A Less Mighty Mississippi

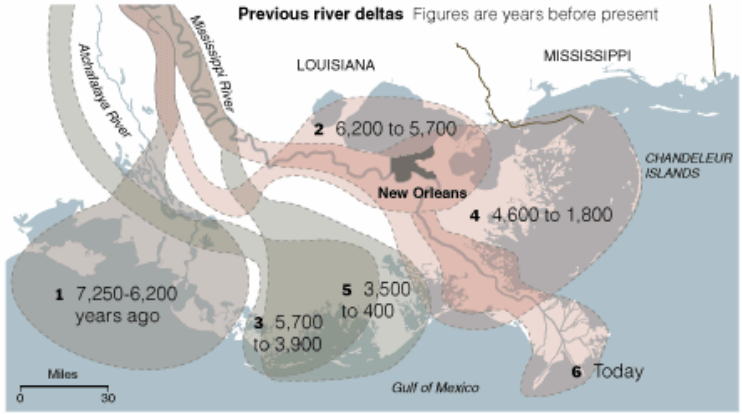
During the past 7,000 years, much of the Louisiana coast was created as the mouth of the Mississippi River meandered across the region filling the coastline with sediment. Now, levees and dams are preventing much of that sediment from replenishing the coast.

DRAINAGE BASIN

The Mississippi drains more than 40 percent of the continental United States.

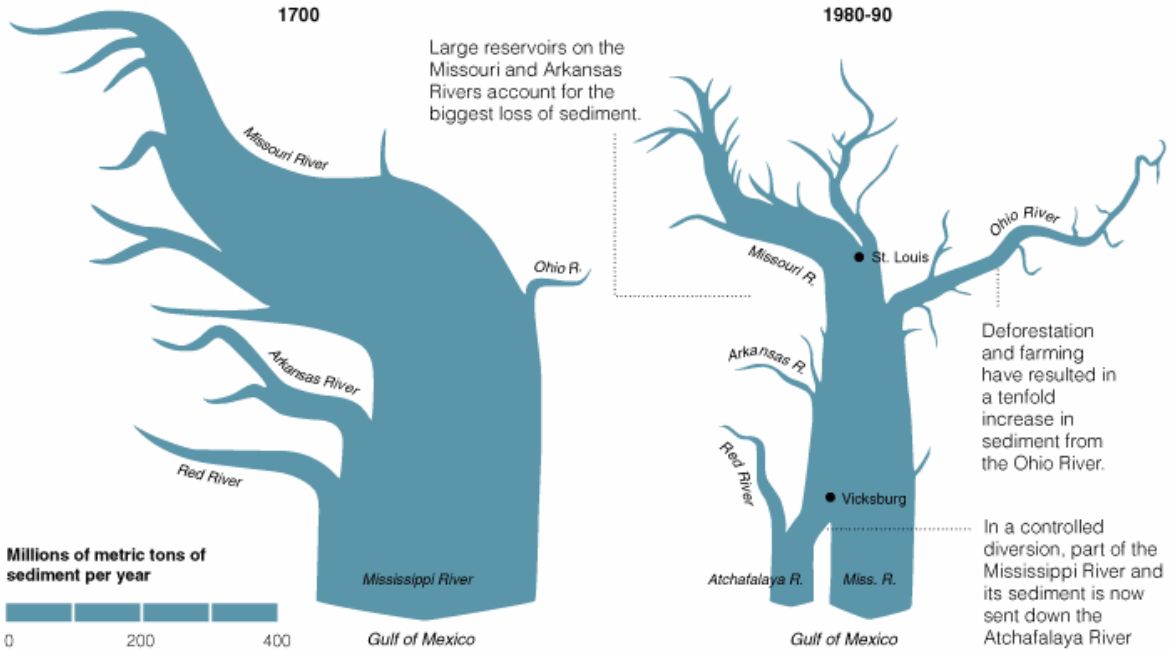
MISSISSIPPI'S MANY DELTAS

The Mississippi has always meandered but levees are preventing the river from making its next move, most likely to the Atchafalaya River.



A LOSS OF SEDIMENT

The Mississippi River transports 200 million tons of sediment per year to the Gulf of Mexico. But that is half of what the river carried three centuries ago, before European colonists first moved to the area and built levees and dams to protect themselves from floods.



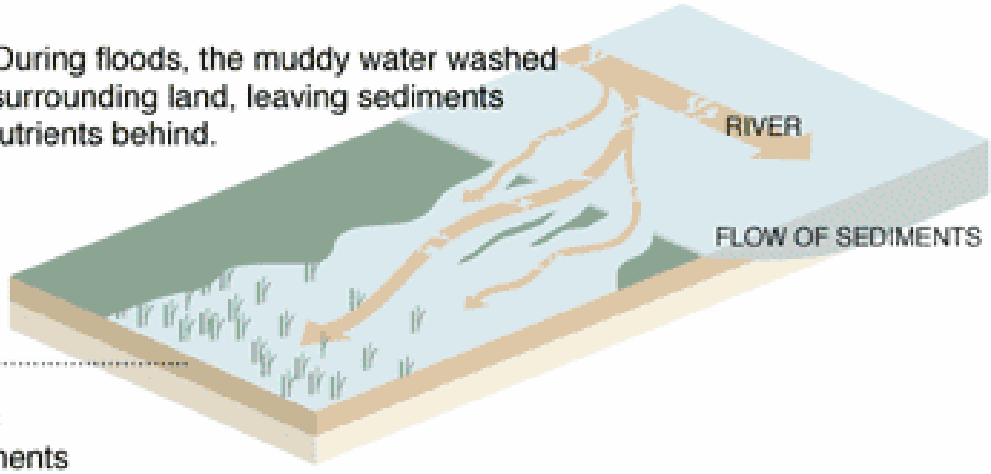
Sources: United States Geological Survey; "Contaminants in the Mississippi River"

