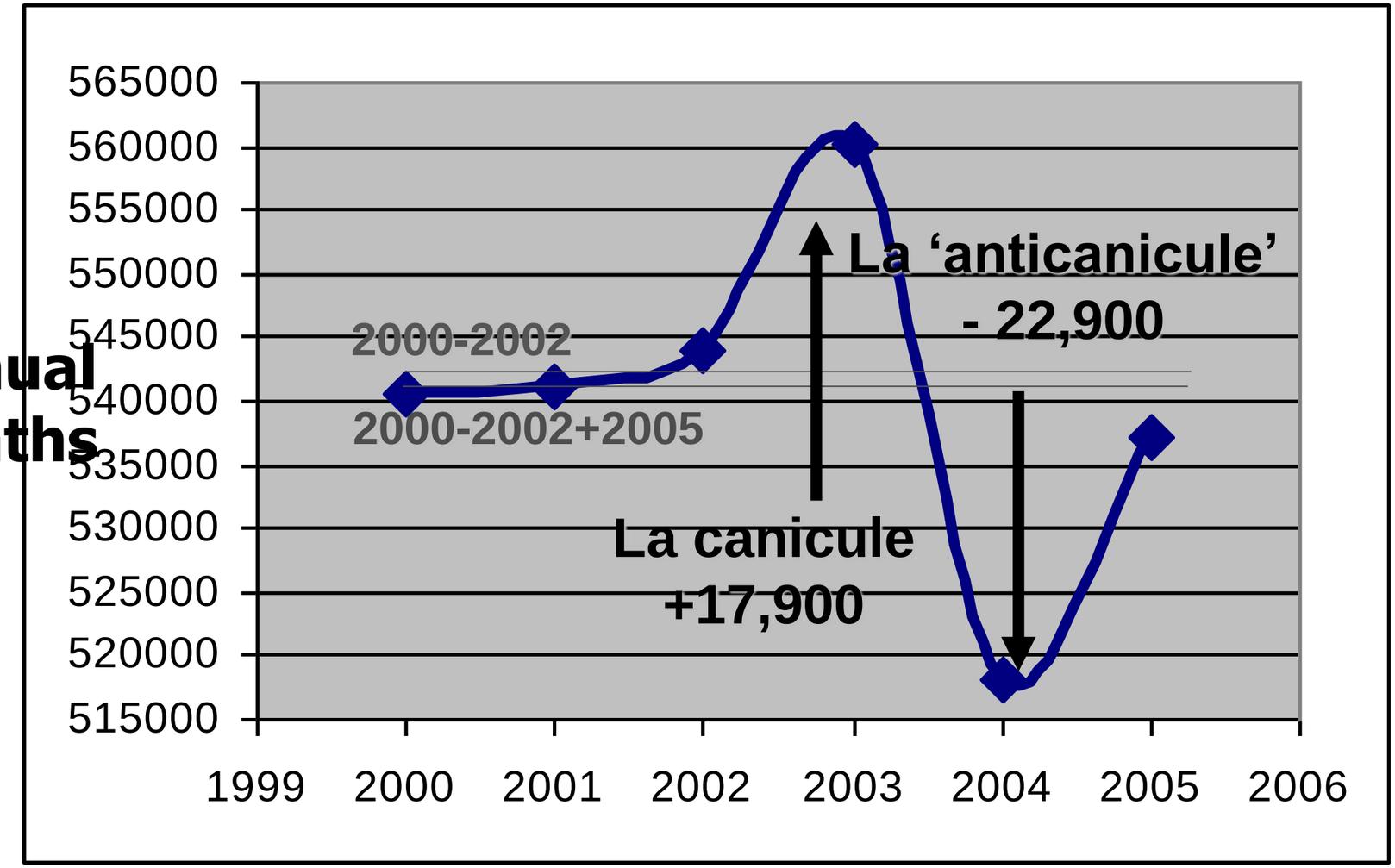
DO NOT UNDERESTIMATE THE CAPACITY TO ADAPT

HOW MANY PEOPLE DIED IN THE 2003 FRENCH HEATWAVE ‘LA CANICULE’ ?

- Hottest summer for 500 years
- 27,000 ‘excess deaths’ across Europe (>50% France)



HOW MANY LIVES WERE SAVED FOLLOWING THE 2003 HEATWAVE IN FRANCE?



2014-2015 BRAZIL DROUGHT

2017: Reservoirs are almost back to pre-crisis levels.

