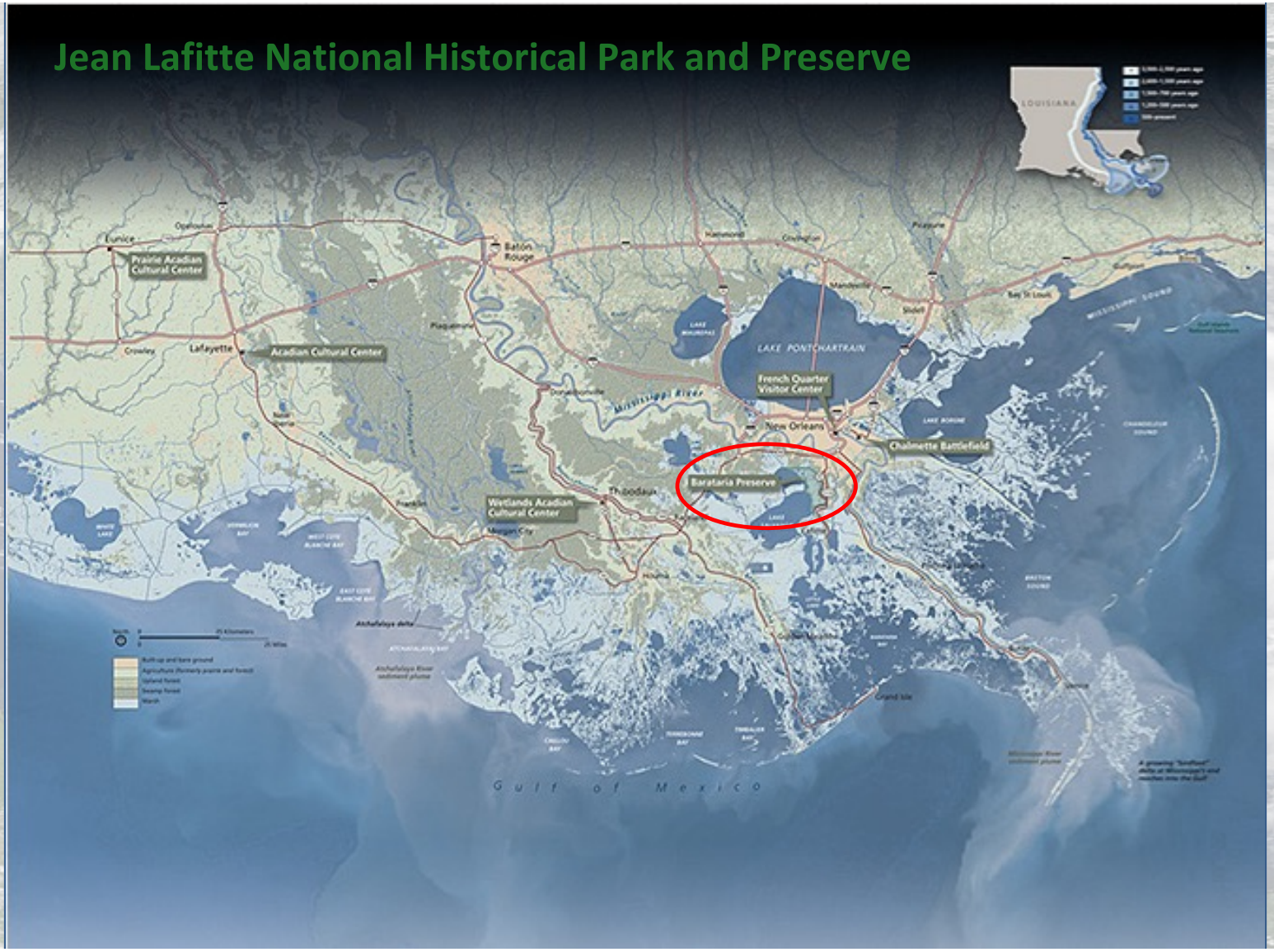
Learning from the landscape: guiding 21st century stewardship at the Barataria Preserve

Julie L. Whitbeck

Jean Lafitte National Historical Park and Preserve



many thanks to

- All of you
- Jean Lafitte NHP&P (JELA) colleagues, especially Natural Resource Mgmt
- To those who had the insight and invested the effort and energy to get the park established

What guides park management?

NPS policy directs park managers to:

- **Restore natural systems**
  - Native plant and animal communities
  - Natural Landscapes
- **Reestablish natural functions and processes**
  - Floodplains
  - Wetlands
  - Watersheds and Streams
- **Remove exotic species**

