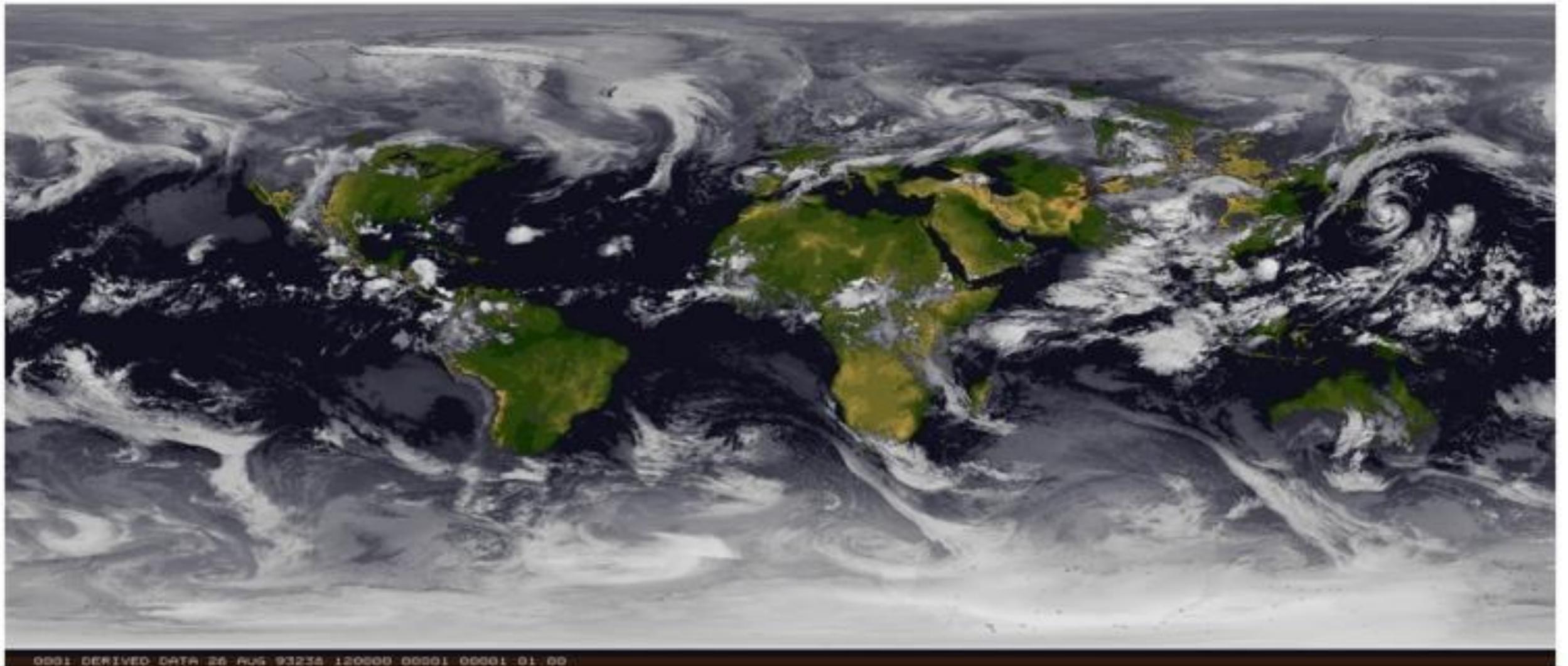


# Adaptation & Agency Planning

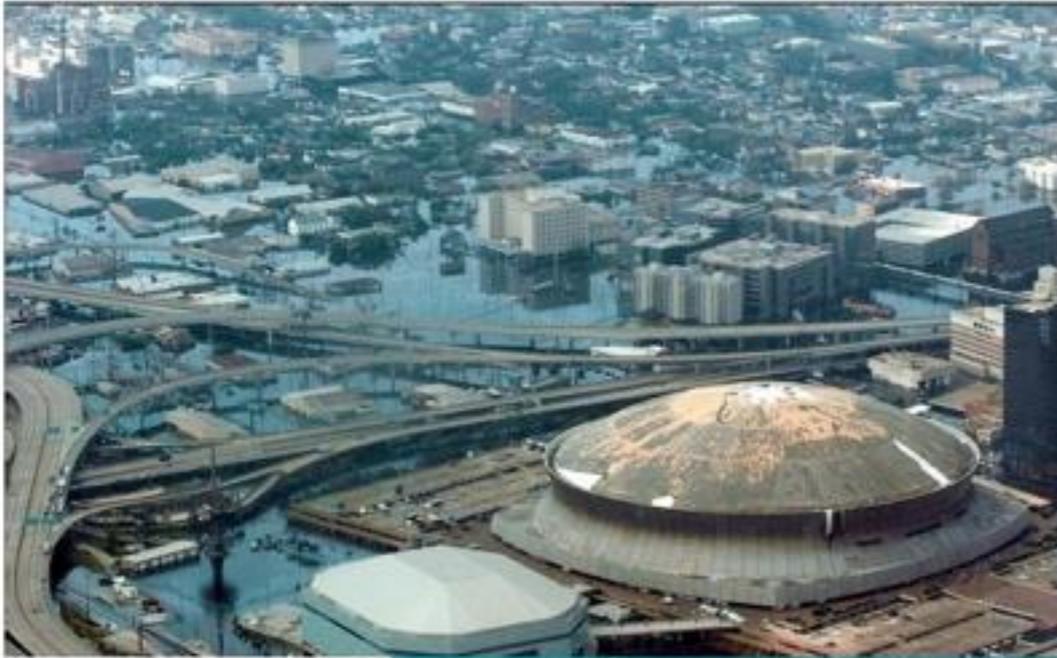


Robert R. Verchick  
Deputy Associate Administrator,  
OPEI  
U.S. Environmental Protection  
Agency

