

A satellite image of Earth from space, showing a large hurricane over the ocean. The hurricane is a large, circular storm system with a dark eye in the center, surrounded by white, swirling clouds. The ocean is a deep blue, and the landmasses are visible in the distance. The text is overlaid on the image in a bold, green, sans-serif font.

***Planning for Zero Waste after
Natural Disasters***

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Status Quo – Very Wasteful

- In the past, disasters have always meant unplanned, uncoordinated, and hasty reactions to natural and manmade disasters, resulting in huge amounts of misallocated resources, but it doesn't have to be that way.
- Zero waste principles, applied before disaster strikes, can massively reduce wasted resources and save lives.

Zero Waste Objectives Regarding Disasters

- Prevent Generation of Disaster Waste
- Maximize Reuse, Recycling, and Composting
- Minimize Disposal and Export

Prevention is always better than Remediation

- Prevention is the most effective way to manage a disaster. Need to be prepared before it happens.
- Imagine if there were no people or buildings in flood zones, what Sandy's impact would have been.
- Must **understand the science** of natural disasters. Know which areas are most susceptible to natural disasters. Study disaster frequency trends.
- **Create a plan** to remove people and structures from harm's way **before** the next disaster. Create a plan to reuse, recycle and compost as much as possible.

Science: Types of Disaster

- Flooding
 - Coastal (storm – wave driven, tsunami)
 - Inland (river)
- Wind (hurricane, tornado)
 - (intensity and duration govern impact)
- Fire
 - Forest/brush fires
 - Urban building fires
- Widescale building collapse
 - (Earthquake, WTC)