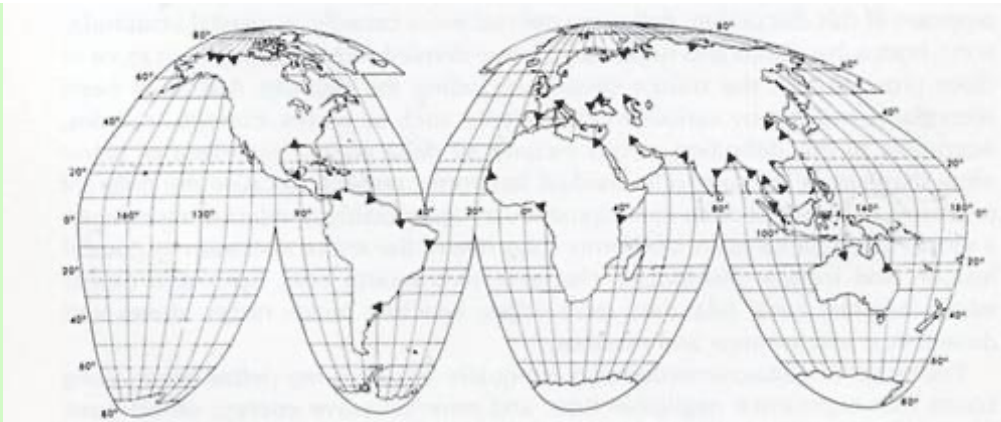
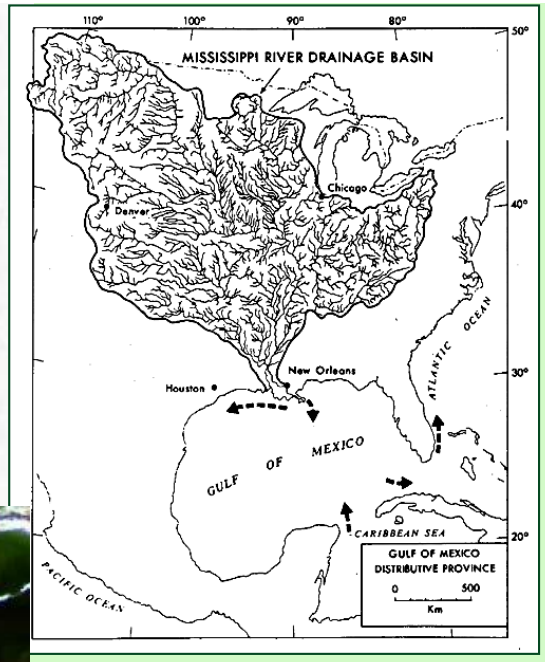
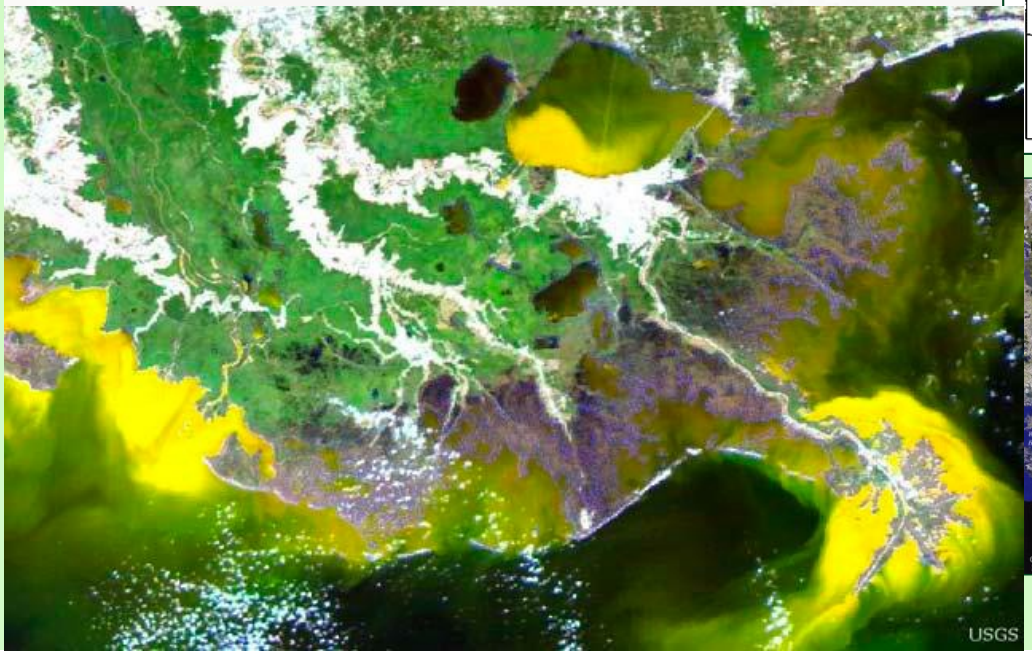


Figure 1. Global distribution of major deltas (from Wright et al., 1974).