*Where in the World is  
Global Warming?*

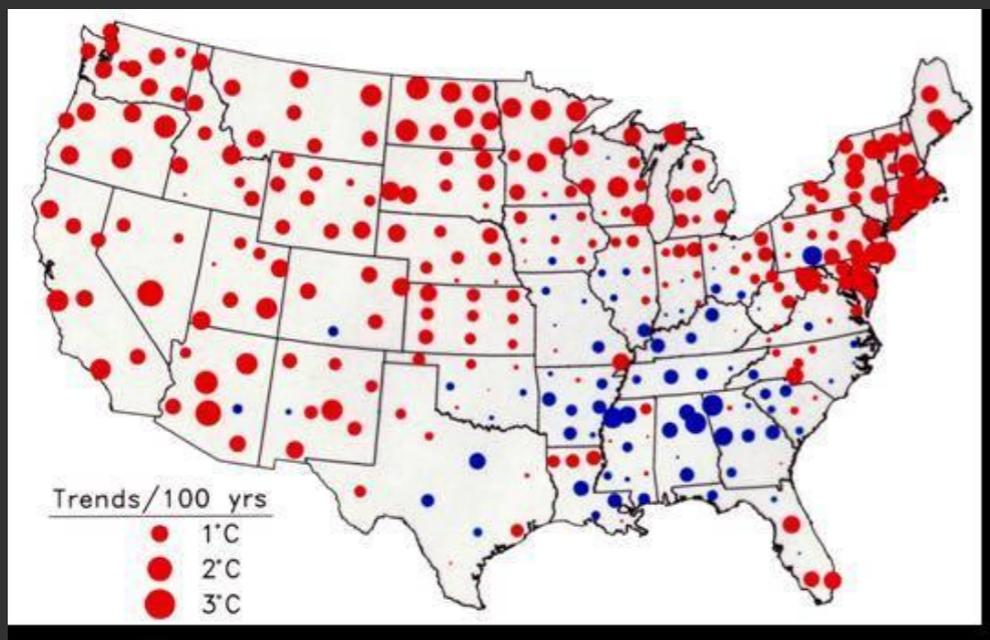


# New Orleans Underwater

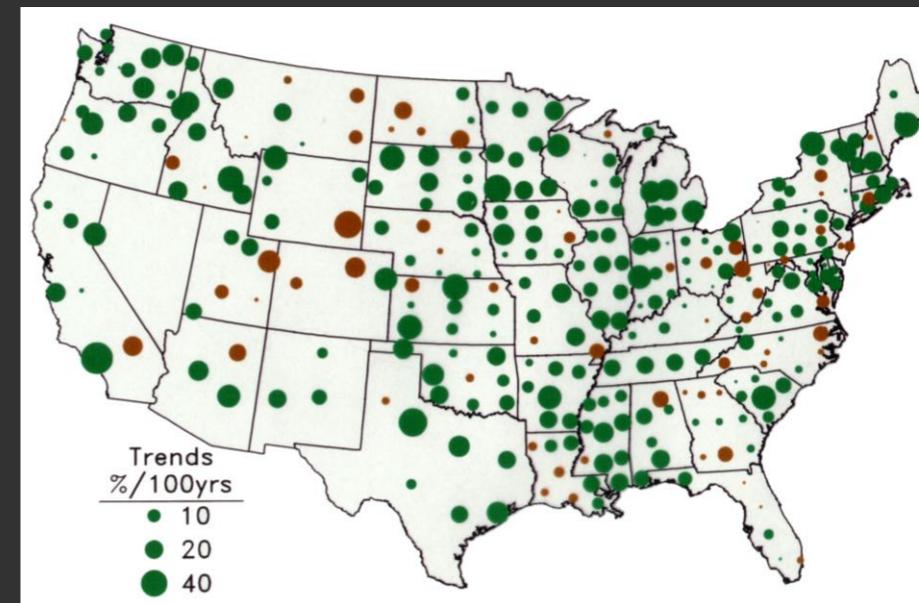


# The Climate is Changing

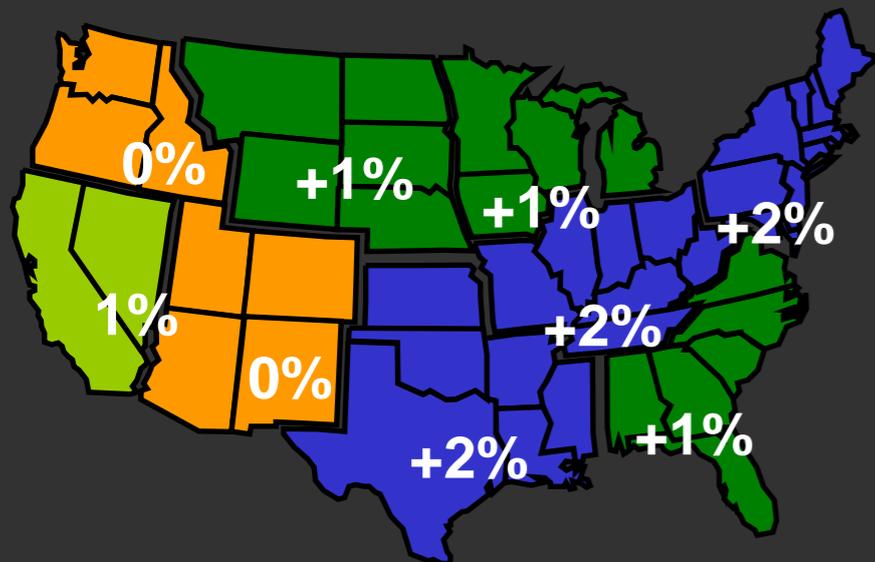
Temperature Trends: 1901 to 1998



Precipitation Trends: 1901 to 1998



More Rainfall Occurring in Intense Downpours



Regional 50% Probability Estimates of Sea Level Rise in 2100 and 2200



# Potential Impacts of Climate Change



## Infrastructure

Water  
Transportation  
Energy Supply & Use

### Climate Changes



**Temperature**



**Precipitation**

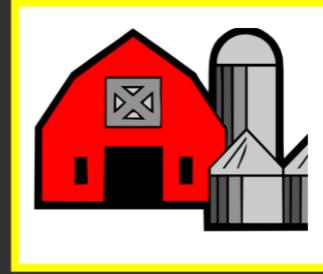


**Sea Level Rise**



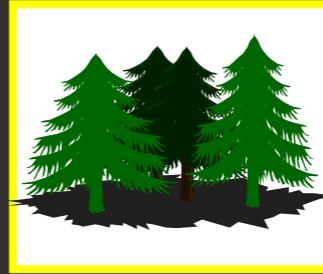
## Health

Weather-related Mortality  
Infectious Diseases  
Air Quality -Respiratory Illnesses



## Agriculture

Crop yields  
Irrigation demands



## Forest

Change in forest composition  
Shift geographic range of forests  
Forest Health and Productivity



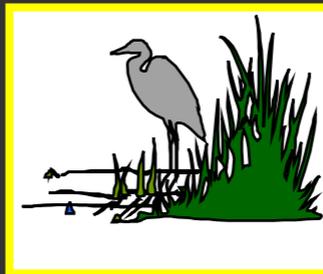
## Water Resources

Changes in water supply  
Water quality  
Increased competition for water



## Coastal Areas

Erosion of beaches  
Inundate coastal lands  
Costs to defend coastal communities



## Wildlife and Ecosystems

Shift in ecological zones  
Loss of habitat and species  
Damage to Coral Reefs



## Cultural Resources



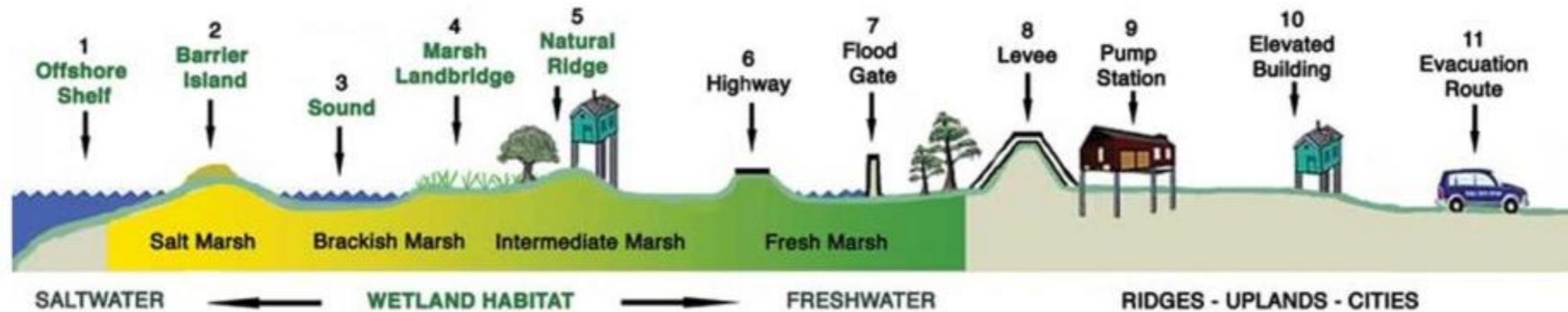
## Economic Disruption

# Risk: Exposure, Vulnerability, Resilience



# 11 Lines of Defense

(6 natural, 5 artificial)

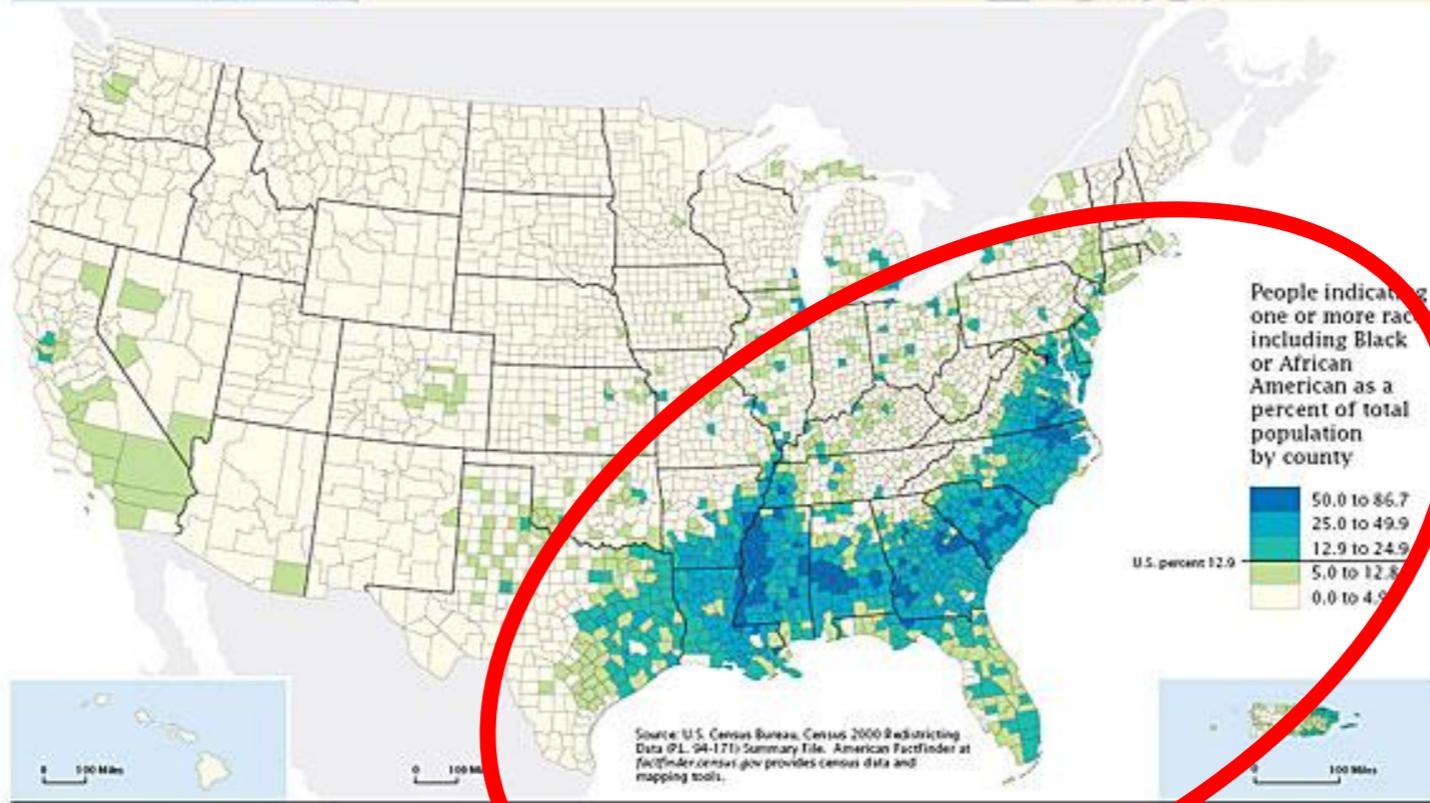
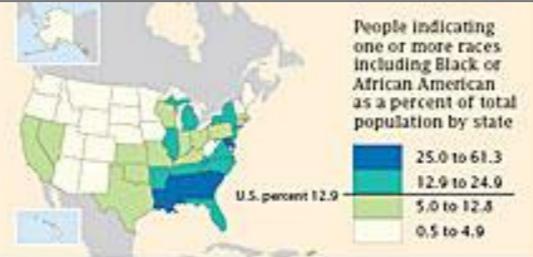