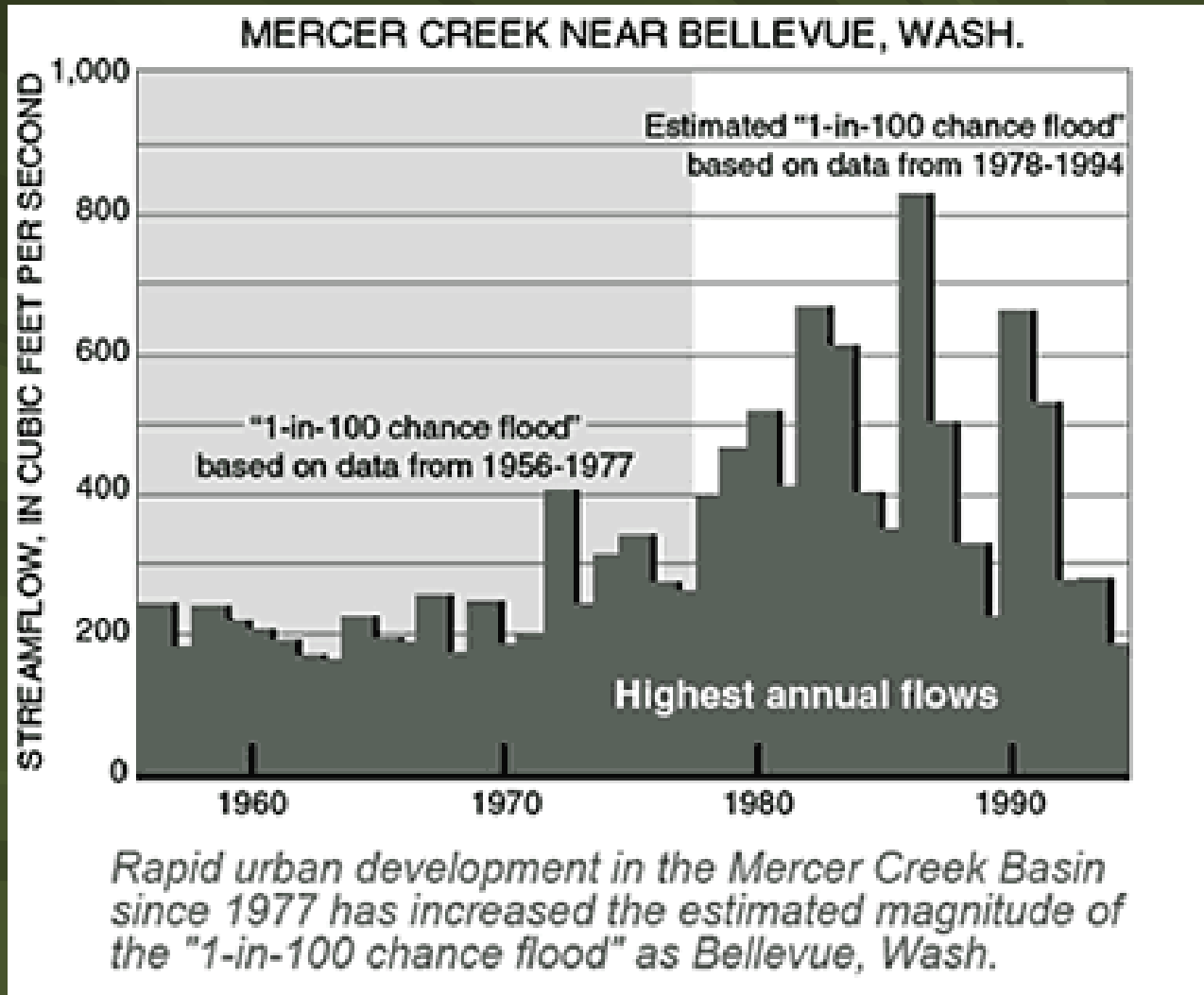
Force of Surging Water

- A single cubic yard of water, weighs nearly a ton and has great destructive force.
- Storm surge of Sandy was 14 feet in places.
- Yet Sandy did not make a direct hit on NYC (it hit near Atlantic City). Winds were not hurricane force (75 mph) even near its center.
- Far worse storms are possible (Phillipines 2013 typhoon was 195 mph sustained).

Flooding is getting worse

- FEMA is updating its flood maps, initially done in the 1960s-1970s.
- Development is Increasing Flood Risk.
 - Buildings, parking lots, etc cause floods to be worse because of reduced infiltration and being forced between buildings. So floodwaters extend further, higher, more often.
- Climate change is increasing Flood Risk.
 - Intensity of storms is increasing (e.g., 100-year storm events are happening more frequently than expected)
 - Sea Level is rising due to glacier melt and thermal expansion