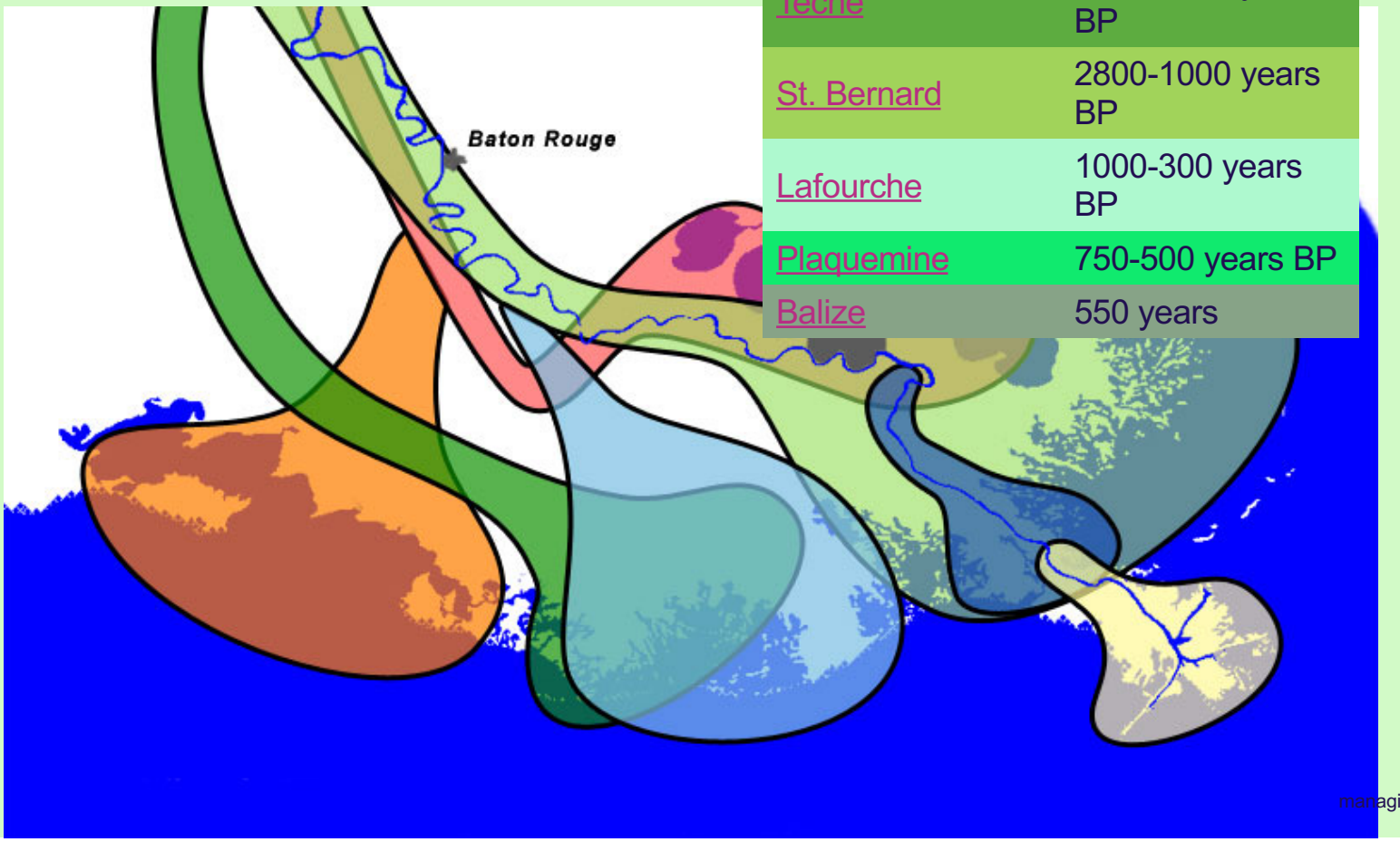


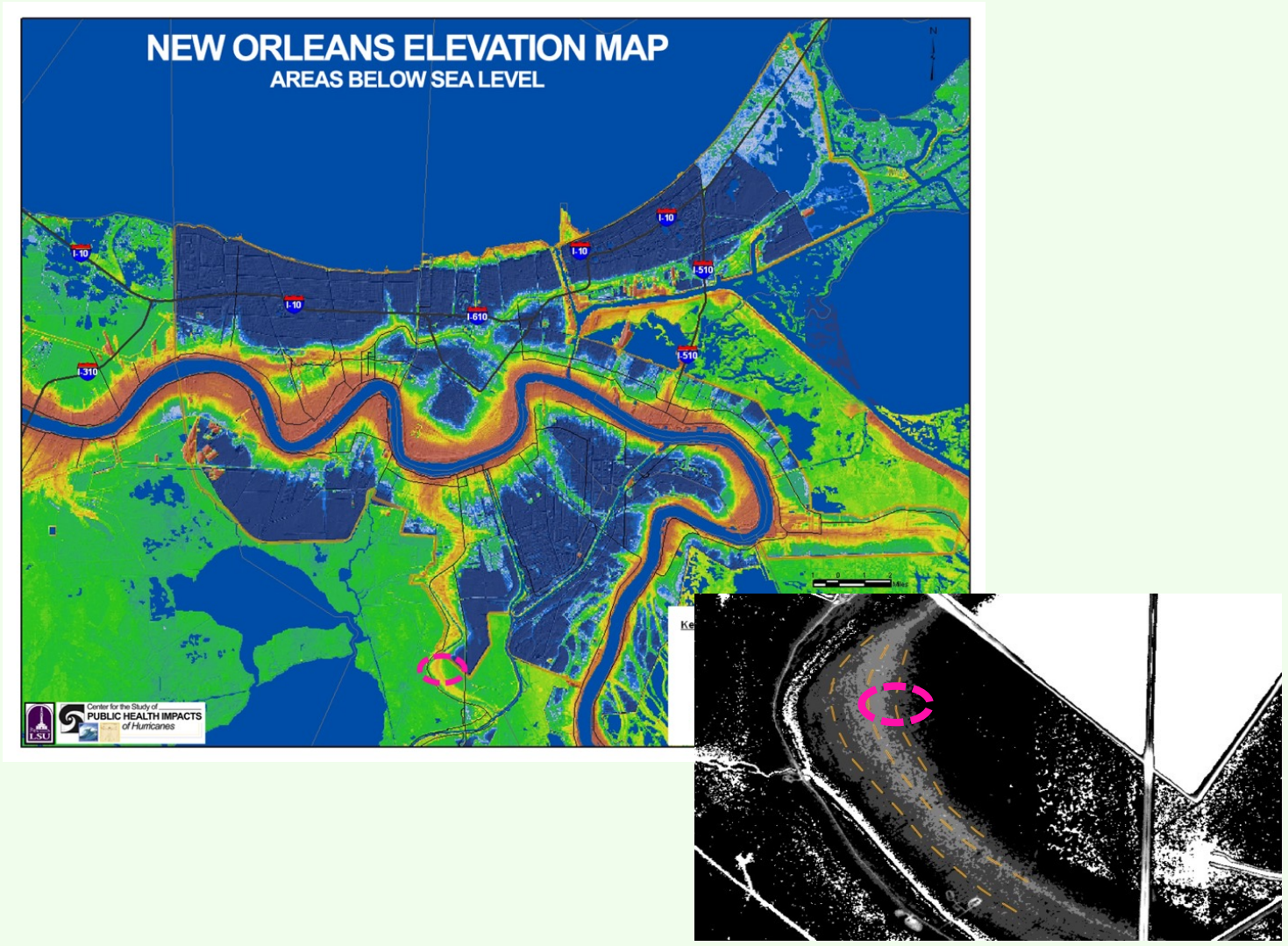


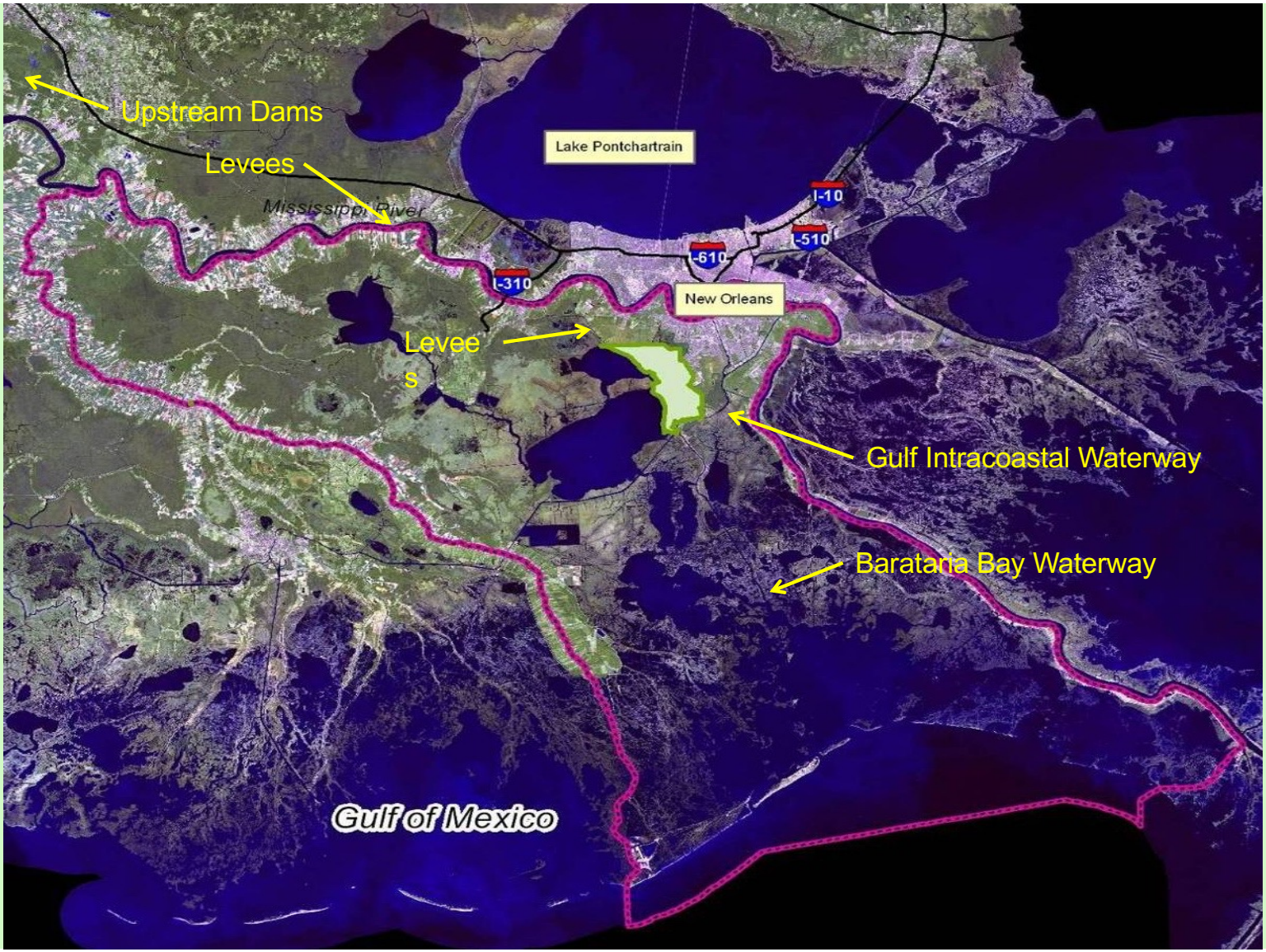
Miss River in flood stage: May 27, 2011

Louisiana's Mississippi River Delta

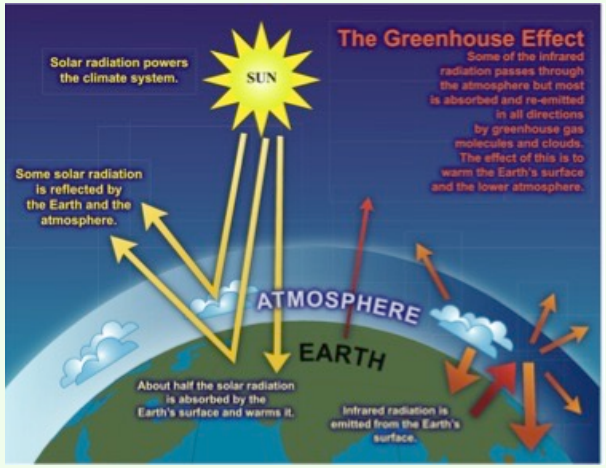
Salé-Cypremort	4600 years BP
Cocodrie	4600-3500 years BP
Teche	3500-2800 years BP
St. Bernard	2800-1000 years BP
Lafourche	1000-300 years BP
Plaquemine	750-500 years BP