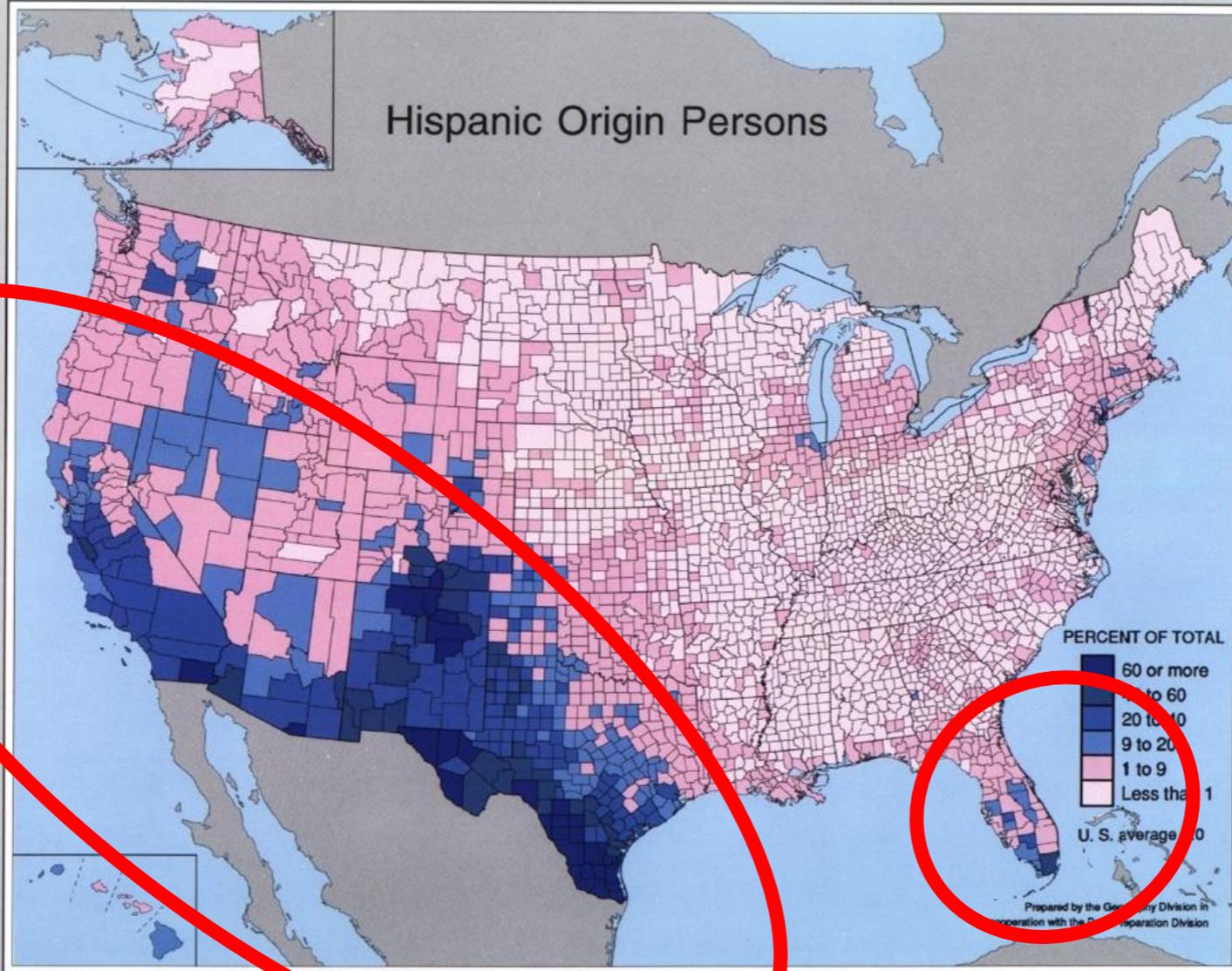
Lopez, John A., 2006, The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana,  
Lake Pontchartrain Basin Foundation, Metairie, LA January 2006



Figure 3.  
**Percent Black or African American Alone or In Combination: 2000**

(For information on confidentiality protection, nonsampling error, and definitions, see [www.census.gov/prod/cen2000/doc/p14-171.pdf](http://www.census.gov/prod/cen2000/doc/p14-171.pdf))





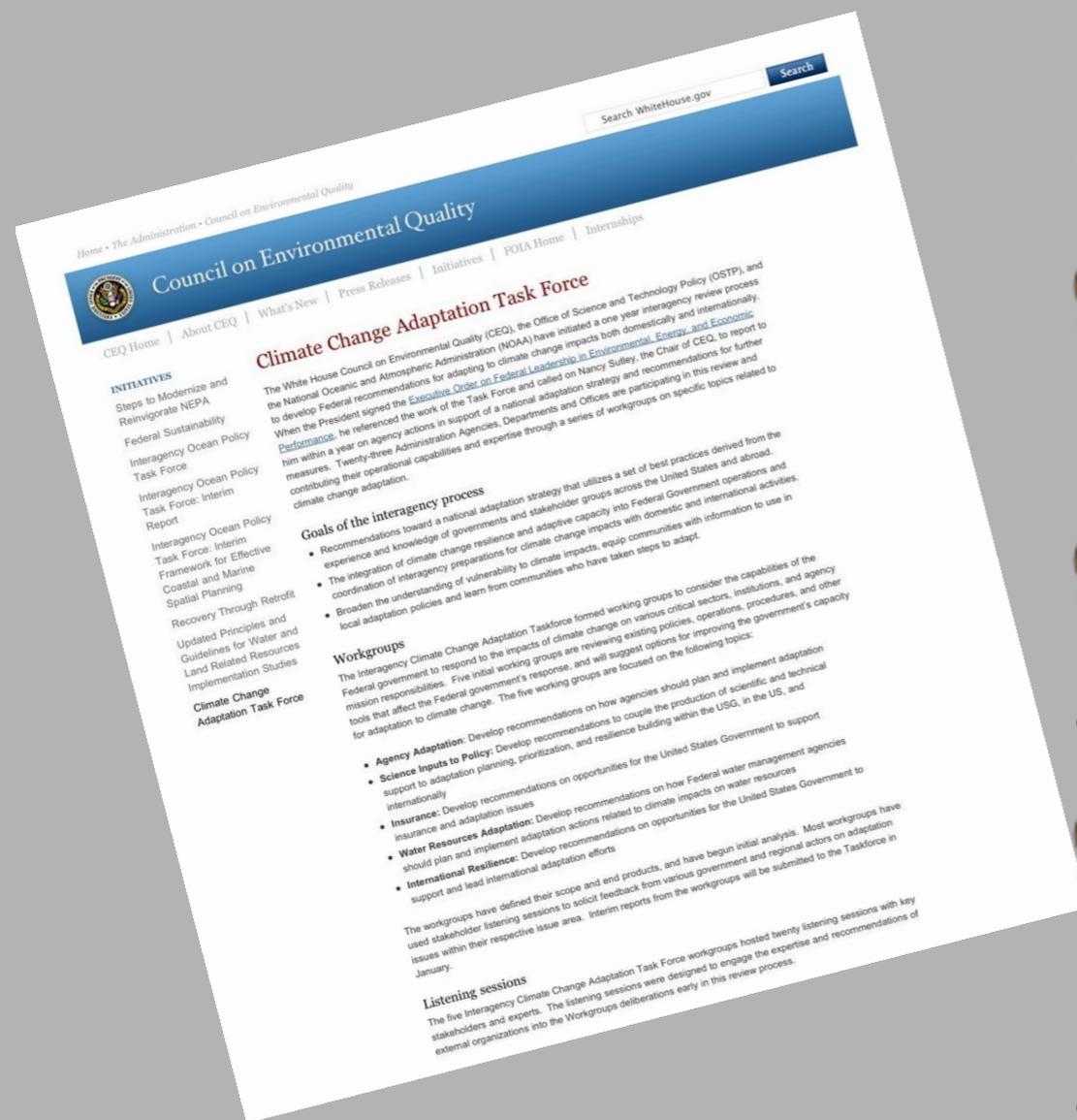
Boundaries are as of January 1, 1990  
RACE AND HISPANIC ORIGIN POPULATION DENSITY OF THE UNITED STATES: 1990  
United States Maps, GE-90 No. 6

# E. O. 13514 (Oct. 2009)



**Sec. 16. *Agency Roles in Support of Federal Adaptation Strategy.*** In addition to other roles and responsibilities of agencies with respect to environmental leadership as specified in this order, **the agencies shall participate actively in the interagency Climate Change Task Force,** which is already engaged in developing the domestic and international dimensions of a U.S. strategy for adaptation to climate change, **and shall develop approaches through which the policies and practices of the agencies can be made compatible with and reinforce that strategy.** Within 1 year of the date of this order the CEQ Chair

# Climate Change Adaptation Task Force (leads: CEQ, OSTP, NOAA)



## Goals:

- Recommendations for national strategy
- Integrate resilience and adaptive capacity
- Equip communities with information for local adaptation policies

# Climate Change Adaptation Task Force (leads: CEQ, OSTP, NOAA)



## Interagency Workgroups:

- Agency Planning
- Science
- Water Resources
- International Resilience
- Insurance
- *more to come . . .*

# Asking the Climate Questions

- What's the mission?
- How is the climate changing?
- How might climate change affect the mission?
- What is the vulnerability. What is the risk?
- What should we do?
- What did we learn?

## EPA's Top Priorities:

### Addressing Climate Change (Mitigation and Adaptation)



### Climate Change Adaptation Team, Policy Office

- Support Interagency Initiatives
- Consider climate in regulatory process
- Support place-based pilot projects
- Build local capacity