Impact of urban development on flooding



Sea Level Rising Faster in Northeast

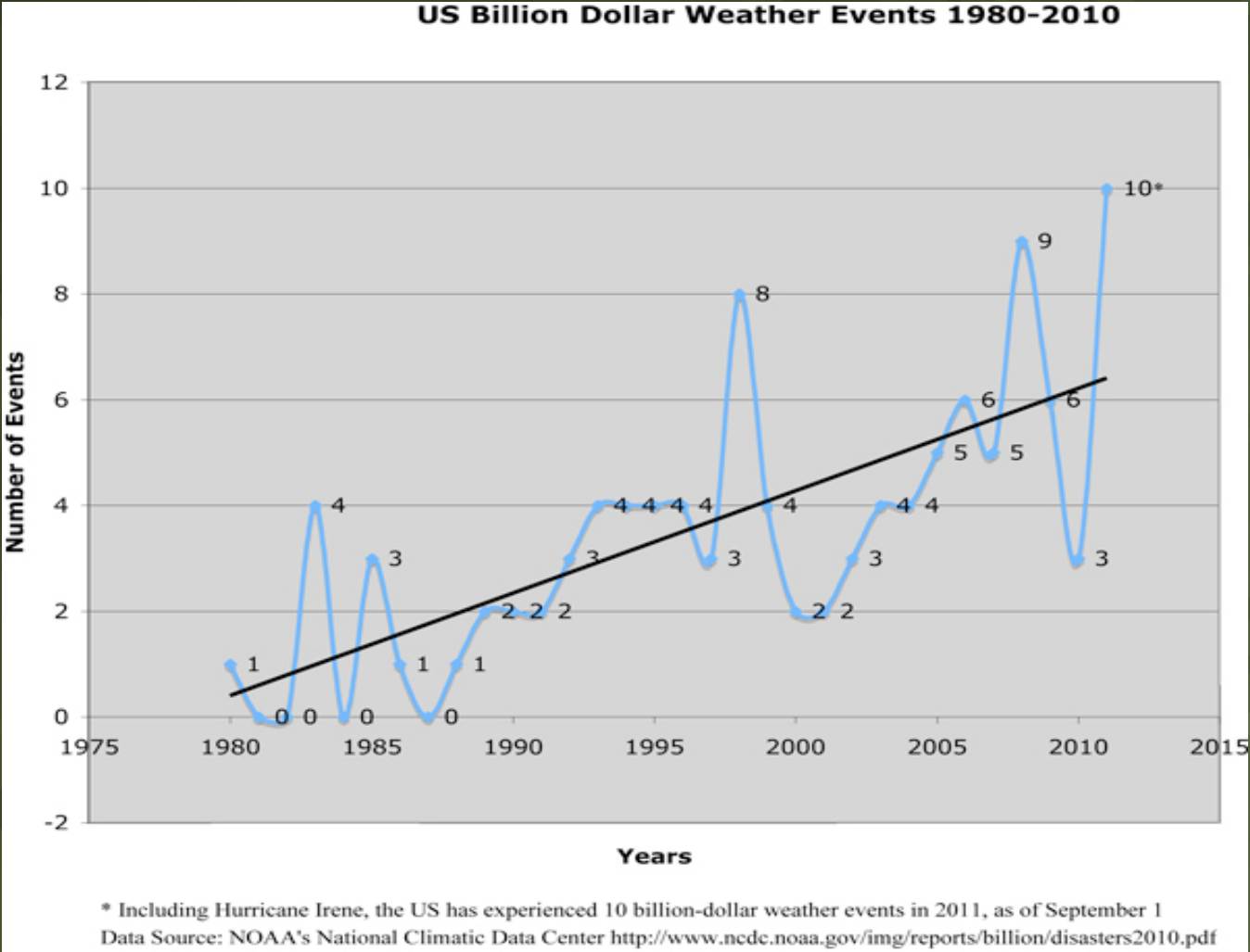
- Based on readings over 75 years at 8 tidal gauges stretching along the Northeast Coast, the rate of sea level rise began to accelerate in 1987 at points north of Norfolk, Va. reversing previous trend.
- If the acceleration continues at this rate — something that is not certain at this point — Boston will see 27 inches of sea-level rise by 2050, New York will see 20 inches and Norfolk will see 24 inches.

John D. Boon (2012) Evidence of Sea Level Acceleration at U.S. and Canadian Tide Stations, Atlantic Coast, North America. *Journal of Coastal Research*: Volume 28, Issue 6: pp. 1437 – 1445.

- Reason for increase is that slowing Gulf Stream (due to melting of Greenland glacier thereby making north Atlantic less saline, less heavy, so less propulsion of the global ocean conveyor) is not pulling water away from Northeast coast as fast as it used to.

Ezer, T., L. P. Atkinson, W. B. Corlett and J. L. Blanco (2013), Gulf Stream's induced sea level rise and variability along the U.S. mid-Atlantic coast, *J. Geophys. Res. Oceans*, 118, 685–697, doi:[10.1002/jgrc.20091](https://doi.org/10.1002/jgrc.20091).