Alexis Morgan of the WWF: “A good crisis has gone to waste”.

12-month rainfall 50% of previous lowest since 1900 “250 yr RP”

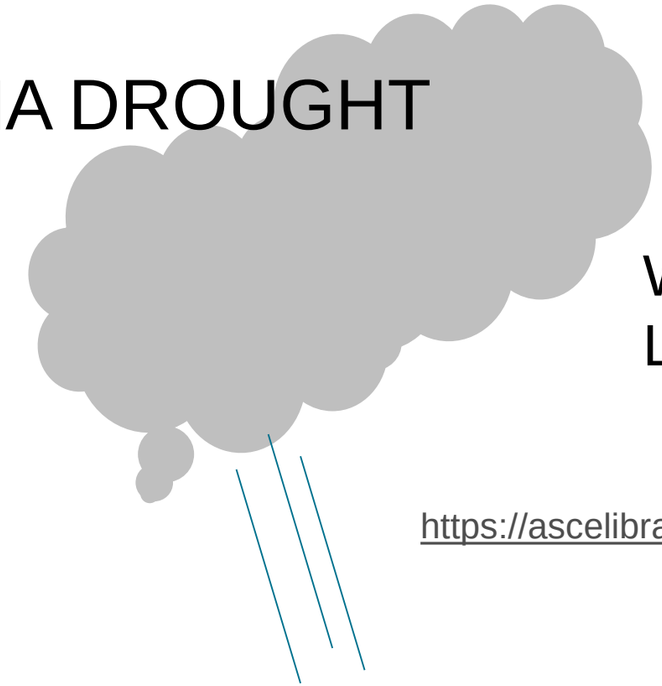
Back-up control centre created for fear of mob invasion.
500 most critical buildings resupplied by separate piping.
Discounts offered to major corporates to discourage well drilling

Main Cantareira reservoir system was down to 5% ,1 month

2012-2016 CALIFORNIA DROUGHT

Farmers shifted to highest value crops

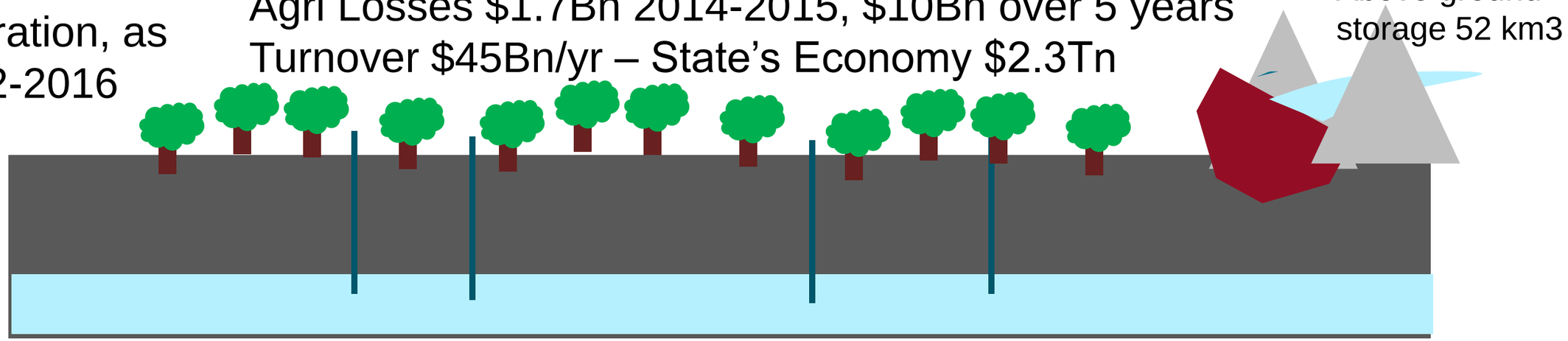
Previous droughts (as in 1988-1992) have created infrastructure and administration, as has 2012-2016



Worst multi-year drought for 500 years
Lost 1/3 of water supplies

https://ascelibrary.org/doi/full/10.1061/%28ASCE%29WR.1943-5452.0000984

Agri Losses $1.7Bn 2014-2015, $10Bn over 5 years
Turnover $45Bn/yr – State's Economy $2.3Tn



Below ground 500 km3. > 70km3 groundwater supplied during drought.
Need to reduce consumption by 2.5km3/yr to sustain supply

HOW DO CITIES MANAGE THEIR PERENNIAL FLOODING PROBLEMS?