Balize	550 years

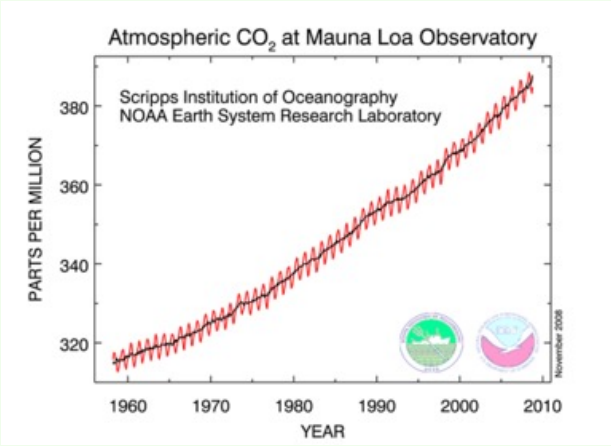



NEW ORLEANS ELEVATION MAP
AREAS BELOW SEA LEVEL
I-10
I-10
I-10
I-10
I-610
I-310
I-510
I-510
Center for the Study of
PUBLIC HEALTH IMPACTS
of Hurricanes

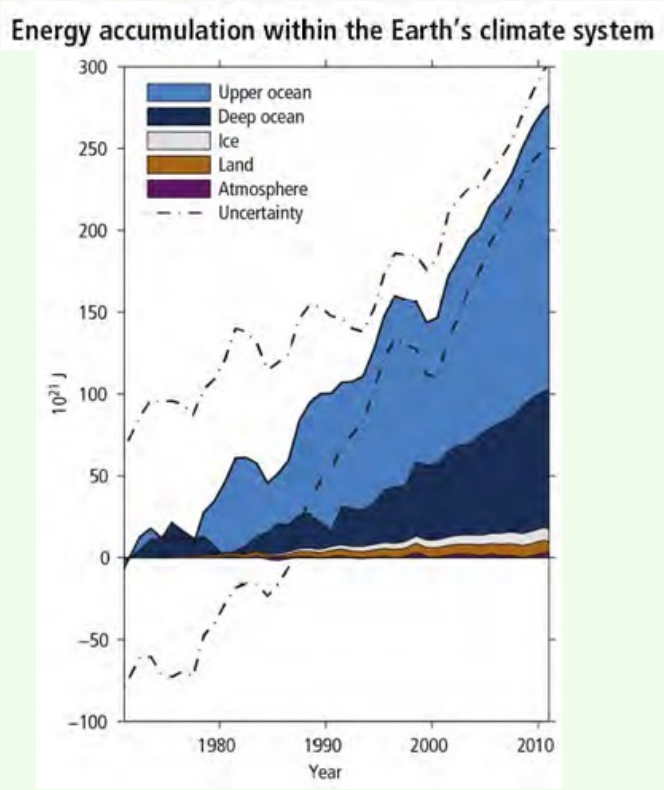

Upstream Dams
Levees
Lake Pontchartrain
I-10
I-510
I-610
I-310
New Orleans
Levees
Gulf Intracoastal Waterway
Barataria Bay Waterway
Gulf of Mexico