Billion Dollar Weather Events on the Rise

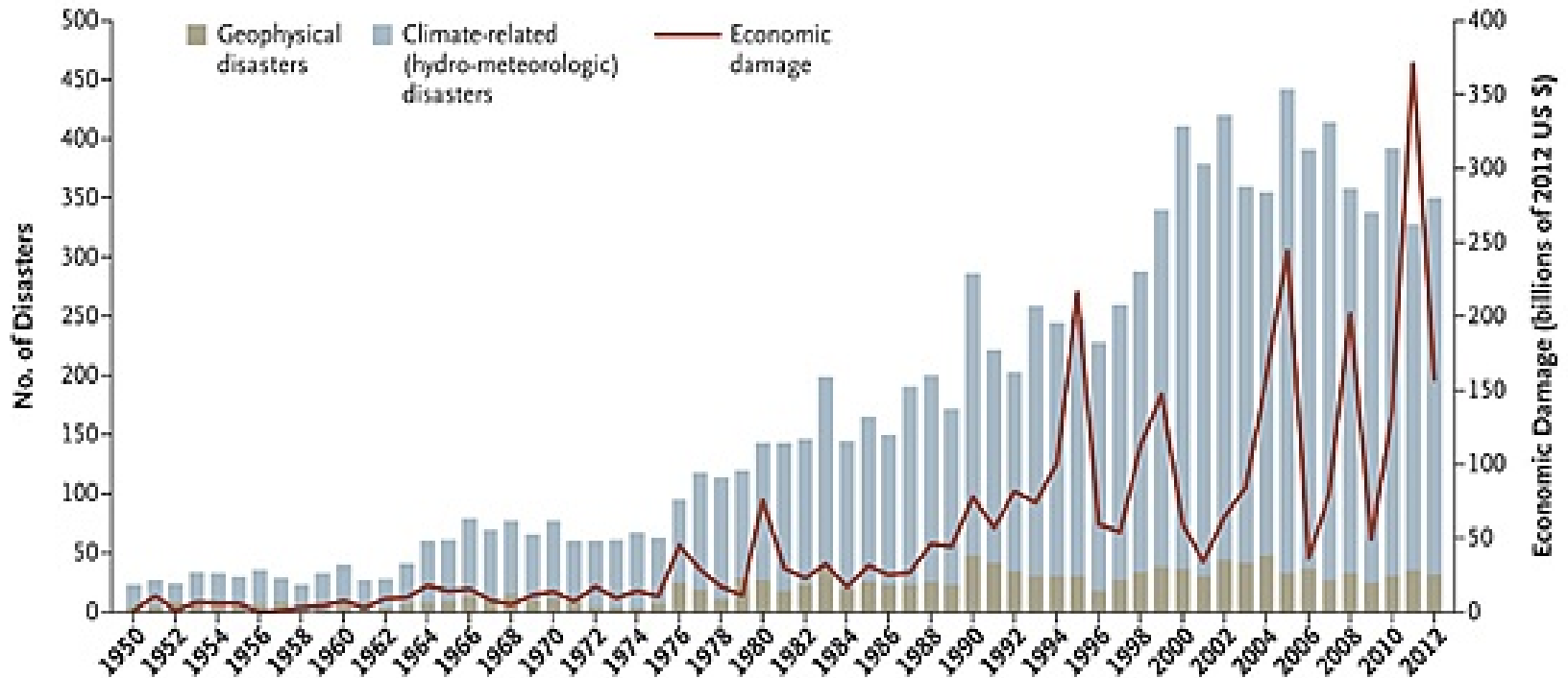


III-Advised Development



Climate-related and Geophysical disasters and Economic Damage

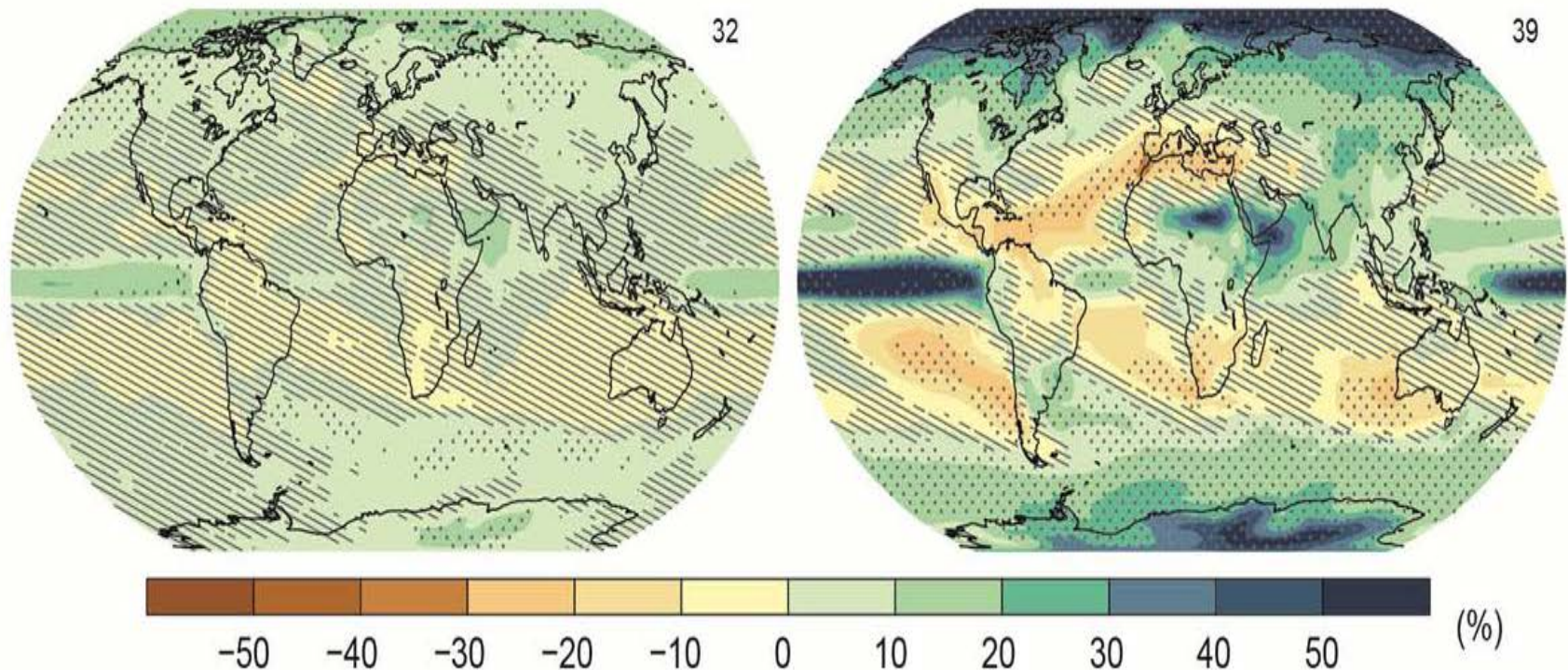
Image below courtesy of EM-DAT International Disaster Database, Center for Research on Epidemiology of Disasters, University of Louvain.