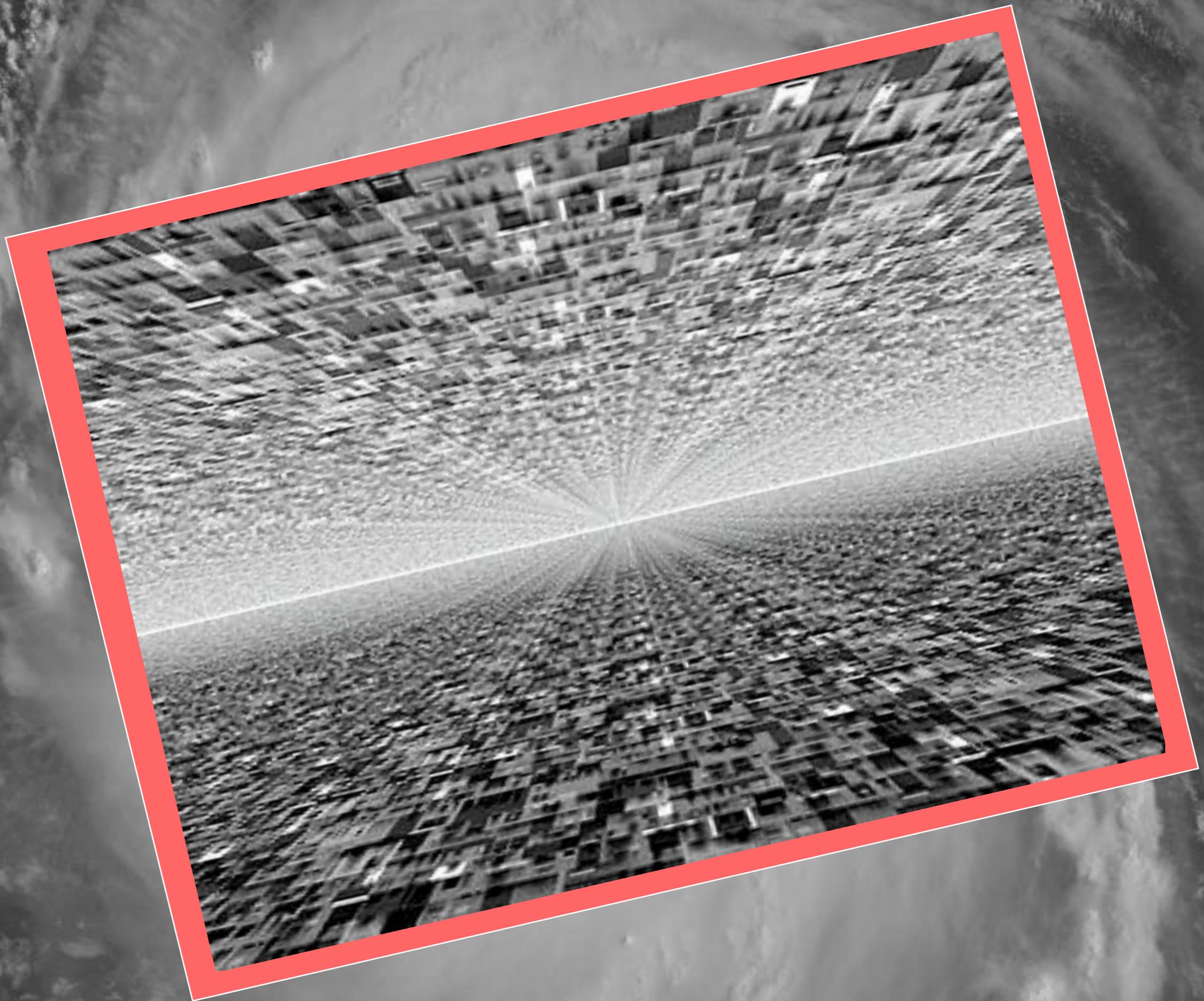
# EPA Pilot Project

## Flood Mitigation in Waverly, Iowa





- CEQ Guidance on Climate Change and NEPA (Proposed)
- Principles and Guidelines on Water Resource Projects (Proposed)
-  *Stay Tuned . . .*



# LAST LINE OF DEFENSE: HOPING THE LEVEES HOLD

*Army Corps of Engineers officials say hurricane levees in the New Orleans area will protect residents from a Category 3 hurricane moving rapidly over the area. But computer models indicate even weaker storms could find chinks in that armor.*

## BARRIERS OF EARTH AND CONCRETE

Levees and floodwalls that protect against flooding from both the Mississippi River and hurricanes are built by the Army Corps of Engineers and are maintained by local levee districts. The corps and the local districts share the construction cost of hurricane levees, while the Mississippi River levees are a federal project. Local levee districts also build and maintain nonfederal, lower-elevation levees with construction money from each district's share of property taxes and state financing.

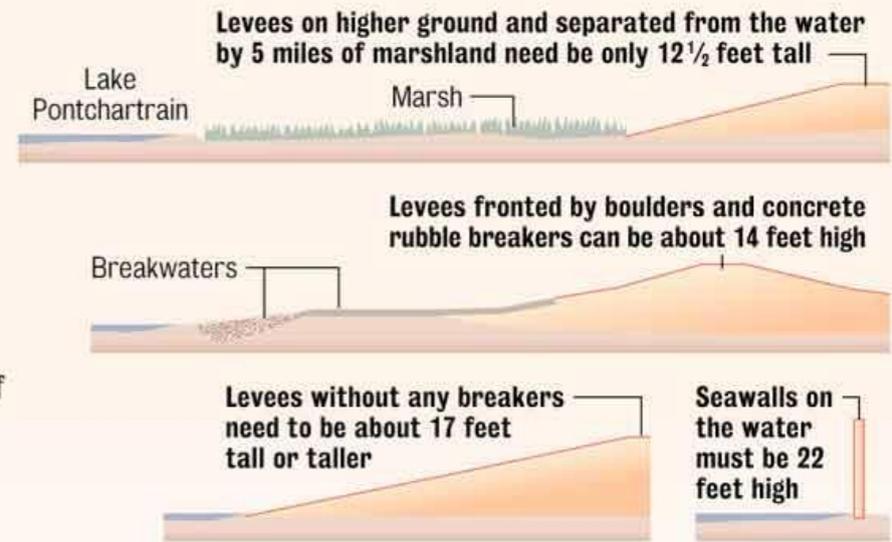
**LEVEES AND FLOODWALLS**

- Mississippi River
- Hurricane protection
- Interior parish

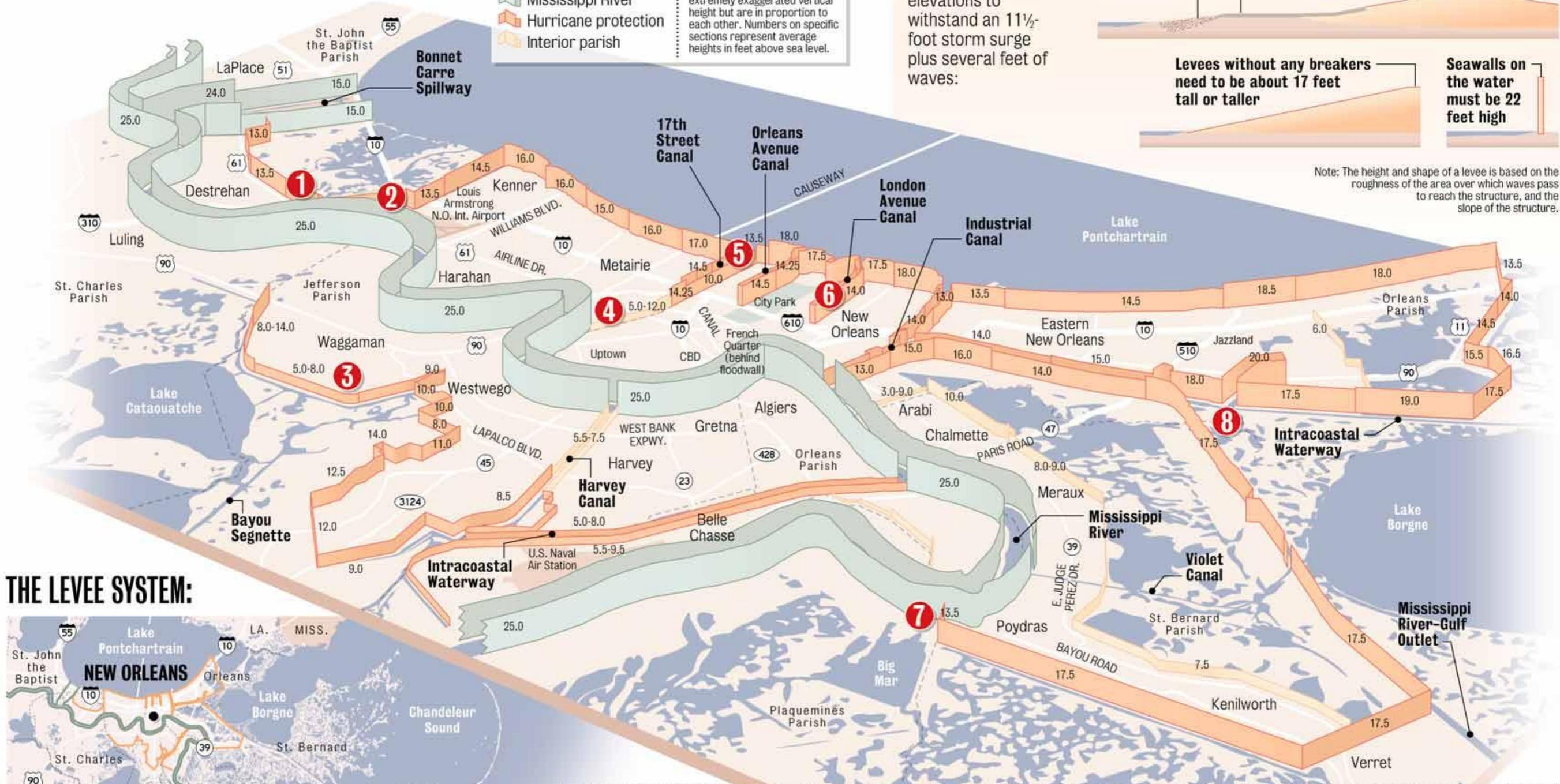
Notes: Levee and floodwall elevations are drawn with an extremely exaggerated vertical height but are in proportion to each other. Numbers on specific sections represent average heights in feet above sea level.

## HEIGHT ISN'T EVERYTHING

Different factors permit Lake Pontchartrain levees of varying elevations to withstand an 11½-foot storm surge plus several feet of waves:



Note: The height and shape of a levee is based on the roughness of the area over which waves pass to reach the structure, and the slope of the structure.



## THE LEVEE SYSTEM:



"We have now concluded we had **problems with the design of the structure**. . . . We had hoped that wasn't the case, but we recognize it is the reality."

