

Economic Impacts of Flooding & the flawed National Flood Insurance Program

Key Concepts

- Damage to **Physical Infrastructure**
- **Social well-being**
 - Public health issues
 - Temporary job loss
- **Urban sprawl**
 - Poor land management and zoning
- **Housing Injustice**
 - Low cost affordable housing being built in more at-risk areas, people are trapped
 - Typically minorities and poverty stricken areas

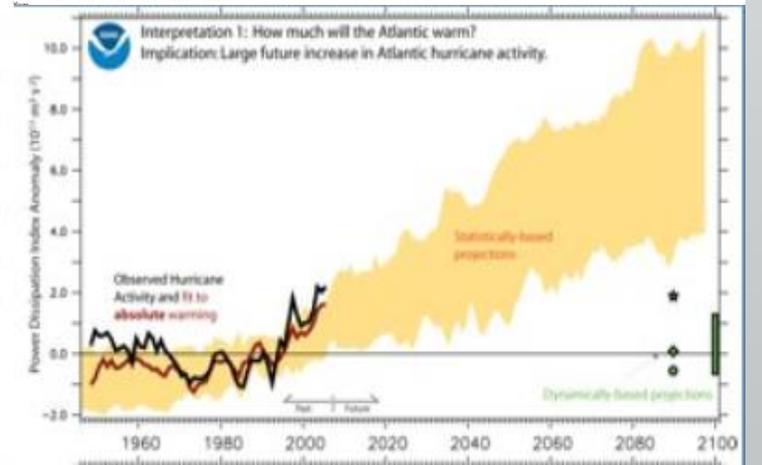
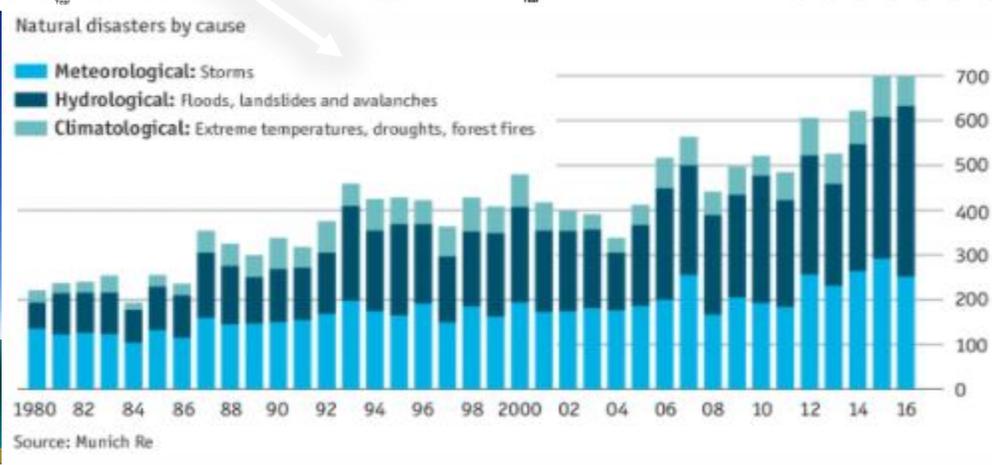
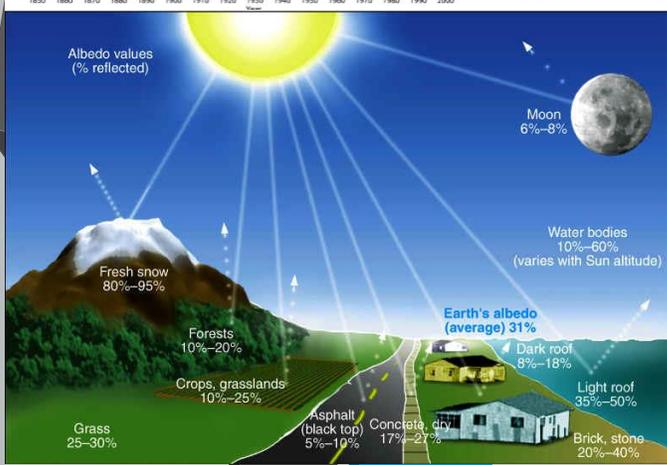
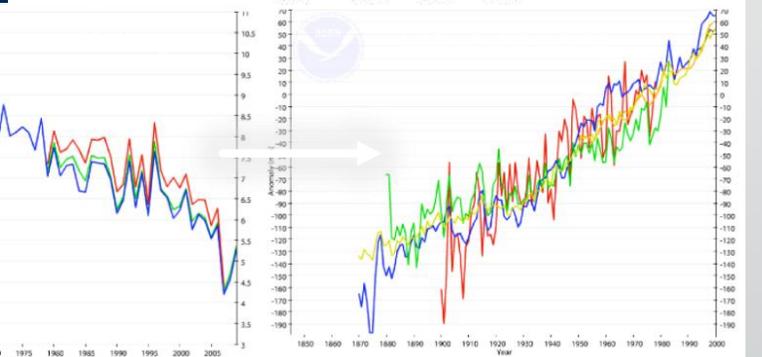
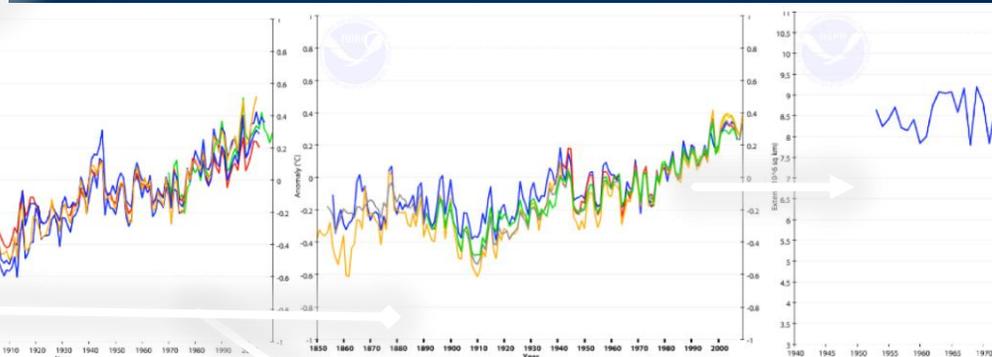
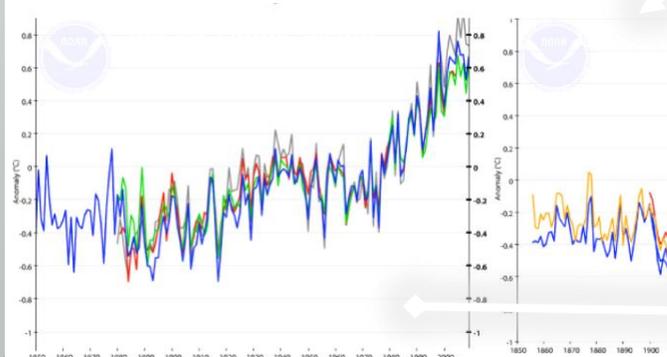
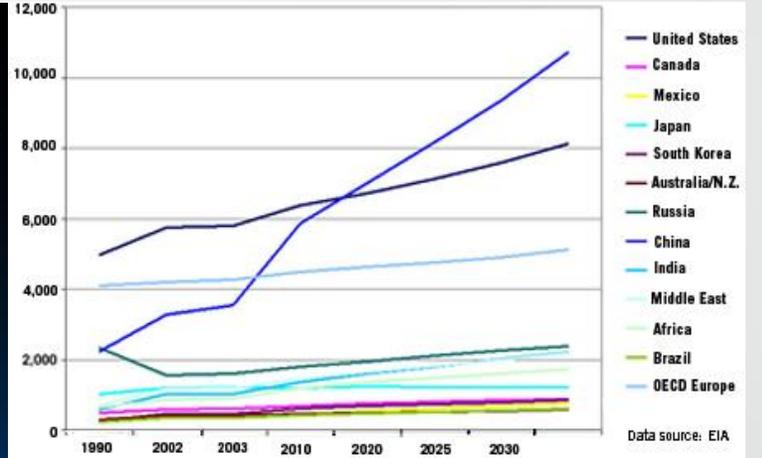
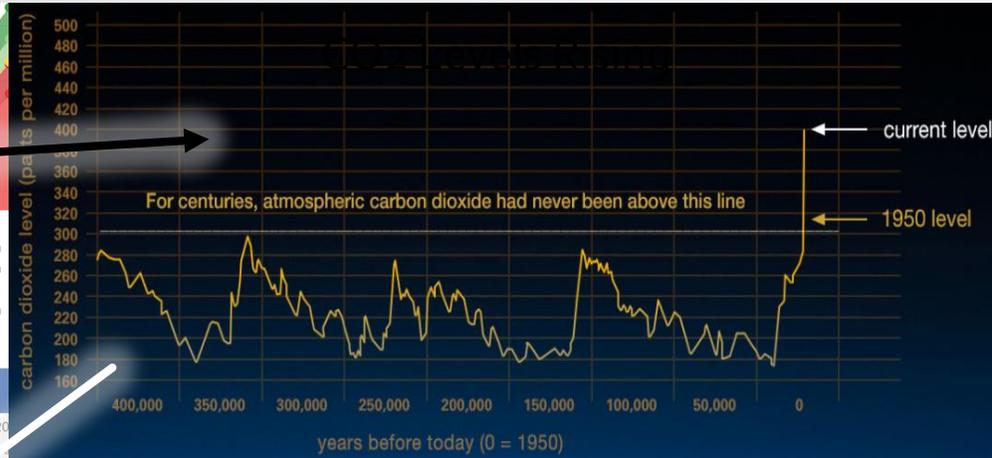
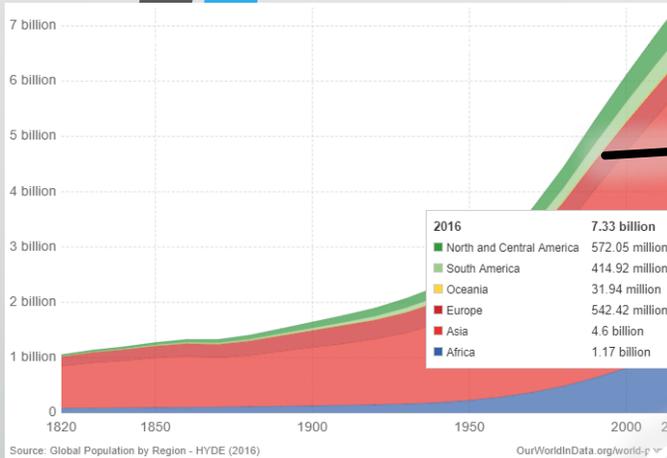
Goals