climate change and sea level rise



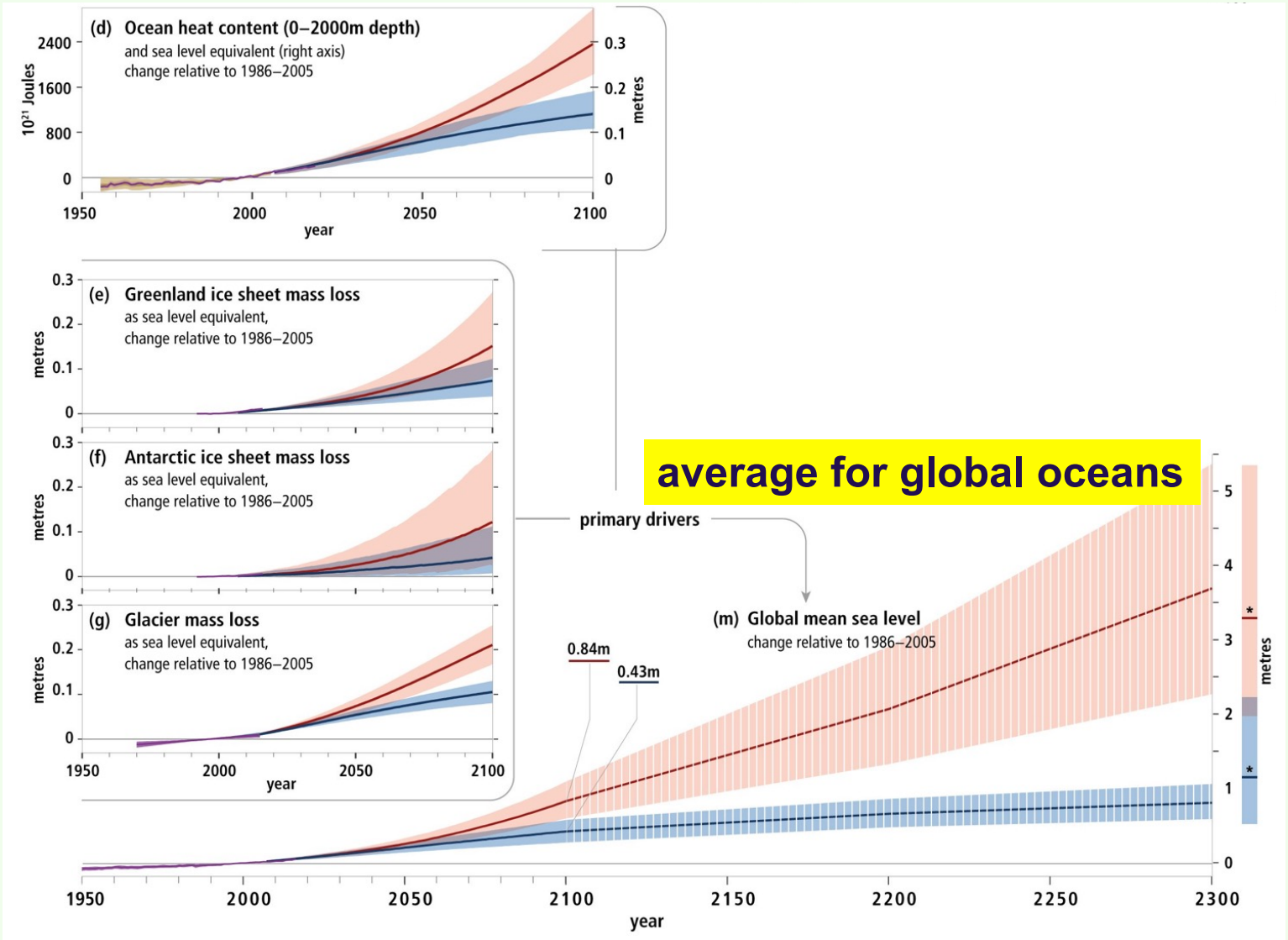


Dr. Pieter Tans, NOAA/ESRL (www.esrl.noaa.gov/gmd/cgg/trends)

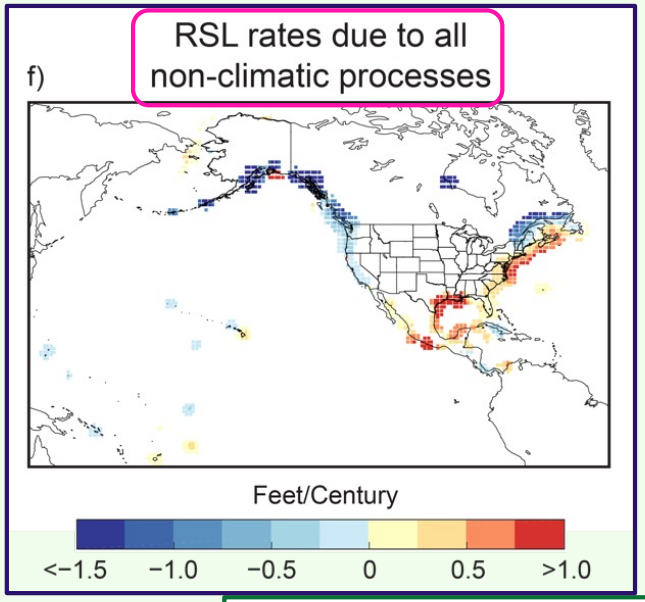


IPCC AR5 Synthesis report 2014

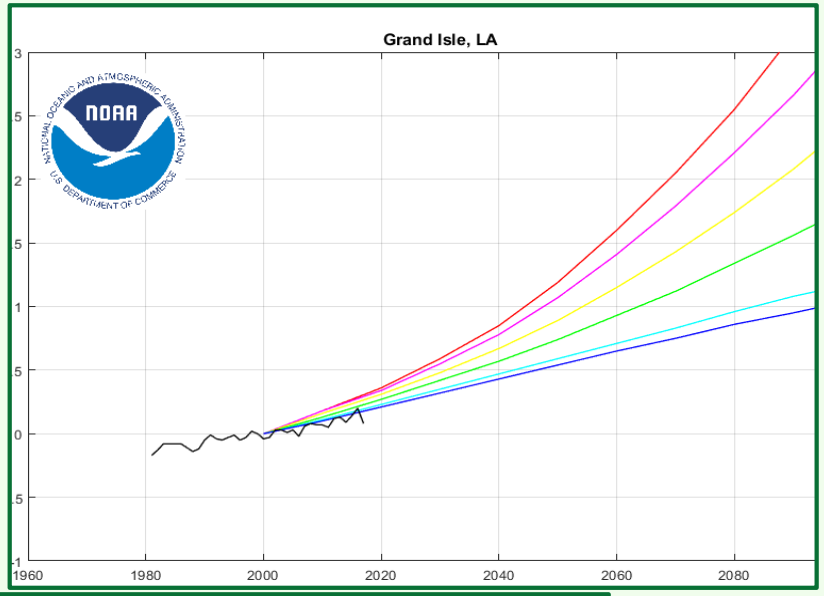
More than 90% of the energy accumulating in the climate system between 1971 and 2010 has been stored in the ocean.