David Constantine, Joe Burgess/The New York Times

Coastal Defenses Are Disappearing

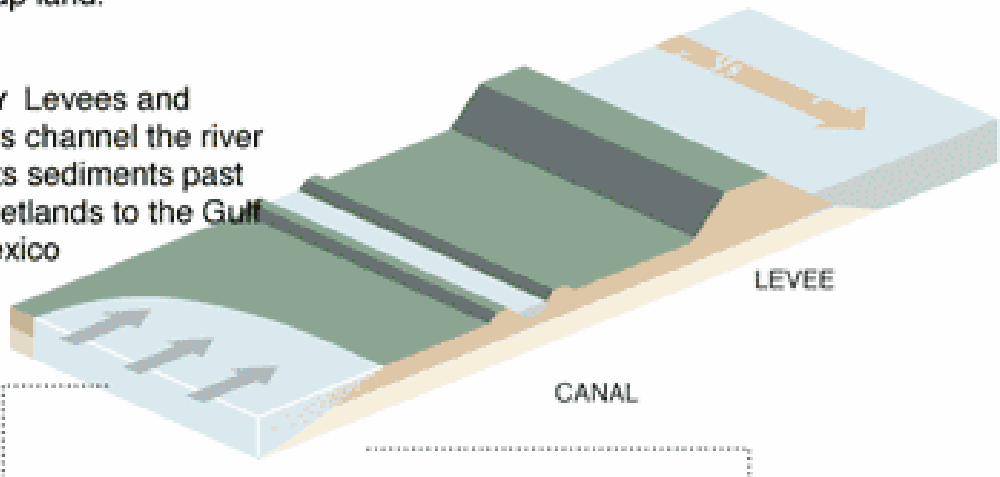
Ever since the early 1700's, when New Orleans was founded and settlers began building levees and canals to control the Mississippi River, Louisiana's coastline has been sinking. Marshes and barrier islands, which protect New Orleans from hurricanes, are eroding fast.

1700 During floods, the muddy water washed over surrounding land, leaving sediments and nutrients behind.



Sediments built up land.

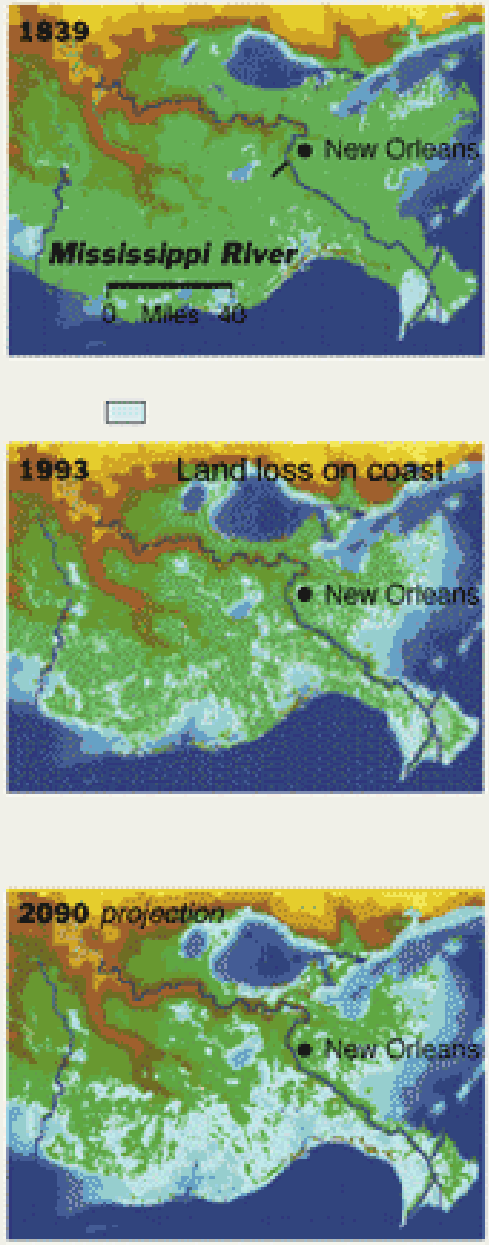
TODAY Levees and canals channel the river and its sediments past the wetlands to the Gulf of Mexico