IPCC Predicted increase in precipitation

(b)

Change in average precipitation (1986-2005 to 2081-2100)



History of Solutions

- 1917-1965 – Flood Control Measures
 - In response to disasters in Florida and Texas
- 1966-1992 – Regulations and Insurance
- 1993- Buyouts and Avoiding new development
 - After Andrew and the 1993 floods
 - But neither buyouts nor avoiding new development have been used that much
- Disaster Aid – Undercuts all of this. People expect government help, and don't want to move. No politician is brave enough to fix this.

The FEMA folly

- Disaster Aid is very costly, so FEMA / National Flood Insurance Program was created (Flood Insurance / Flood maps) so that Feds could get *some \$* back
- This led to a false sense of security with FEMA's "floodproofing" measures.
- These encouraged more development in flood zones that banks would not have insured.

FEMA policy encourages bad decisions

“You can take advantage of grandfathering by buying a policy before the new maps (known as Flood Insurance Rate Maps or FIRMs) take effect. Homes and businesses may qualify for the low-cost Preferred Risk Policy, with premiums starting as low as \$129 for a home and its contents and \$643 for a commercial building and its contents.* ”

http://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/grandfathering.jsp

Government Buyouts

- 1993 – Mississippi River flood started buyout program. Moved a whole town out of the floodplain.
- Sandy – NYS buyouts have been voluntary. Mandatory buyouts would return land to natural state / parkland faster.
- But people want to rebuild, don't want to leave.
- Rebuilding, particularly at government expense, guarantees a later problem

Failure to relocate mobile assets



After Hurricane Sandy

After Hurricane Katrina



After Hurricane Andrew

What to do now?

- Waste Prevention would dictate not to build anything close to flood zones.
- This requires local zoning changes
- Because of increased sea level, increased development, and increased variability of storms, an even larger buffer is advisable.
- Increase flood insurance premiums in high risk areas

Prevention

- Planning for disasters (writing plans, research to understand disaster impacts - location, severity),
- Prepositioning assets (both for protection against disaster and for recovery from disaster),
- Retrofitting to secure roofs, prevent flimsy structures
- "Don't Build It There" - zoning
- Buyouts – to stop the vicious cycle
- Education of the Public not to send clothing etc.

Reuse

- Plan for how to reuse building materials – how to know which ones are safe to use, keeping mold away,
- How to employ deconstruction / reuse of building materials after a disaster,
- How and where to collect items that need repair and get them repaired.
- Reuse window protections (e.g. shutters) rather than buying plywood for each storm.