--Lt. General Carl Strock, U.S. Army Corps of Engineers (testifying before the Senate)

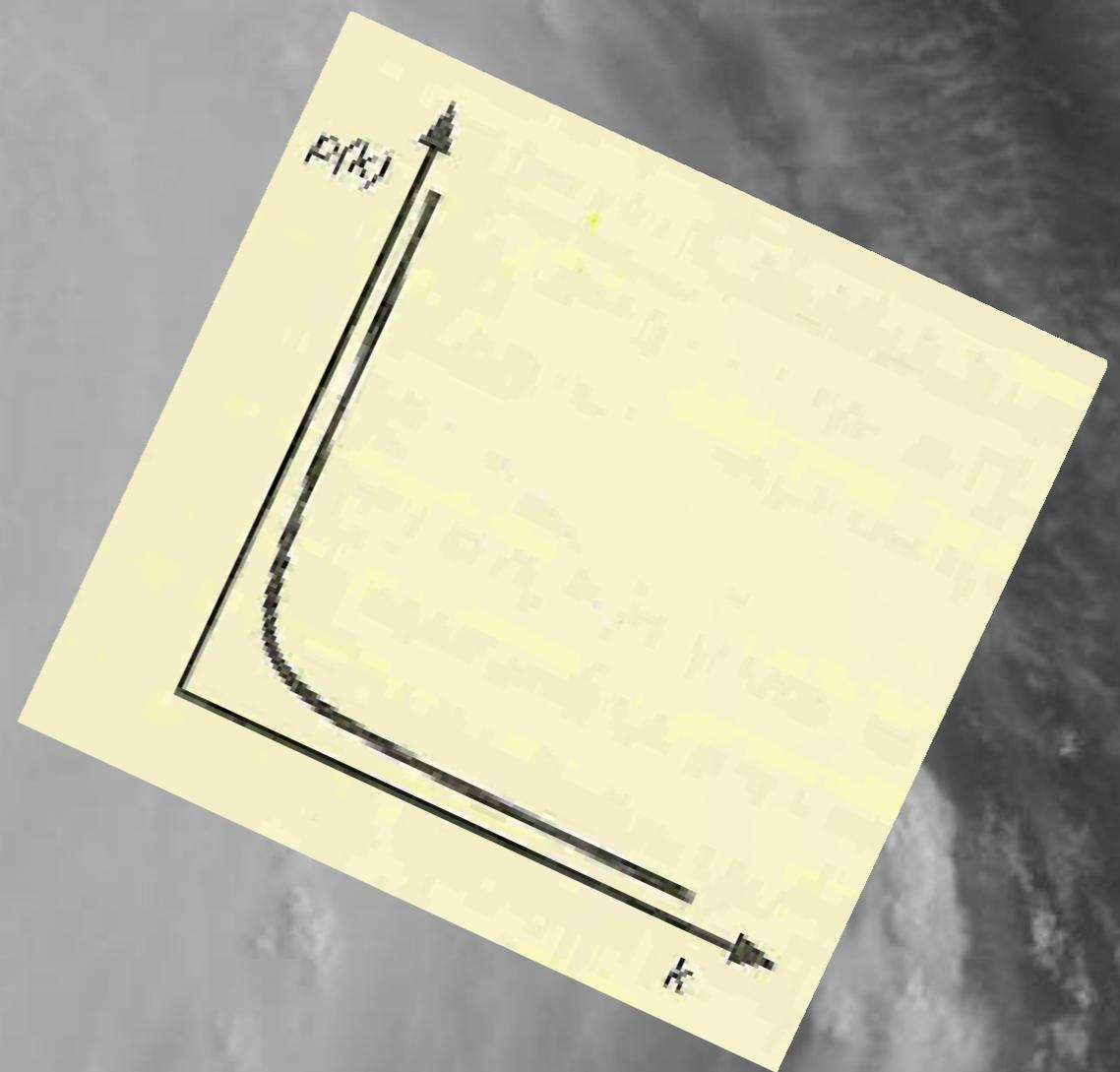
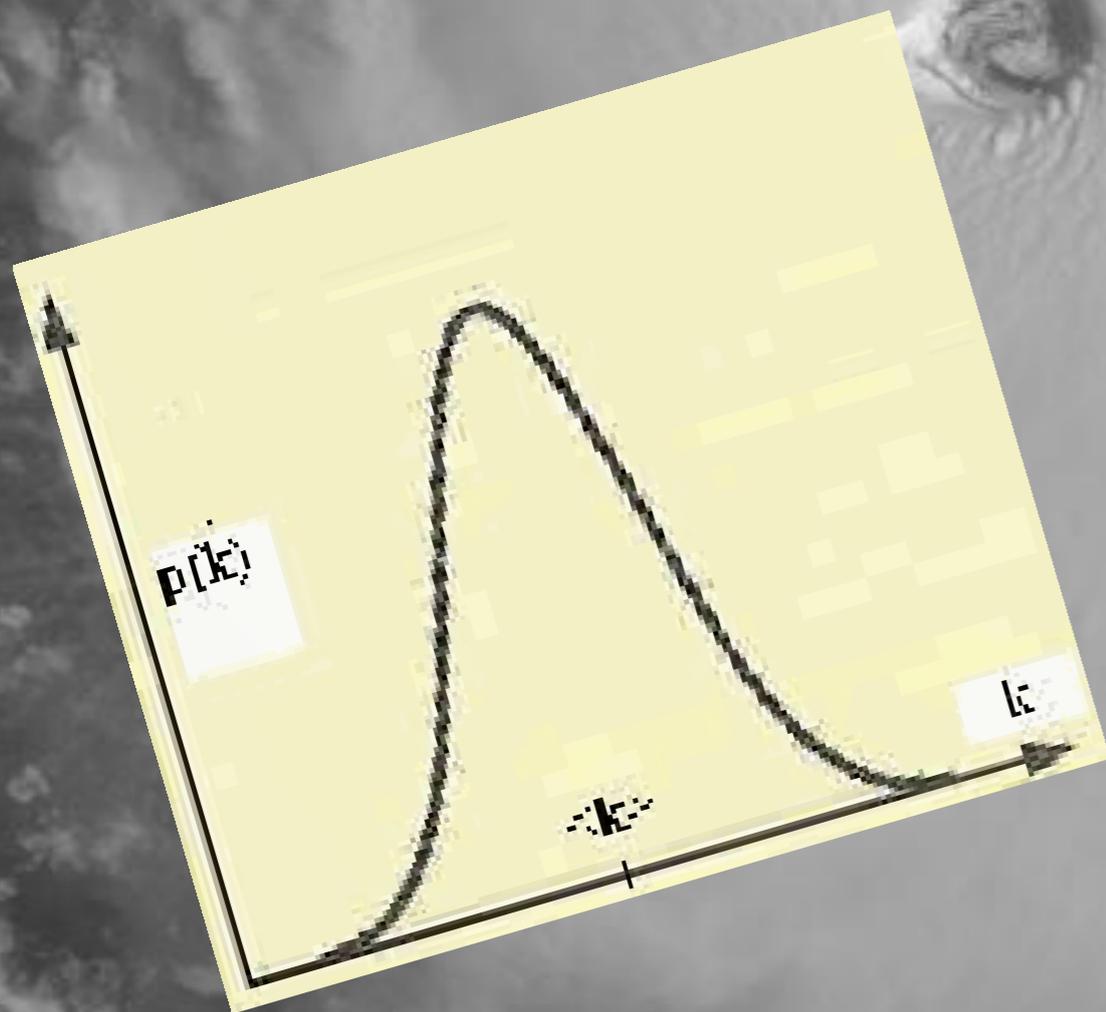




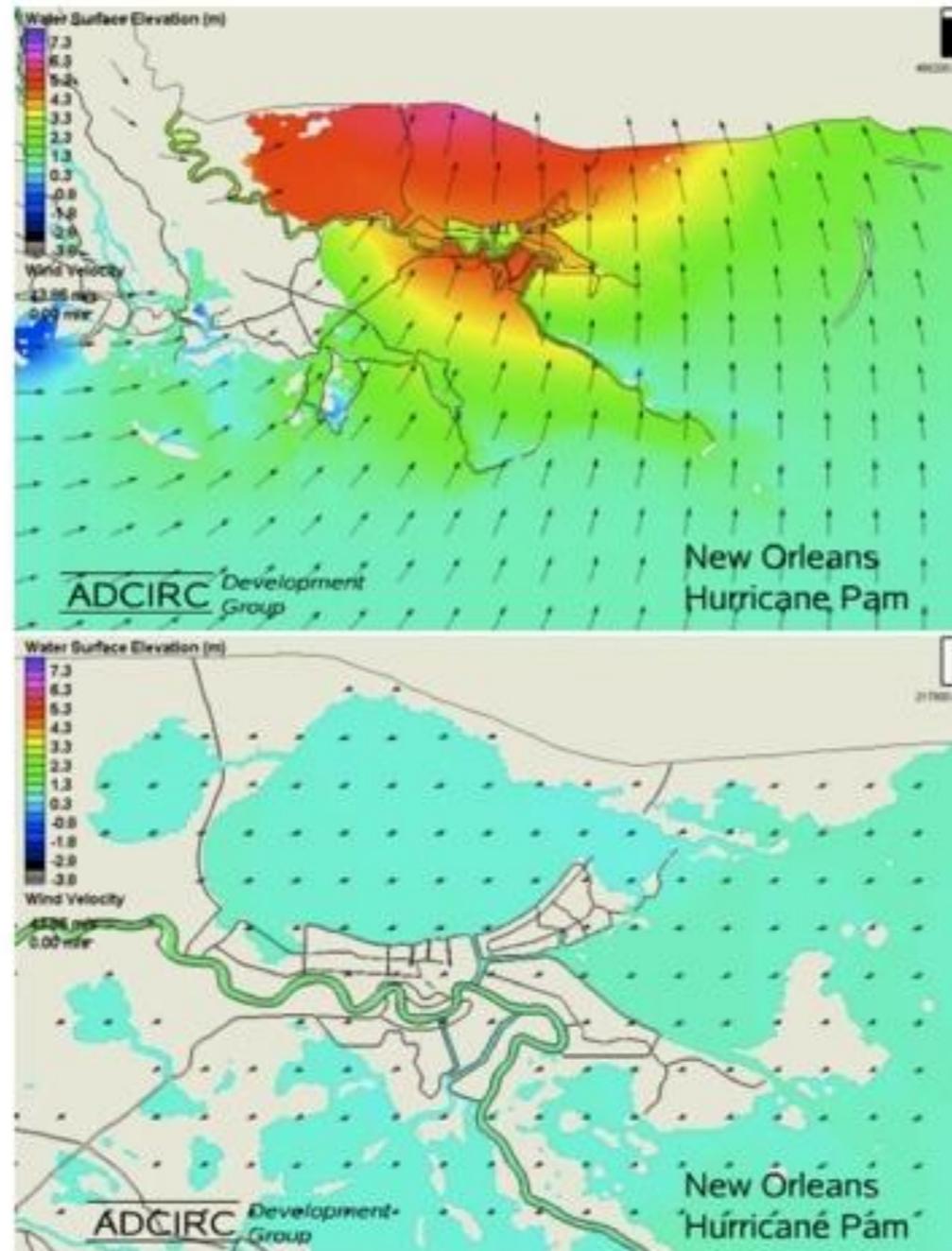


At this stage we decided the curve not considering Camille (1969) and the Keys (1935) storms should be used. Our decision was based on the idea that these two hurricanes contained extremely low  $p_0$ 's resulting in sustained wind speeds that were not reasonably characteristic of the northern gulf coast and the Florida Keys.