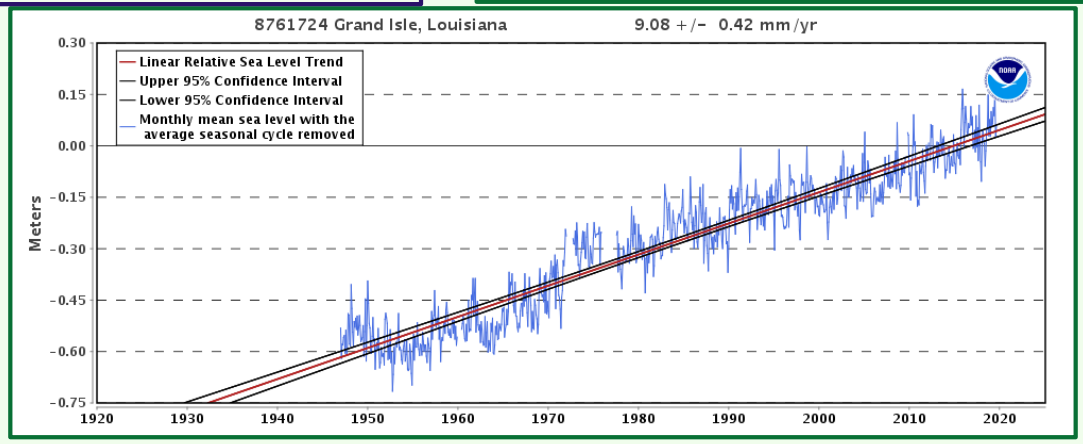

(d) Ocean heat content (0–2000m depth)
and sea level equivalent (right axis)
change relative to 1986–2005
10^{21} Joules
metres
year
(e) Greenland ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(f) Antarctic ice sheet mass loss
as sea level equivalent,
change relative to 1986–2005
(g) Glacier mass loss
as sea level equivalent,
change relative to 1986–2005
primary drivers
average for global oceans
(m) Global mean sea level
change relative to 1986–2005
0.84m
0.43m
*
*

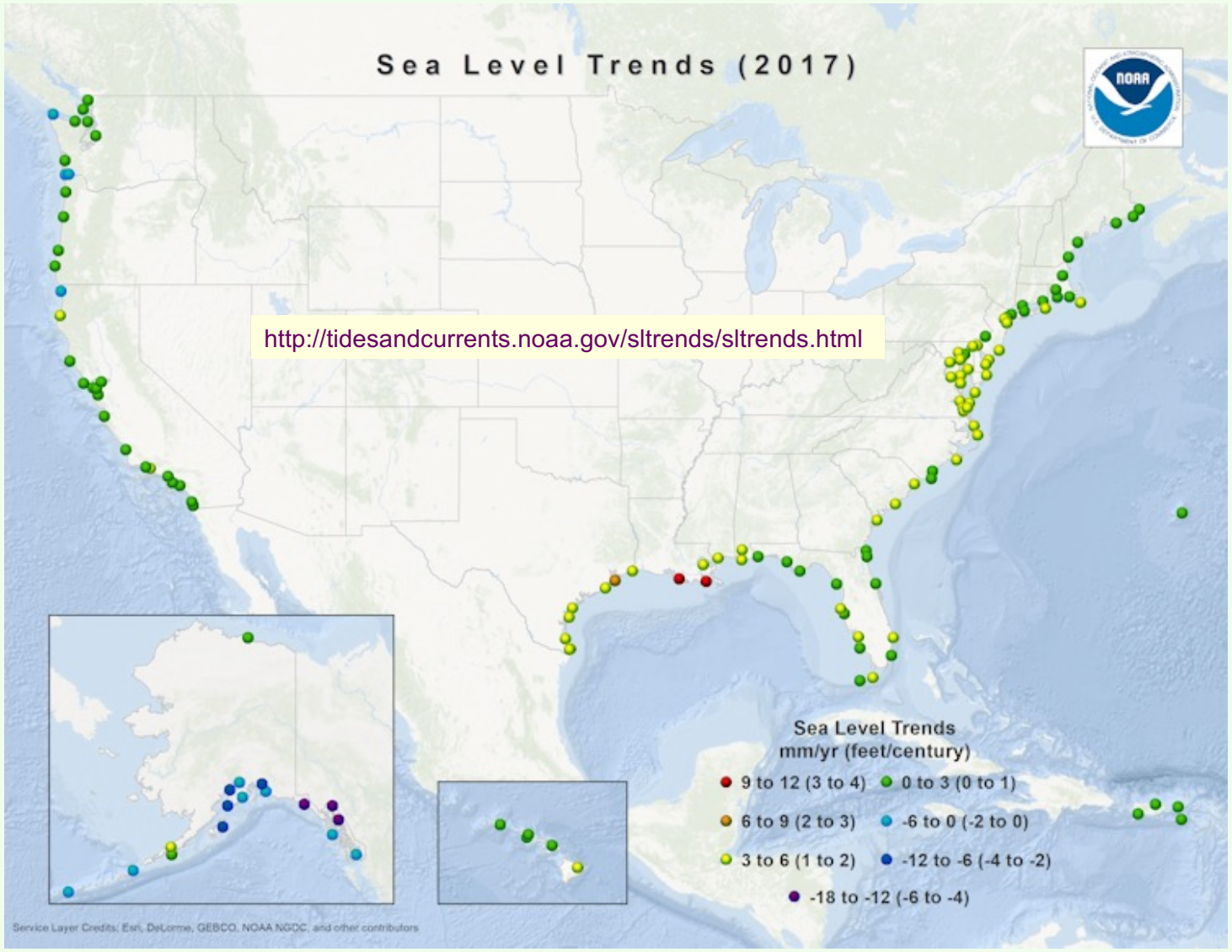
relative sea level rise (rSLR) near Barataria Preserve