Recycling

- Plan for sorting materials for collection (e.g. metals from buildings - pipe, siding, white goods, etc), textiles, etc.
- Arrange for MRF capacity, labor, transportation
- Plan for Execution of sorting / markets

Organics

- Part of any Disaster Waste plan is to
 - Reuse lumber from buildings where possible
 - Salvage wood from downed trees and buildings for composting.
 - Compost unpainted wood from buildings
- Arrange for prepositioning of sufficient wood chippers, windrow space, labor, etc.
- Determine, in advance, sites for staging areas, pre-planning of trucks, crews

Elements of Good Disaster Waste Prevention Pre-planning

- Must have Knowledge of Risk / Danger – not just by scientists, but by everybody
- Municipal zoning, strong building codes to prevent unwise building
- How to motivate the Public to make prudent decisions regarding not building in, or post-disaster, moving homes and businesses from flood zones?

Lessons on Building post Hurricane Andrew

- Category 5 Hurricane Andrew damaged or destroyed more than 125,000 Florida homes in south Miami-Dade County,
- The destruction due to a mix of 165 mph winds, outdated building codes, shoddy construction and poor inspection practices.
- New state building code was tested during the 2004 and 2005 hurricanes and is still being adjusted and researched today.
- But how many other states are learning?

Warnings before Sandy

- Research by Princeton in 2005 -- found that New Jersey's rapid population growth in coastal counties was setting the scene for monumental environmental damage and property loss. The report argued that much of the hazards were man-made, and predictable (and avoidable).
- One 2010 study by geologist Alan Benimoff found that Staten Island sat in the "bull's eye" for a storm surge in New York harbor. Development had intensified that threat, as landscapes that once served as natural storm buffers were paved over and populated.
https://gsa.confex.com/gsa/2010NE/finalprogram/abstract_169194.htm

Existing Disaster planning guidance

- Guidance from governments focus on post-disaster, not on prevention of waste.
- California's guidance has some on non-disposal alternatives; little on prevention
 - <http://www.calrecycle.ca.gov/Publications/Documents/LocalAsst%5C31097006.pdf>

Enlightened Solutions: UNEP recommendations

- 1. Pre-planning activities.
- 2. Ensuring governmental coordination.
- 3. Identifying likely waste and debris types.
- 4. Forecasting amounts of waste and debris.
- 5. Listing applicable national, and local environmental regulations.
- 6. Preparing an inventory of current capacity for waste and debris management and

Source: UNEP. Annex XII. Disaster waste management contingency planning.
https://ochanet.unocha.org/p/Documents/DWVG_Annex%20XII.pdf

UNEP continued

- 6b. Determining waste and debris tracking mechanisms.
- 7. Pre-selecting temporary waste and debris storage sites.
- 8. Identifying equipment and administrative needs.
- 10. Developing a communications plan.
- 11. Creating a disaster debris **prevention** strategy.

UNEP continued

- 12. Creating a debris removal strategy.
- 13. Identifying harmful materials and preparing **hazardous waste management** recommendations.
- 14. Researching **recycling** options.
- 15. Researching waste-to-energy options.
- 16. Evaluating disposal options.
- 17. Evaluating open burning options.

Real Estate Developers In Charge

- While academics and scientists have known about the dangers, nothing happens on a policy or legislative level.
- “On Staten Island, developers built more than 2,700 mostly residential structures in coastal areas at extreme risk of storm surge flooding between 1980 and 2008, with the approval of city planning and zoning authorities.”