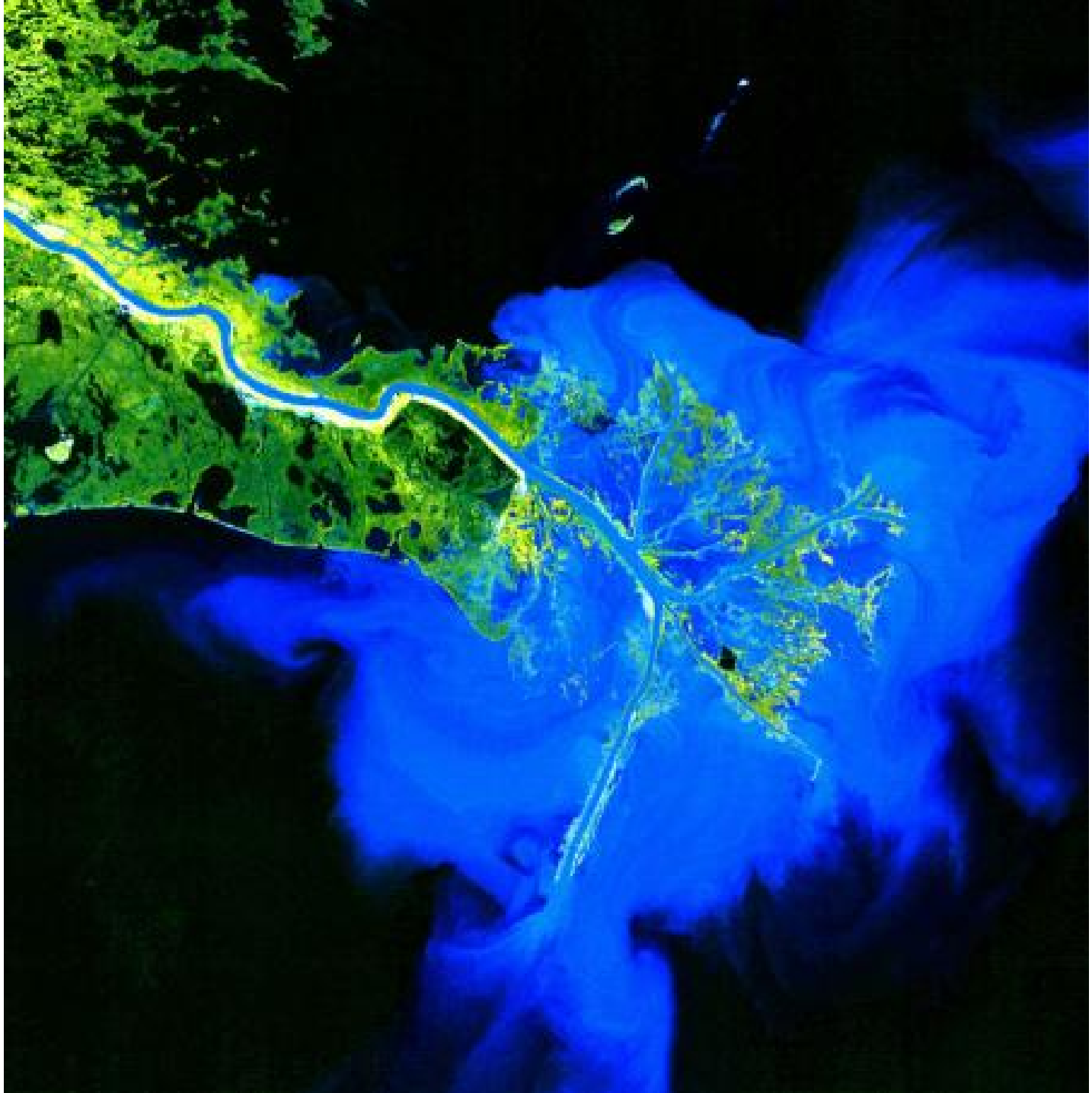
Saltwater moves in, killing marsh plants. Nothing remains to hold the marsh together.