# Probabilities Behaving Badly



# Well, you should see Hurricane PAM . . .





multiple  
scenario  
planning

multiple  
planning  
scenario

multiple  
scenario

planning

scenario  
planning

MULTIPLE  
SCENARIO  
PLANNING

scenario  
multiple  
planning

multiple

multiple  
planning  
scenario

multiple  
scenario  
planning

planning  
scenario  
multiple



# Cognitive Tool *and* Communications Tool

**U**  
**i**  
**s**  
**i**  
**o**  
**I**

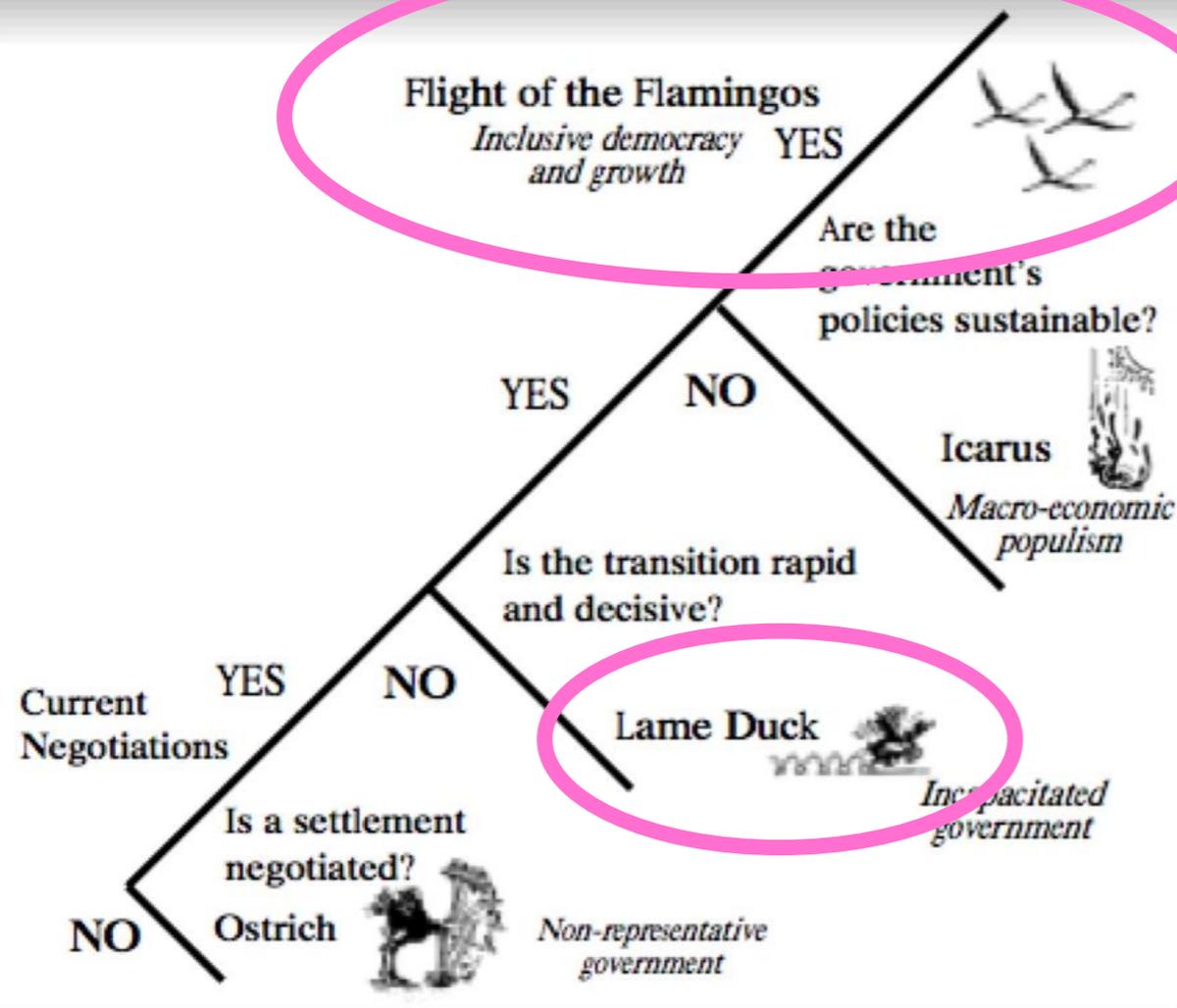
Avoids the urge to predict

Memorable

Considers the  
Exogenous and  
the Endogenous

Invites Redundancy

# Logic of the Scenarios



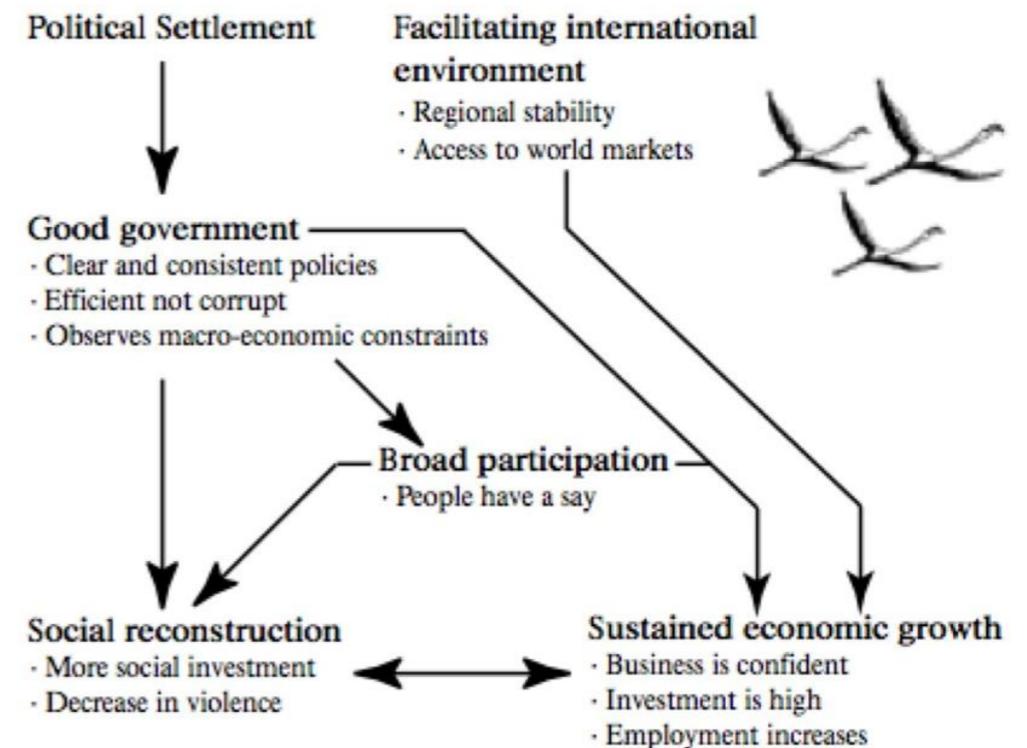
## Lame Duck Scenario



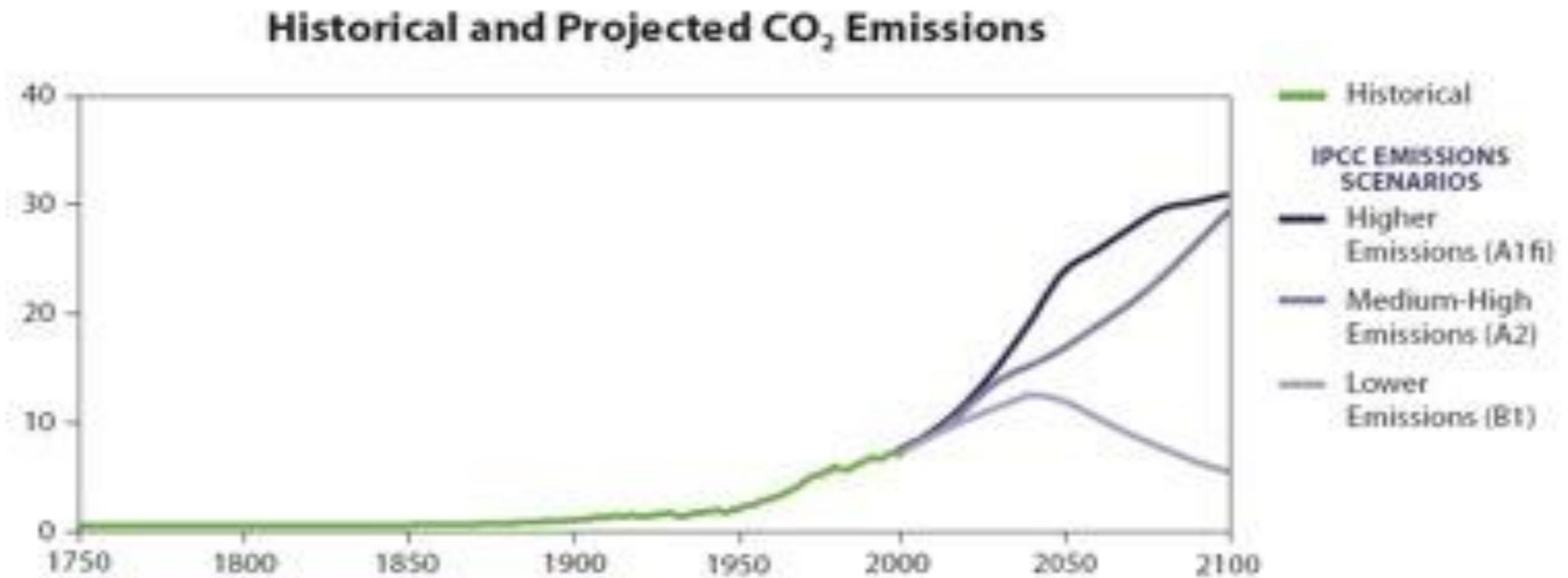
- Long transition**
- Political settlement
  - All party coalition
  - Sunset clauses