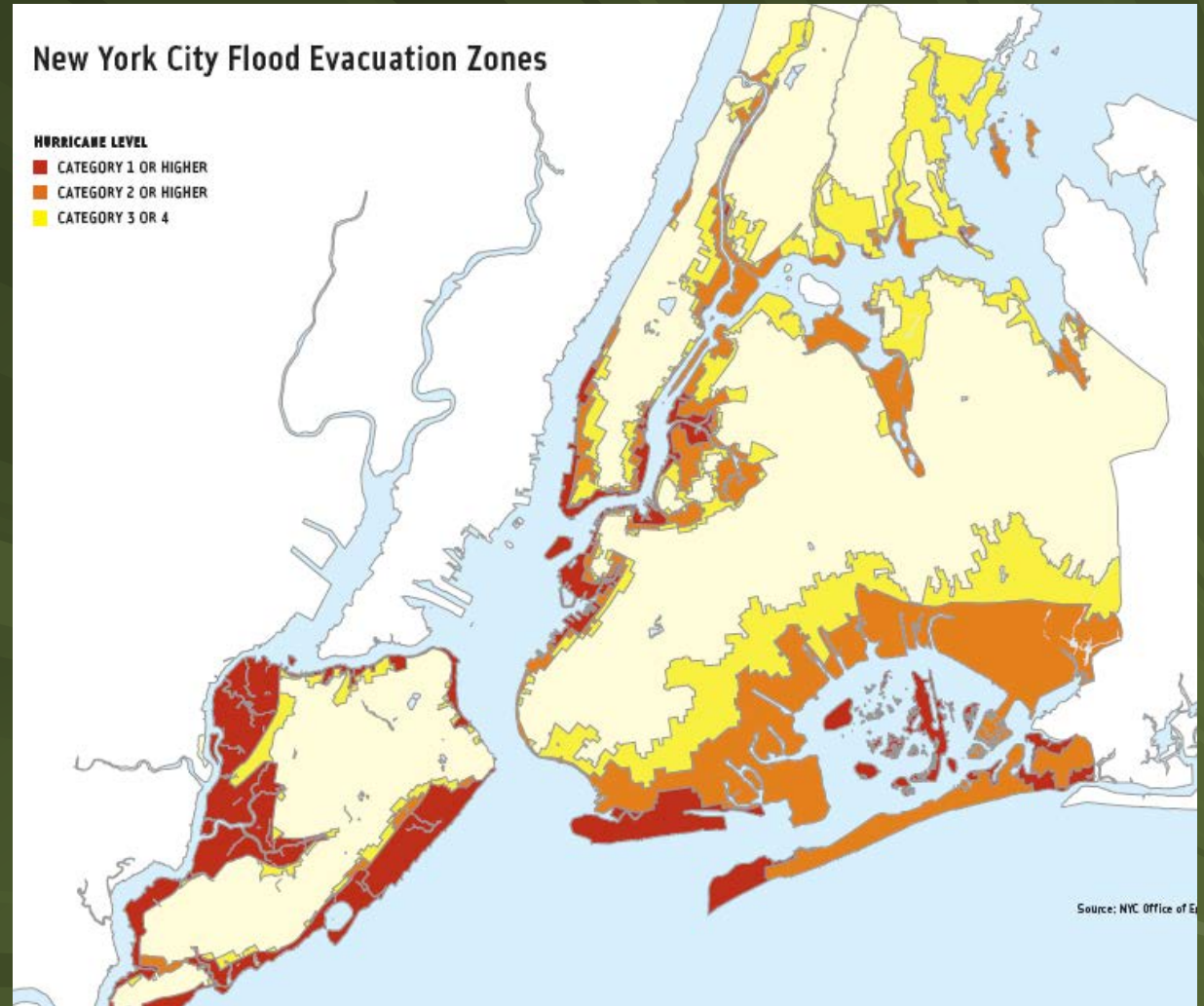
http://www.huffingtonpost.com/2012/11/12/hurricane-sandy-damage_n_2114525.html