- Determine an area susceptible to flooding and vulnerable to the associated problems
- Predict the future urban expansion if continued growth occurs with limited land use management

Key Questions

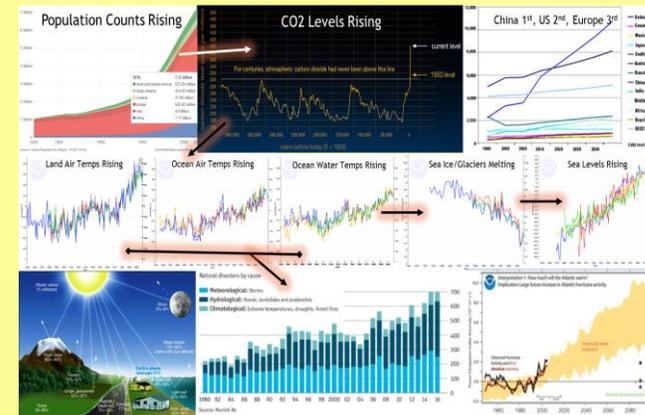
- Q1: What may be the economic downfalls for a sprawling city near the coast (at low elevation/vulnerable to hazards associated with climate change) and what are the governing bodies responsibilities on regulating growth in flood-prone areas?
- Q2: How is the National Flood Insurance Program flawed and how poorly equipped are our coastal cities and ports to this issue.

Physical Climate



Political Climate

- The president has made over 115 tweets discounting the effects of anthropocentric caused climate change
- In June, the US left the Paris Climate agreement (only nation which is not participating)
- On August 15th president Trump revoked Obama's executive order 13690 on establishing a federal flood risk management standard and process
 - Improves floodplain mapping and essentially rejects any new development in areas where flooding has been statistically predicted to occur by using geospatial technologies
- Cut the FEMA's budget by 11% equating to approximately \$1 billion
 - Cutting \$190 million (1/5th of total budget cut) annually to mapping work alone
 - Flood maps for Houston were 75% inaccurate
 - Only currently about \$2.3 billion remaining in the federal disaster coffers
 - Emergency disaster funds to other entities being cut