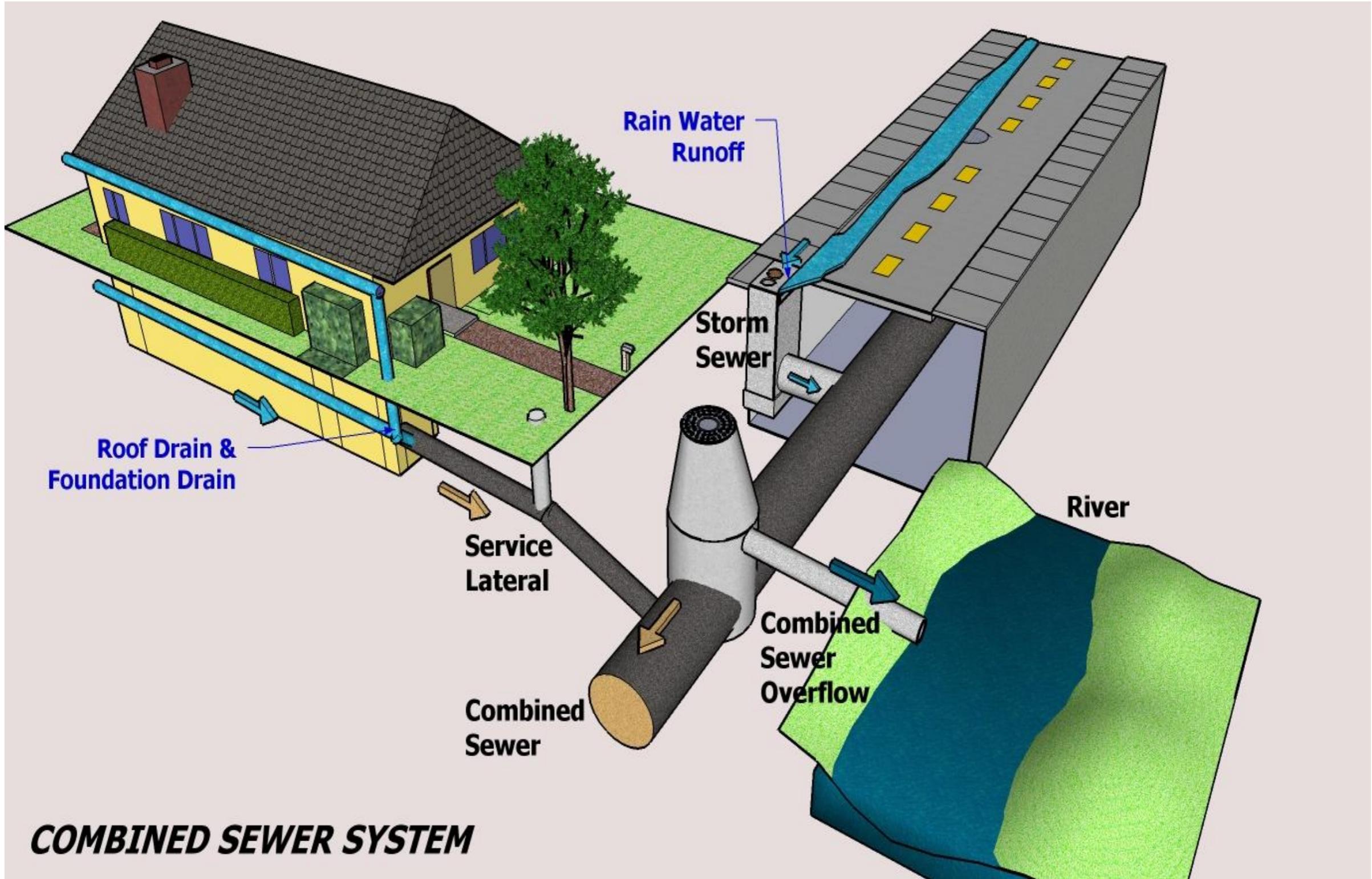
## Flight of the Flamingos

### Inclusive Democracy and Growth



# IPCC Emissions Scenarios





# *USA: Combined sewer overflows*

*Courtesy: Kellogg Schwab*



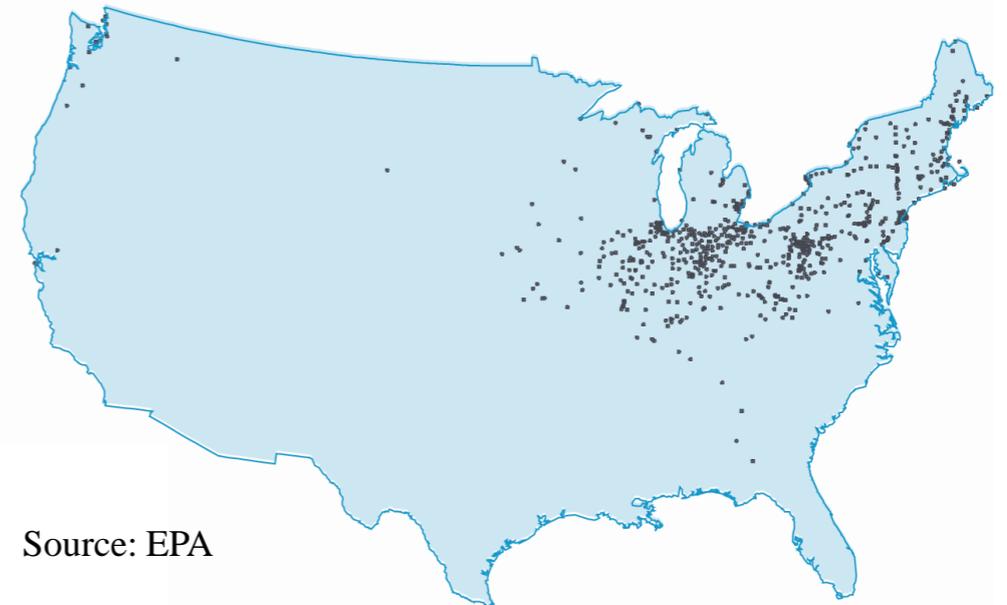
**1.2 trillion gal of sewage & stormwater a year  
discharged during combined sewer overflows  
– would keep Niagara Falls roaring for 18 days**

*Center for Water & Health, JHU Bloomberg School of Public Health*

# Combined Sewer Systems

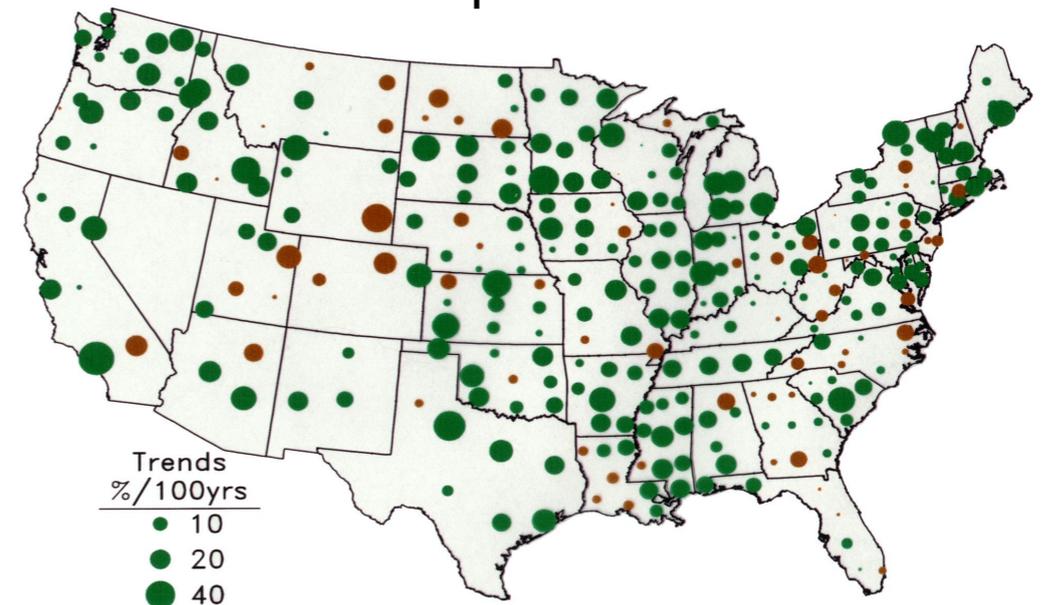
- 770 systems serve around 40 million people
- 182 CSSs in the Great Lakes Region
- 1,260 billion gallons untreated sewage and storm water released yearly
- \$45 billion in future investment needs (EPA estimate in 2001)