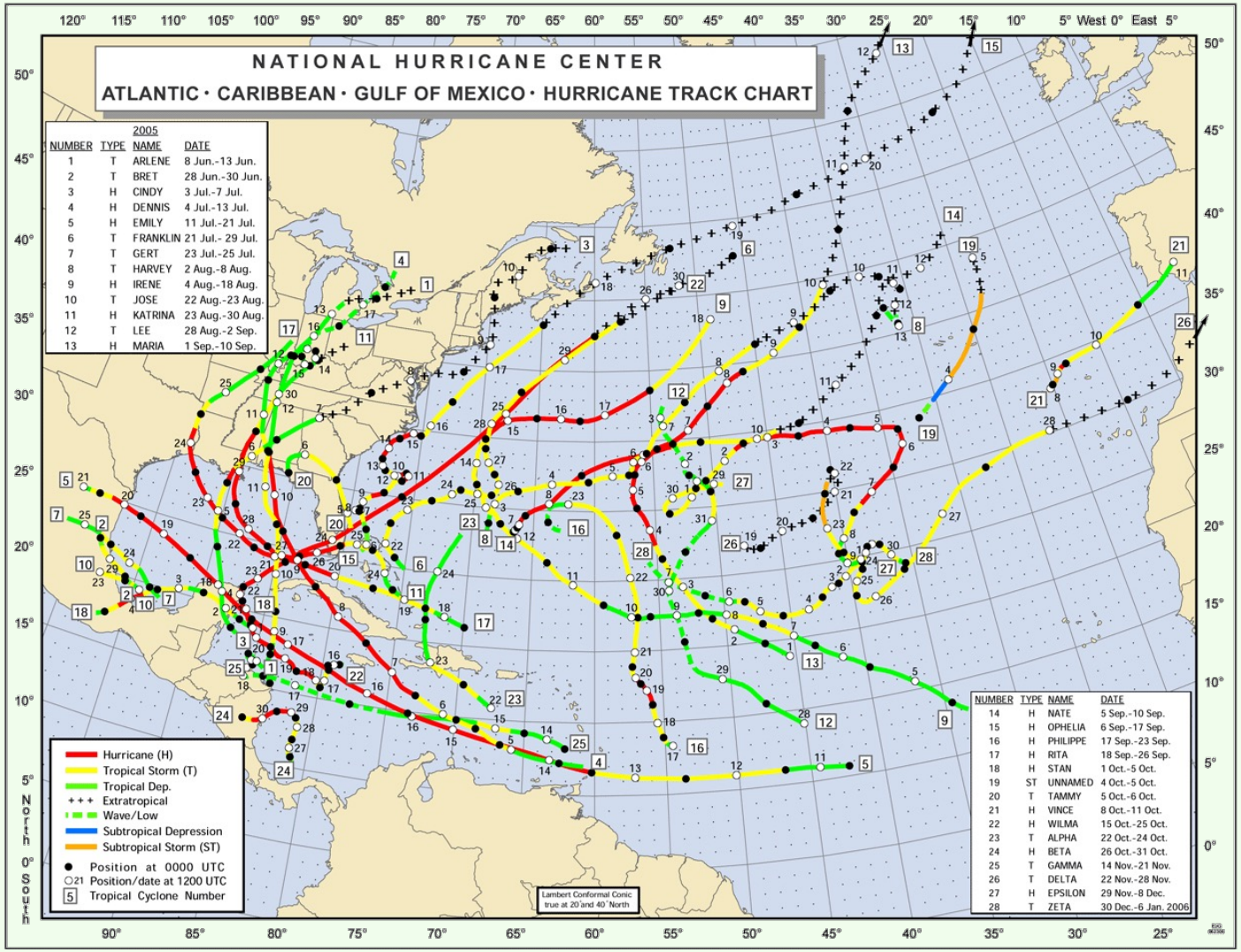


NCA4, 2017






Sea Level Trends (2017)
http://tidesandcurrents.noaa.gov/sltrends/sltrends.html
Sea Level Trends
mm/yr (feet/century)
9 to 12 (3 to 4)
6 to 9 (2 to 3)
3 to 6 (1 to 2)
0 to 3 (0 to 1)
-6 to 0 (-2 to 0)
-12 to -6 (-4 to -2)
-18 to -12 (-6 to -4)
Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors


NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
2005
NUMBER TYPE NAME DATE
1 T ARLENE 8 Jun.-13 Jun.
2 T BRET 28 Jun.-30 Jun.
3 H CINDY 3 Jul.-7 Jul.
4 H DENNIS 4 Jul.-13 Jul.
5 H EMILY 11 Jul.-21 Jul.
6 T FRANKLIN 21 Jul.- 29 Jul.
7 T GERT 23 Jul.-25 Jul.
8 T HARVEY 2 Aug.-8 Aug.
9 H IRENE 4 Aug.-18 Aug.
10 T JOSE 22 Aug.-23 Aug.
11 H KATRINA 23 Aug.-30 Aug.
12 T LEE 28 Aug.-2 Sep.
13 H MARIA 1 Sep.-10 Sep.
NUMBER TYPE NAME DATE
14 H NATE 5 Sep.-10 Sep.
15 H OPHELIA 6 Sep.-17 Sep.
16 H PHILIPPE 17 Sep.-23 Sep.
17 H RITA 18 Sep.-26 Sep.
18 H STAN 1 Oct.-5 Oct.
19 ST UNNAMED 4 Oct.-5 Oct.
20 T TAMMY 5 Oct.-6 Oct.
21 H VINCE 8 Oct.-11 Oct.
22 H WILMA 15 Oct.-25 Oct.
23 T ALPHA 22 Oct.-24 Oct.
24 H BETA 26 Oct.-31 Oct.
25 T GAMMA 14 Nov.-21 Nov.
26 T DELTA 22 Nov.-28 Nov.
27 H EPSILON 29 Nov.-8 Dec.
28 T ZETA 30 Dec.-6 Jan. 2006
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Extratropical
Wave/Low
Subtropical Depression
Subtropical Storm (ST)
Position at 0000 UTC
21 Position/date at 1200 UTC
5 Tropical Cyclone Number
Lambert Conformal Conic
true at 20°and 40° North
120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25° 20° 15° 10° 5° West 0° East 5°
50° 45° 40° 35° 30° 25° 20° 15° 10° 5° North 0° South

natural resource management challenges

Modified water budget & hydrology

- **Elimination of River source** (River levees)
- **Increased penetration of Gulf water & forces** (canals)
- **Reduction & elimination of precipitation draining from upper basin** (storm protection levee)
- **Relative sea level rise *(> 10 mm/yr; highest rate in N. America*)**
  - ➢ **Increasing ocean influence**
  - ➢ **Rapid increase in flooding depth & duration**

Global climate change

- **Increasing air, water & soil temperatures**
- **Changes in timing & intensity of precipitation**
  - regional and continental/watershed scales
- **Increased tropical storm frequency &/or intensity**

What guides park management?

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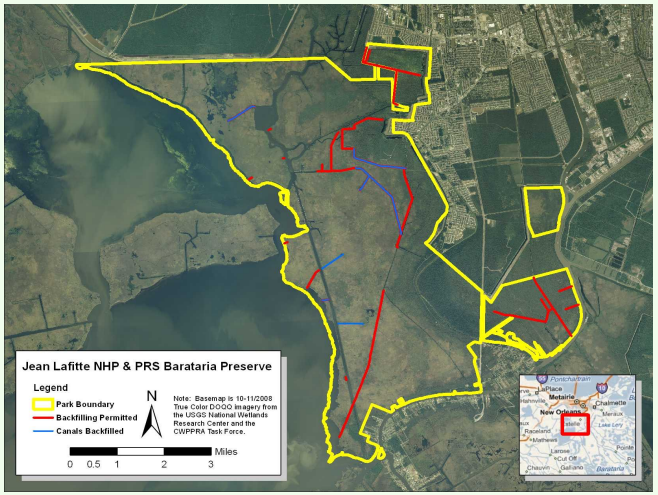
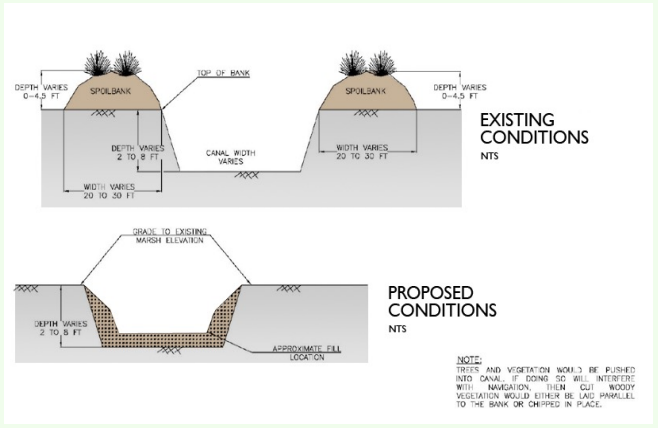
What guides park management?