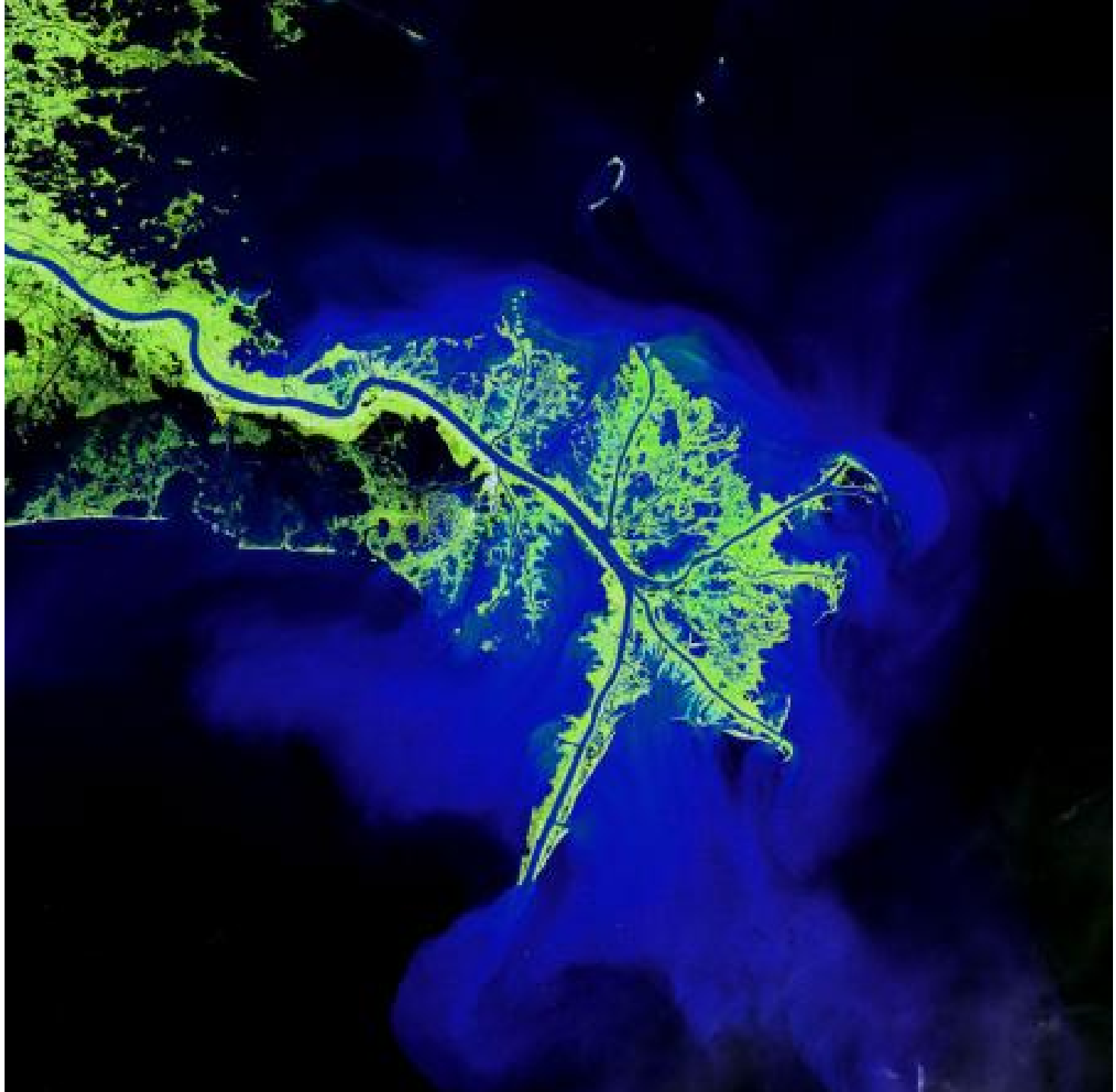
As sediment compacts, sinks and erodes, nothing comes in to replace it.