New York City's response

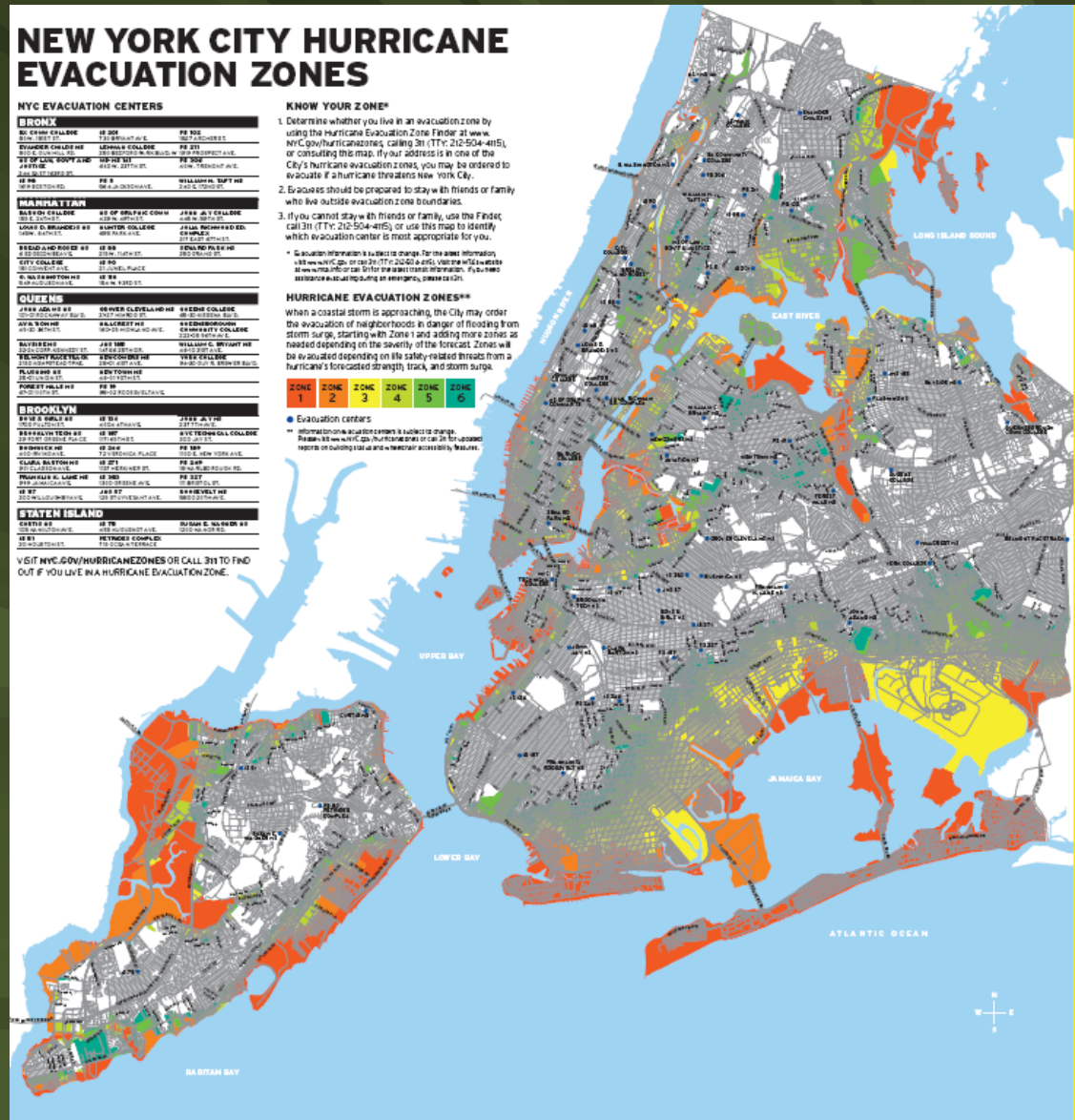
- “As a part of our long-term sustainability initiative, PlaNYC, and our extensive climate change work, the City is reviewing both its building and zoning codes to better prepare for weather events and is continuing to develop measures that lower our risk and mitigate the impact of climate change.”

http://www.huffingtonpost.com/2012/11/12/hurricane-sandy-damage_n_2114525.html

Pre-
Sandy
NYC
maps –
(evacuation
orders
given 1 day
before
storm)



Post Sandy maps – More informative map, but there are so many structures to get out of harm's way!



Real Solutions – Get Out of the Way

- Zoning – To prevent new development. This amounts to “a taking”, but we must do this.
- Buyouts – Use these wherever buildings are in floodplains. Start now, not only **after** disasters.
- Plan: Schedule and strategize for moving structures off barrier islands and from wetland areas.
- Enact Stringent building codes
- Pre-position mobile assets out of harm’s way – lesson still not learned
- Pre-position / plan for debris collection, sorting, reuse outlets, recycling, wood chipping, and composting capacity – labor, capacity.

Conclusions

- Despite scientific consensus, warnings, climate change exacerbations,
- Despite flood insurance, the few government buyouts and regulations
- Flood Risk is rising and we are still unprepared
- We are allowing real estate developers to build, and emotional residents to rebuild, continuing the dangerous and expensive cycle.

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