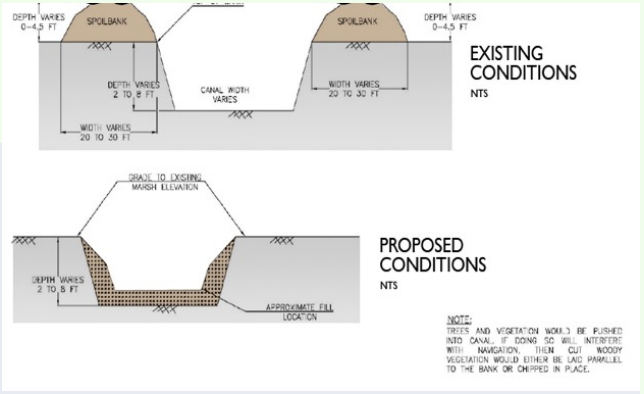




Jean Lafitte NHP&P Policy

- **Enabling Legislation**
  - Restore more natural hydrology
- **General Management Plan**
  - Canals alter hydrology in park
- **Resource Management Plan**
  - Highest priorities
    - **Study hydrology**
    - **Restore freshwater and sediment input**
    - **Reduce erosion**
  - Proposed landscape function restoration by backfilling canals

Canal Backfilling benefits – observed & projected



Hydrological Restoration

- reduces cross sectional area of canals
- replaces deep channels with shallow ones
- reduces barriers to surface flow
- reduces impoundment

➢ *reduces influence of Gulf forces (i.e. storm surge physical force, salt water) on coastal marshes & swamps (?)*

➢ *increases resilience to disturbance by Gulf forces?*

Coastal Wetland Restoration

- reduces wetland edge vulnerable to erosive forces
- restores marsh soil types & substrate properties on former spoilbank areas
- restores marsh or swamp vegetation on former spoilbanks
- reduces habitat for exotic woody vegetation
- increases in growth of submerged and/or floating aquatic vegetation in canal channel
- increases habitat for coastal wetland biota
- may increase primary productivity, carbon storage, accretion

What guides park management?

. . . sound science!

Barataria Preserve forested wetlands circa 2000

What do I see? . . . contributes to sense of urgency

panoramic photos taken 2018-03-31 just uphill of “swamp” site


AMERICORPS
ENVIRONMENTAL
STEWARDS
CONSERVATION
legacy

June ‘15

Questions?

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Jean Lafitte National Historical Park & Preserve
www.nps.gov/jela

National Park Service
U.S. Department of the Interior

EXPERIENCE YOUR AMERICA

How can we better understand ongoing change?

- Monitor key environmental characteristics
  - **weather**
  - **hydrology**
  - **terrestrial surface elevation**
- Measure biological responses
  - **along environmental gradients**
  - **over long time scales**
  - **pay attention to especially sensitive biota & processes**
- Predict and measure landscape change over time
  - **land/water boundaries**
  - **spatial distribution of biological communities/ecosystems**

Barataria Preserve change-detecting "tools"

tool type	elements	scale / design	focal ecosystem/s	gradient/s	date established
weather station	*RAWS-compliant*	hourly as of 9/2016			1980 & 2016
elevation map / data		landscape (0.1 m vertical resolution)	terrestrial	- topographic - aquatic/terrestrial boundary detection	various
water quality monitoring		fixed points (1-2 mo frequency)	- waterways - freshwater forested wetlands	- focal inflow locations - watershed position	- circa 2000 - 2014
elevation & hydrology dynamics array	- benchmark rods / SETs - marker horizons - water level wells & loggers	ecosystem to landscape elev: every 5 yrs accretion: yearly hydrology: hourly	elev: terrestrial accretion: terrestrial water level: all	- topographic - hydrologic / flooding - salinity	2014 - 2018
vegetation map	spatially-explicit digital product suite	landscape	all *aquatic veg not mapped*		2016
monitoring plots	varies: community & ecosystem properties & processes foci	0.01 ha (marsh) 0.05 - 5.0 ha (forest/swamp)	- freshwater floating peat marsh - bottomland hardwood forested wetland - bald cypress swamp	- salinity exposure - topographic - hydrologic / flooding	various: 1998 - 2011
'signal' taxon monitoring	- amphibians & herps - breeding birds	community	bottomland hardwood		2010
biological inventories	taxon-specific	public trail &/or waterway-based	terrestrial focus		various
phenology monitoring	"citizen science"	fixed points on trails	freshwater forested wetlands		2017
research archive	web access				circa 1980

management implications of BLH forest dis-integration

Forested wetland replacement communities uncertain

- Marsh invasion?
- Conversion to open water?
- A palmetto “desert”?

Park could actively manage regeneration

- palmetto thinning
- assisted upslope migration
  - ➢ depends on management approach & decisions

How can we best assess rSLR for this place?

Path:

Where are we? -- setting

management needs

key objectives

monitoring design

tools

challenges

Barataria elevation-hydrology array

How will Preserve managers use these tools?

+ gather information (& sustain long-term monitoring)
+ baseline for regular 5-10 year change assessment
+ inform vulnerability assessment
+ planning
  - natural resource management strategies
  - cultural resource protection
  - facilities (trails, buildings) modification
  - public education program focus
+ share with regional resource managers & coastal planners

How might scientists use these tools?

+ inform experimental design for focal studies
+ enable broader understanding (by leveraging other data)
+ utilize tool datasets for predictive understanding
+ provide context for focal study interpretation
+ ‘ ground truth’ remotely sensed observations
+ amplify spatial resolution of regional studies

for example . . .

- link geological & ecological understanding of delta cycle processes
- identify state factor thresholds regulating
  - key ecosystem properties & processes
  - community structure
  - focal population dynamics