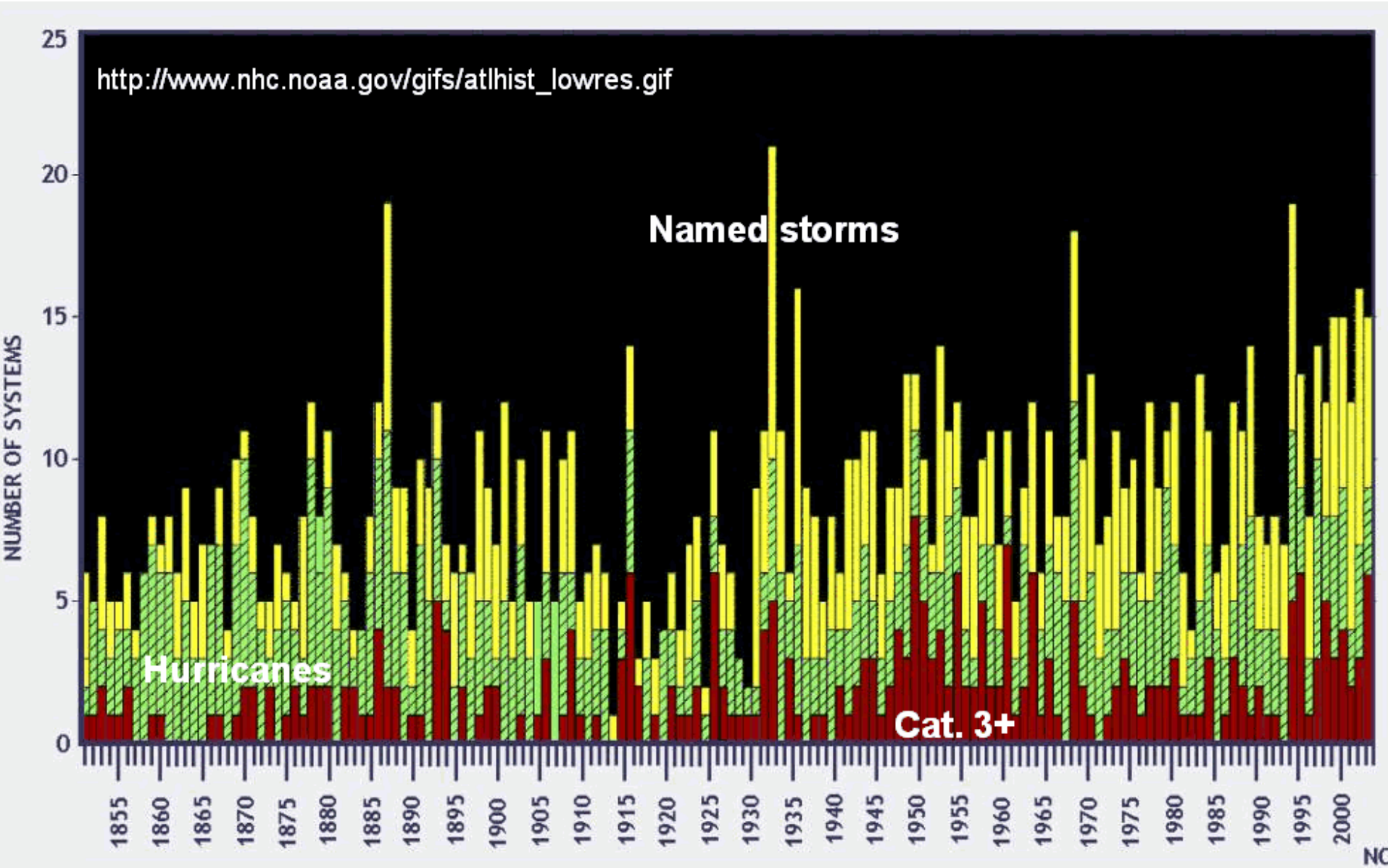
DECONSTRUCTING A COAST

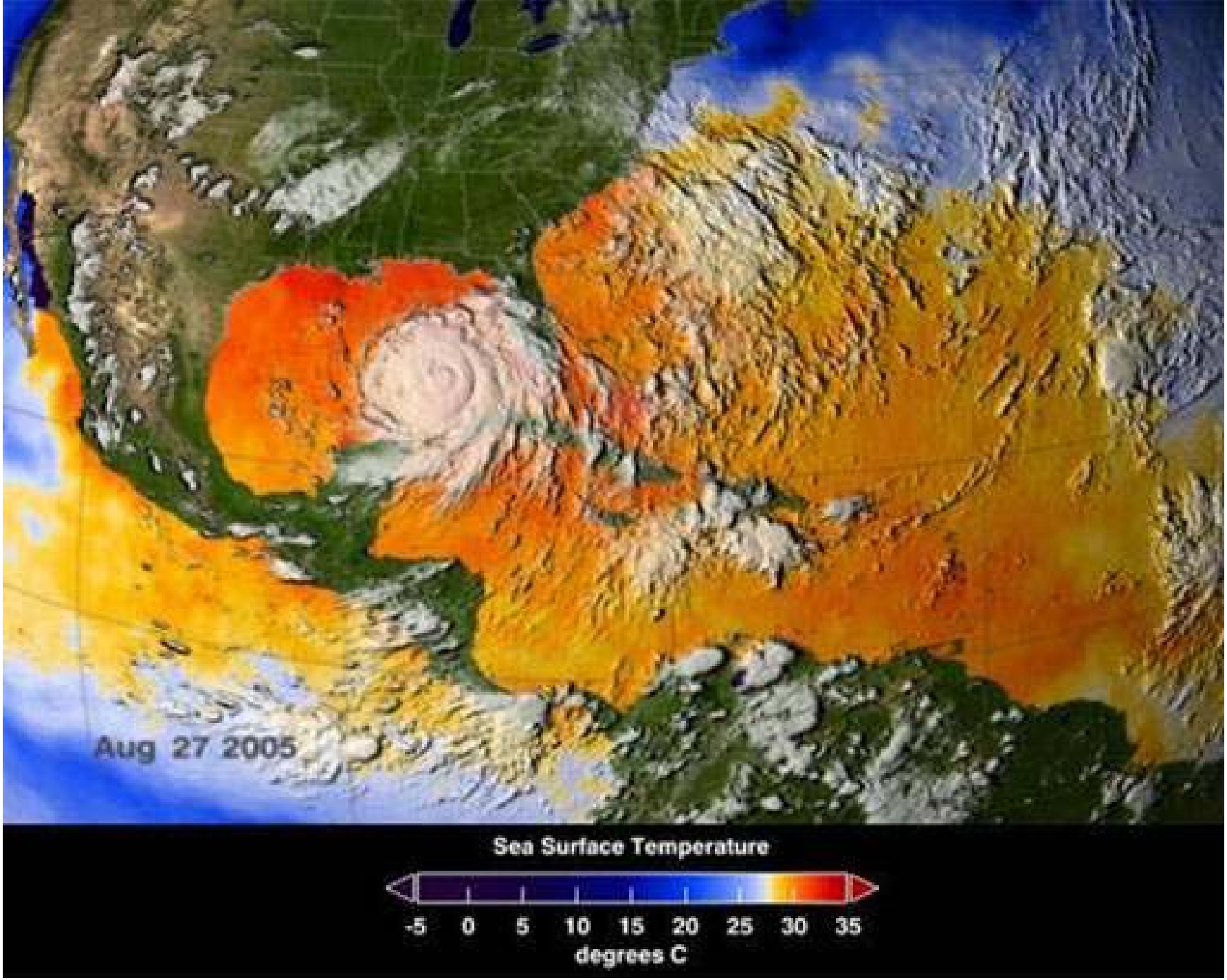


Source: Louisiana Water Resources Research Institute, Louisiana State University






http://www.nhc.noaa.gov/gifs/atlhist_lowres.gif
Named storms
Hurricanes
Cat. 3+
NUMBER OF SYSTEMS
25
20
15
10
5
0
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000