Trump being blinded by the truth



Flooding

- Increased urban development= more impervious (impermeable) surface cover = more drastic flooding
- Extreme weather events such as flooding is exacerbated by climate change:
 - Increased storm surges
 - Flooding (worsened by widespread impervious (impermeable) surface cover)
 - Replacing water absorbing soil with pavement/rooves
 - Future sea level rise
- 9 out of 10 natural disasters in the US involve flooding
- 9.6 million households are in 100 year flood plain in US (50% have insurance)
- Katrina was called a once in a 500 year flood, look at Harvey and Irma just 12 years later
- We are in control
 - Yet people still in at great risk
- People choose to live in coastal areas because of work and economic activity but also because it's a luxury
- Not just along coast, aggressive development can happen anywhere
- People take risks
- People are uninformed



Rank	Hurricane	Year	Damage Costs (billions)
1	Harvey	2017	>\$110 (estimated)
2	Katrina	2005	\$108
3	Sandy	2012	\$71.4
4	Ike	2008	\$29.5
5	Andrew	1992	\$26.5
6	Wilma	2005	\$21
7	Irene	2011	\$7.3
8	Charley	2004	\$15.1
9	Rita	2005	\$12
10	Frances	2004	\$9.5
11	Allison	2001	\$9
12	Jeanne	2004	\$7.6
13	Hugo	1989	\$7.1
14	Floyd	1999	\$6.9
15	Isabel	2003	\$5.3
16	Opal	1995	\$5.1

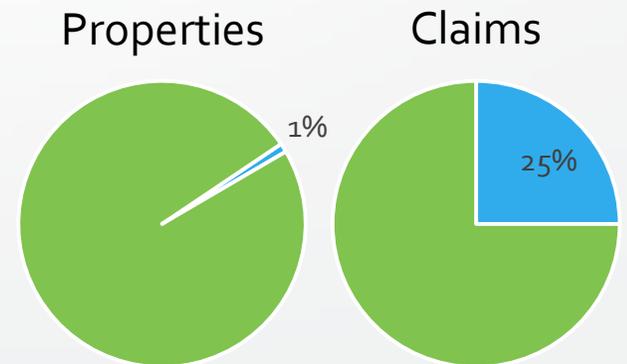
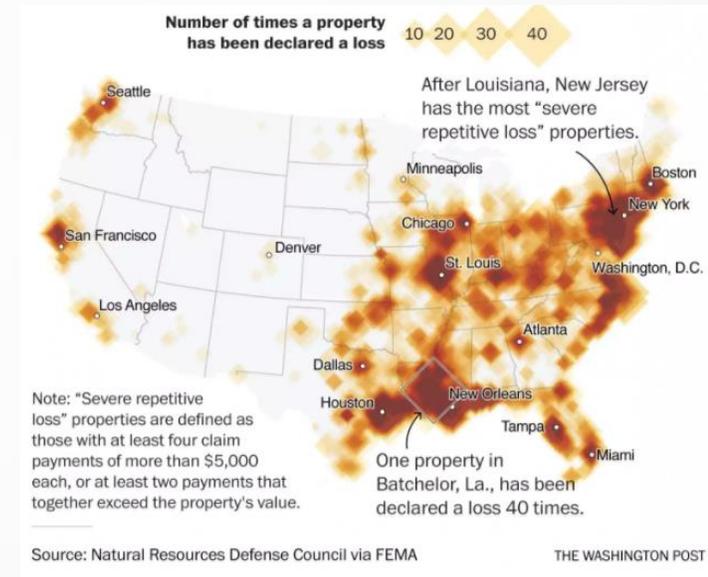


National Flood Insurance Program

- What some call "The most unsustainable program that will make the largest impact on the US economy"
- \$25 billion dollars in debt (this is before Harvey and Irma)
- Started in the 1968 after recurring floods and Hurricane Betsy
- Not like most homeowner's insurance policies
- Set up as a temporary fix at very low costs with the hopes that people wouldn't stay
 - "They presumed that if they told people they were at-risk then they would move and that over the life of the program, the discounts wouldn't need to be continued, but that didn't happen." -Roy Wright (FEMA Administrator)
 - Required if you live in a flood prone area and have a federally backed mortgage

There are a few key problems associated with it:

1. Government is responsible
 - Insurance companies win big
2. Another large chunk goes to properties that are repetitively flooded
 - New Jersey: \$56,000 house flooded over 40 times, NFIP has attributed \$438,000 (8 times more than the house is worth)
 - St. Louis (near the Mississippi River): \$90,000 property has flooded 34 times, racking up claims of more than \$608,000 (almost 7 times its worth)
 - Houston: \$72,400 home has flooded 15 times, received more than \$1 million in payouts (14 times its assessed value)
 - An island off the coast of Alabama has only paid \$9 million in premiums, but has received over \$72 million in payments to damaged homes
3. 1 in 5 are vacation homes
 - Guaranteed return on investment for the wealthy
4. People are trapped because no one wants to buy these "at-risk" properties
 - Need buyout
 - Even then, people are stubborn