CSS Communities



Source: EPA

Past Precipitation Trends



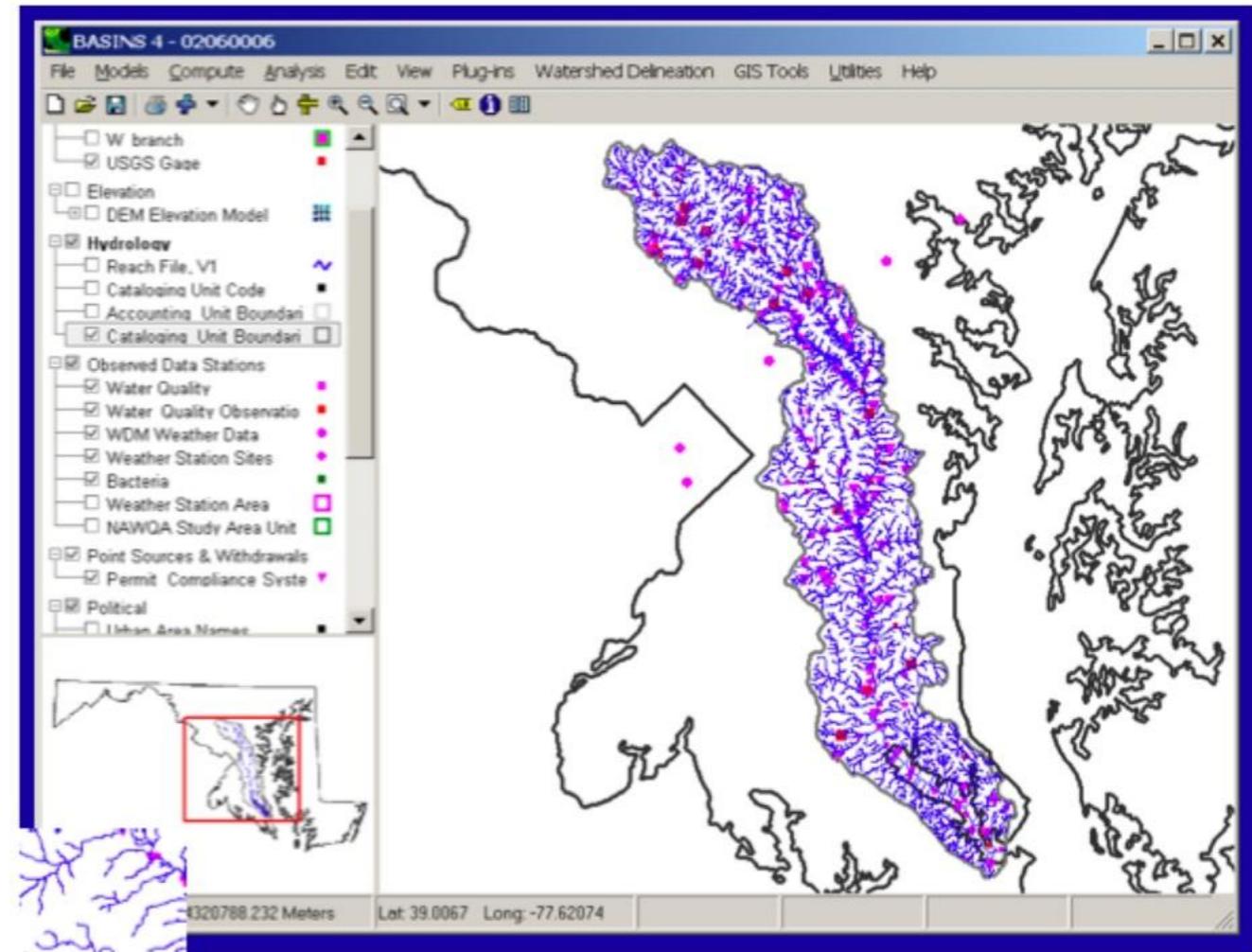
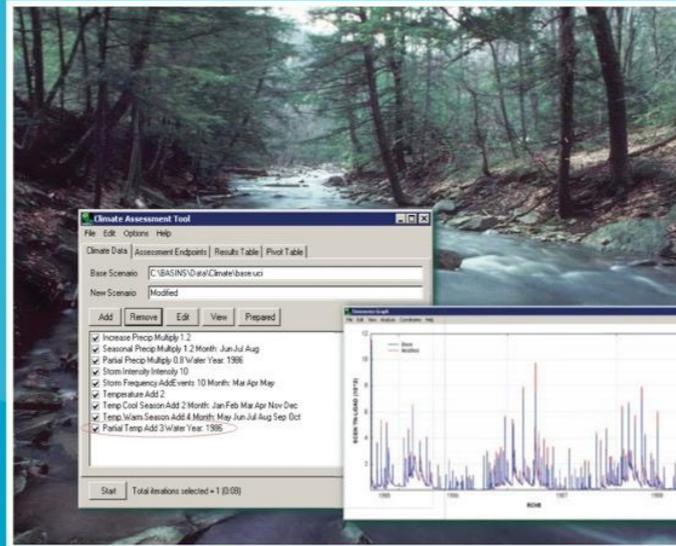
Source: National Climatic Data Center/NESDIS/NOAA



# Combined Sewer Overflow in the Great Lakes Region (EPA report released February 2008)

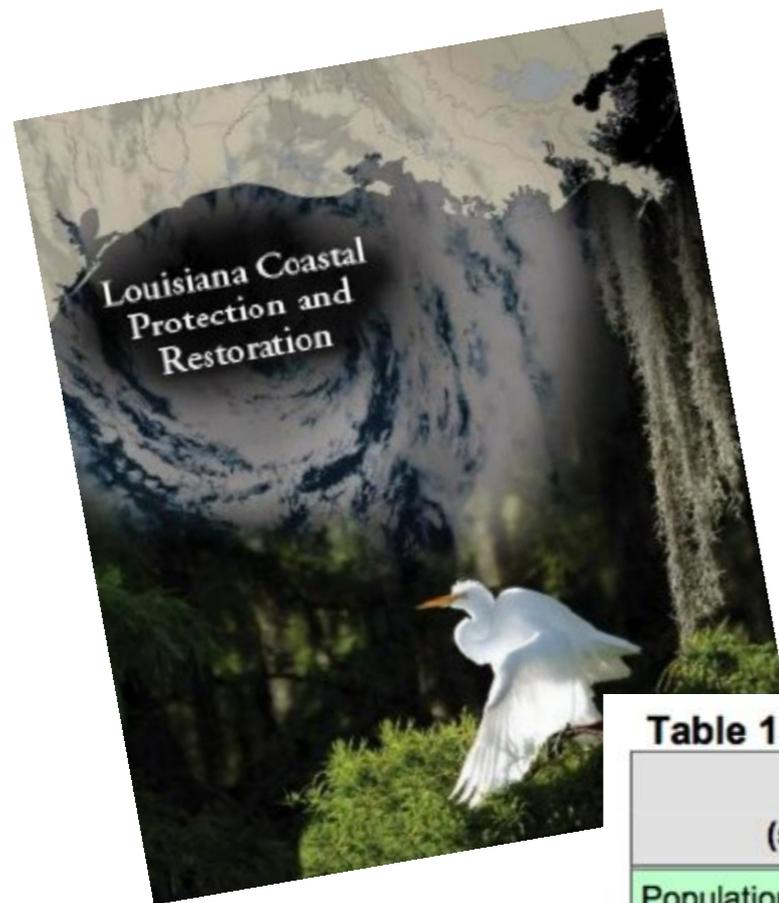
- Issue: There are 182 combined sewer systems in the Great Lakes Region. Billions of dollars are being spent redesigning and rebuilding these systems.
- Key Questions:
  - ü Does climate change matter to the redesign of combined sewer systems in the Great Lakes Region?
  - ü When the climate changes, how might CSO event frequency change, and in how many cases will the four CSO events per year threshold be exceeded?
- If combined sewer systems are designed to meet the EPA's CSO Control Policy design standard of 4 events per year, but fail to plan for climate change:
  - ü climate change may result in failure to meet the standard
  - ü **there could be an average of 237 events per year above the control policy's objectives across 182 communities**

## BASINS 4.0 Climate Assessment Tool (CAT): Supporting Documentation and User's Manual



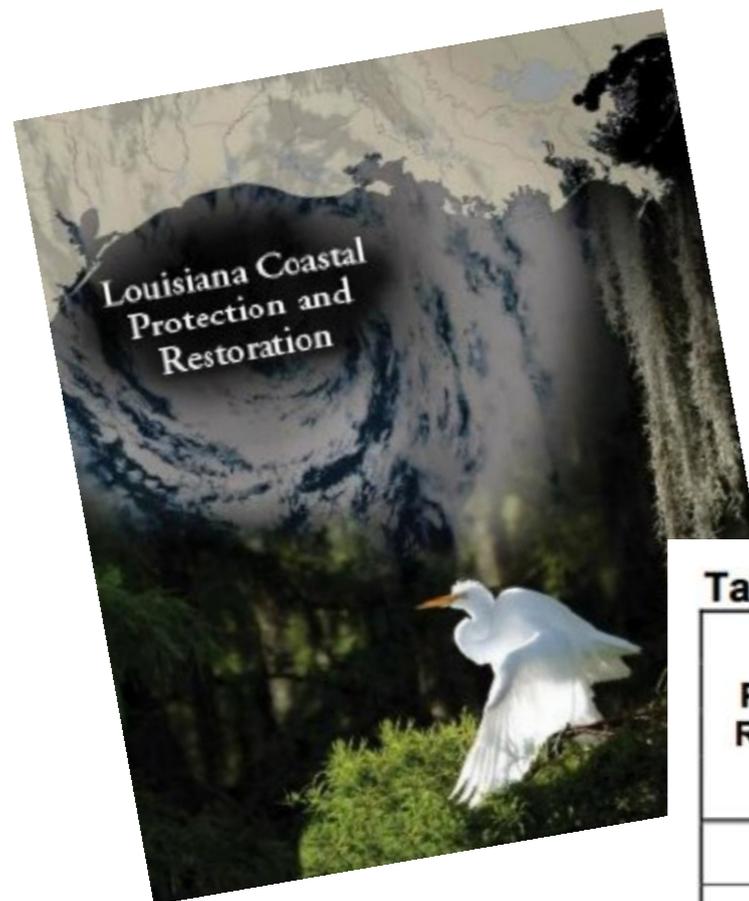


**Figure 7-3. LACPR planning area map showing the extent of the 1000-year hurricane surge inundation (hatched area).**



**Table 13-2. Number of times stakeholders ranked each metric as most important.**

Metric (shown in descending order by total)	Planning Unit					Total
	1	2	3a	3b	4	
Population impacted (people/year)	21	15	17	8	10	71
Direct wetland impacts (acres)	8	4	3	4	6	25
Indirect environmental impact (unit-less scale, -8 to +8)	8	2	5	2	4	21
Residual damages (\$, million/year)	3	2	2	3	4	14
Construction time (years)	1	1	3	4	1	10
Employment impacts (jobs disrupted/year)	2	2	0	2	1	7
Life-cycle cost (\$, million/year)	1	1	0	1	1	4
Historic properties protected (# of properties)	1	0	0	0	0	1
Historic districts protected (# of districts)	0	0	0	1	0	1
Archeological sites protected (# of sites)	0	0	0	0	0	0
<b>Number of Survey Respondents</b>	<b>45</b>	<b>27</b>	<b>30</b>	<b>25</b>	<b>27</b>	<b>154</b>



**Table 13-4. Planning Unit 1 MCDA rankings by scenario.**

Plan Rank	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Low RSLR High Employment Disperse Population	High RSLR High Employment Disperse Population	Low RSLR Business-as-Usual Compact Population	High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-100	NS-1000
2	NS-100	NS-400	NS-1000	NS-100
3	NS-400	NS-100	NS-400	NS-400
4	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3
5	Coastal	HL-a-100-3	Coastal	Coastal
6	HL-a-100-3	Coastal	HL-a-100-3	HL-a-100-3
7	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2
8	HL-a-100-2	HL-a-100-2	HL-a-100-2	HL-a-100-2
9	C-LP-a-100-1	C-LP-a-100-1	C-LP-a-100-1	C-LP-a-100-1
10	C-HL-b-400-2	C-HL-b-400-2	C-HL-b-400-2	C-HL-b-400-2

Sometimes the most unlikely events *do* happen.