Aug 27 2005
Sea Surface Temperature
-5 0 5 10 15 20 25 30 35
degrees C

List of some things we did

Dammed river – reduced sediment supply, 400 million t/y to 200 t/y

Built artificial levees – reduced nourishment of flood plain

Constrained flow to modern Balize delta – caused delta to build to shelf break, and lose sediment to continental slope

Prevented lobe switching – eliminated sediment supply to other parts of delta plain

Removed water and natural gas – accelerated consolidation of deltaic sediment and subsidence of land surface

Dredged channel – created depressions that act as sediment traps


MEDIOLANENSIS
DUCATUS PARMAE
MARE
SINUS
LIGUSTICUS

Po River

Drains northern Italy

Enters the northeast Adriatic Sea, forming delta in late Holocene

Evidence of lobe switching dated in sediments back to Bronze Age

Sedimentation causes northward migration of delta

Sediment began to enter Venice lagoon to north

Filling of lagoon would have eliminated the "natural moat" protecting the Republic of Venice

Therefore, path of Po River altered to a southward location (1599-1604)

Po River

Drainage basin includes:
south flank of Alps,
north flank of Apennines

Area = 75,000 km^2
(Columbia River = 670,000)

Sediment discharge = 15 million t/y
(Columbia River = 10 million t/y

Po sediment yield (production from square meter of land surface) is much greater than Columbia River basin


2/27/99

Modern Po Delta

Five distributaries, but only one operates during non-flood conditions

Predominant southward transport and accumulation of sediment, which causes northward migration of delta

Po River today

Sediment supply reduced by dams and mined for construction aggregate

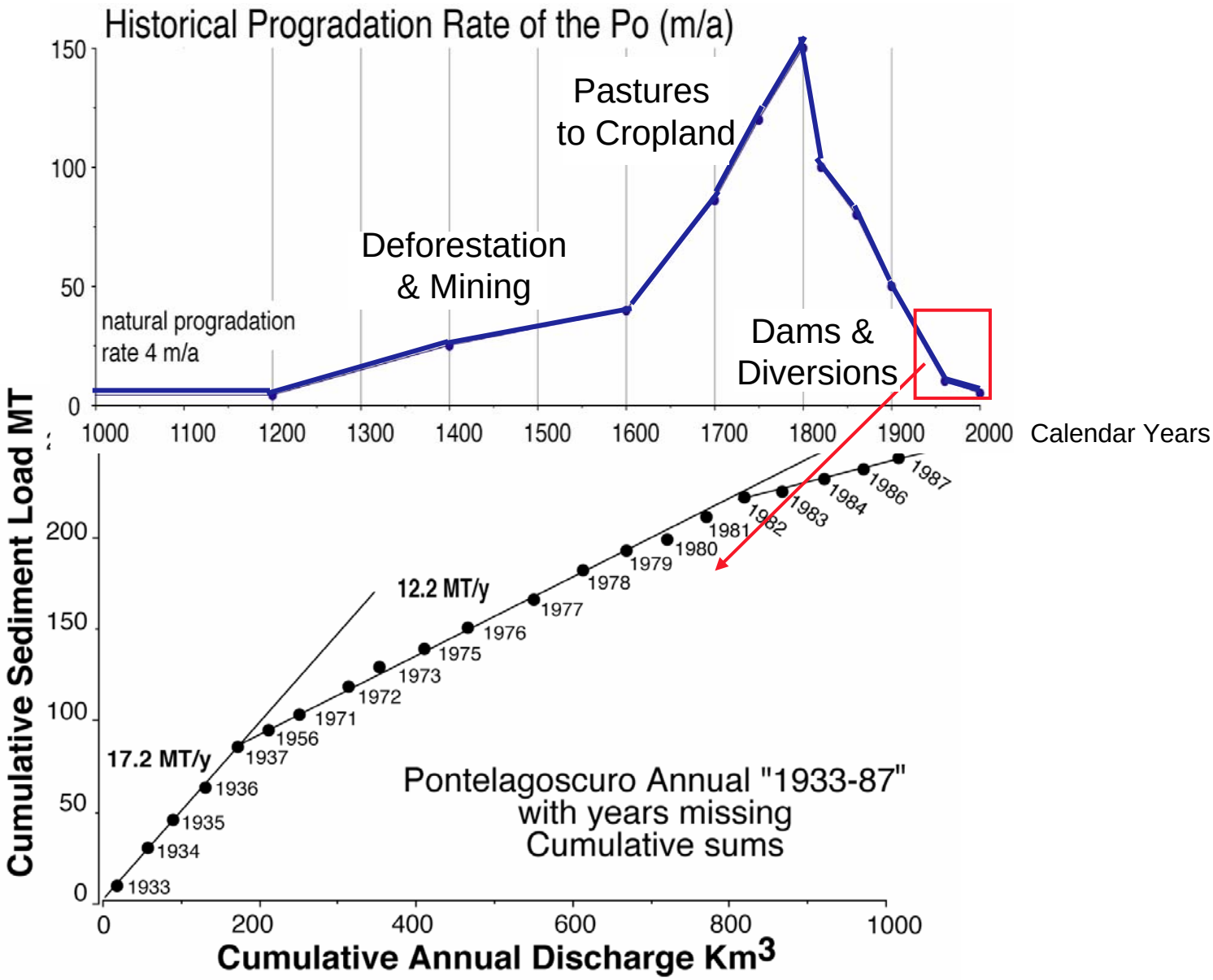
Sediment reaching river is constrained by artificial levees (i.e., does not reach floodplains), and carried to Adriatic Sea