Houston, We Have a Problem

- One of the highest, fastest growing populations
- Very sparse
- One of the most sprawling
 - Mostly single family homes
 - 25% more pavement in just 15 years
 - Again, more sprawl=impervious surface cover (thus impermeable surface cover)= more associated with flooding
- Has most land to grow on (no geographic constraints like in NYC or SF) (Marchov Chain model & SLEUTH Model below)
- Physically and socially vulnerable

And to top it off,

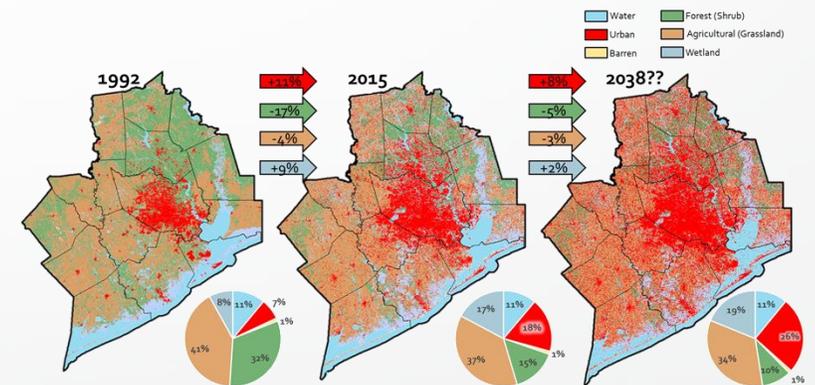
- Top CO₂ emitting metropolitan area per capita in the top emitting state
- Climate change denialists

Houston Flooding

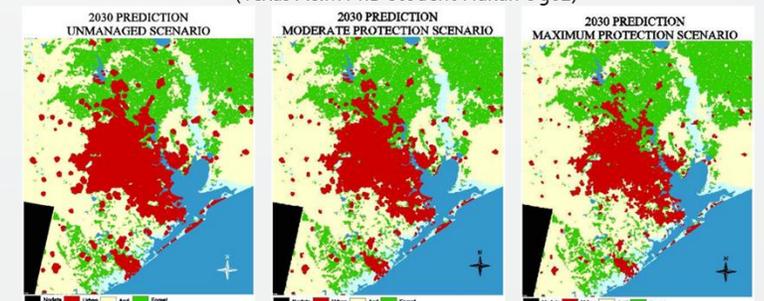
- 4 feet of flooding
- Destruction blamed on poor planning
 - Inadequate Zoning
 - Sprawling web of development and roads
 - Poor management
- 4 out of 5 homes that flooded did not have flood insurance because they were unaware of their flooding risk



Marchov Chain Probability Model (Josh Hammes)



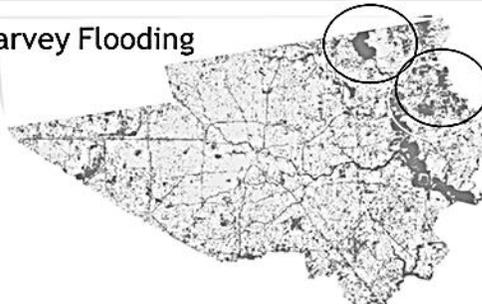
SLEUTH (cellular automata) Urban Growth Model using Policy Scenarios (Texas A&M PhD student Hakan Oguz)



FEMA Flood Map



Harvey Flooding



*Only a small area of the total Houston MSA of flood waters was available online in tif format

Key Takeaways

- We are pretty good at disaster response but terrible at disaster mitigation
- Political pendulum will swing
- Coastal cities will inevitably grow larger
- Flooding will inevitably occur
- We are the future

Key Suggestions

- Reform Flood Insurance Program
 - Elect the people who will represent you
- Means testing
- Eliminate discounts for second homes
- Gradually increase insurance rates for at-risk properties
- Improve and update national flood mapping
- Incorporate LIDAR technology
 - Improve surface models
- Avoid rebuilding in risky areas
- Reclaim parking lots while making autonomous vehicles a norm
- Use porous pavement



Got the blues from all of this?
Listen to Stevie Ray Vaughan's *Texas Flood*