Cuspate delta builds into Adriatic Sea

~50% of sediment discharge

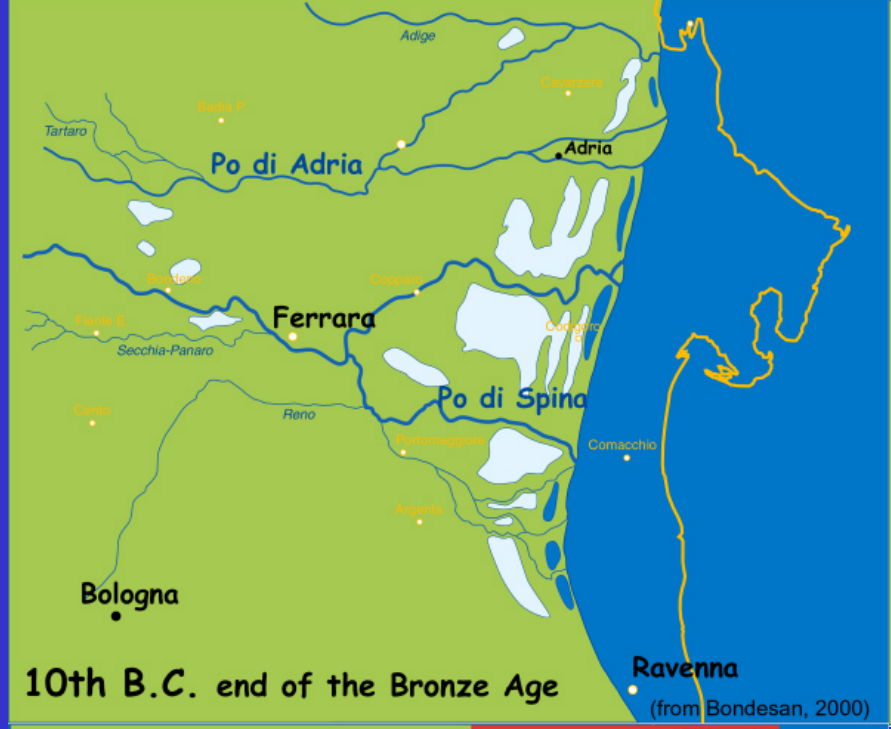
Located far enough south of Venice, sediment carried away

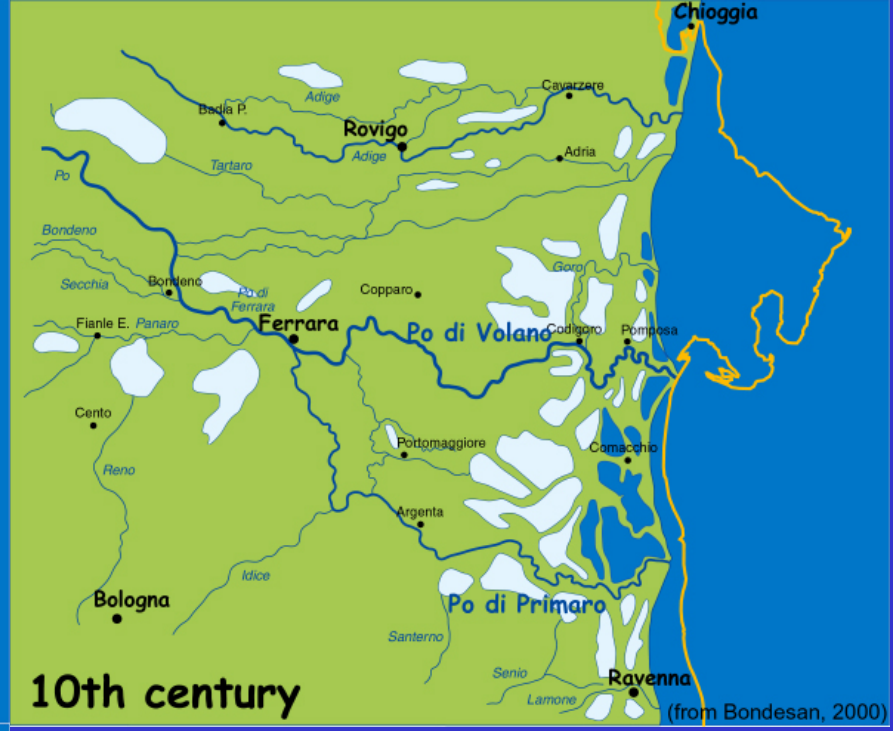
~50% of sediment discharge

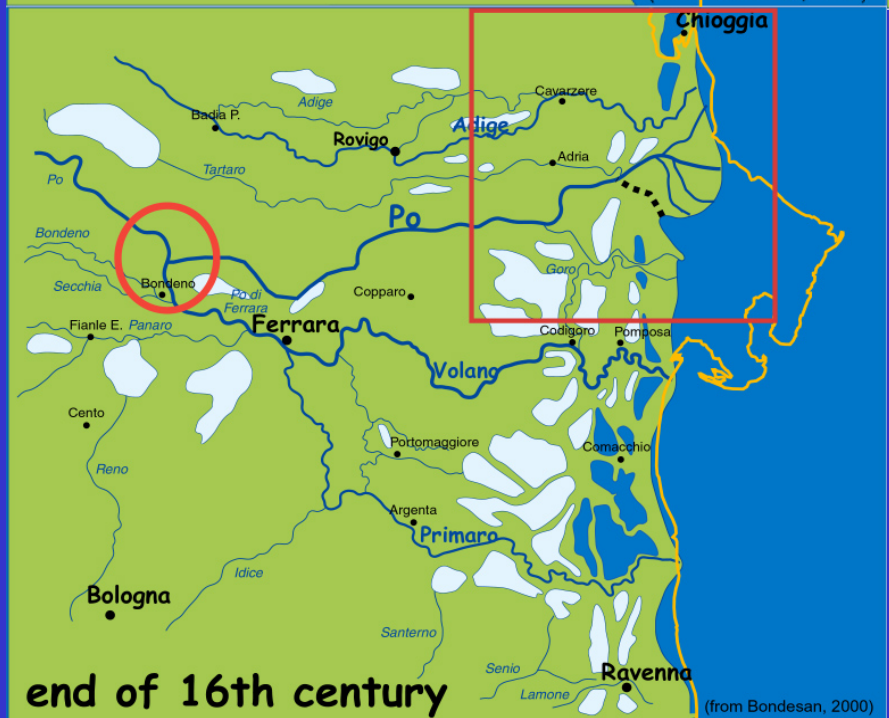

Historical Progradation Rate of the Po (m/a)
150
100
50
0
Pastures
to Cropland
Deforestation
& Mining
natural progradation
rate 4 m/a
Dams &
Diversions
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Calendar Years
Cumulative Sediment Load MT
200
150
100
50
0
12.2 MT/y
17.2 MT/y
1933
1934
1935
1936
1937
1956
1971
1972
1973
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1986
1987
Pontelagoscuro Annual "1933-87"
with years missing
Cumulative sums
0
200
400
600
800
1000
Cumulative Annual Discharge Km3

Ancient Po mouth had many distributaries covering a large area

Flow was not concentrated at a narrow location on coast





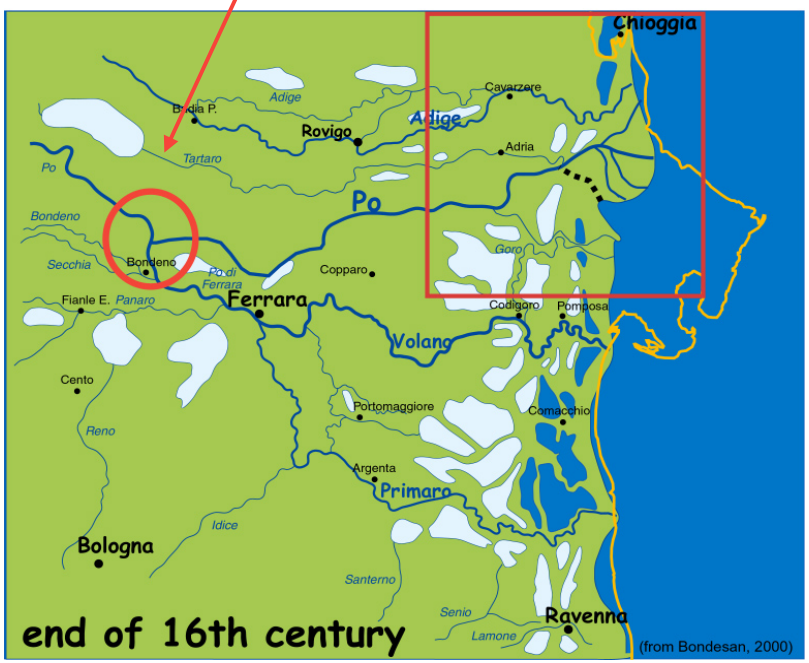


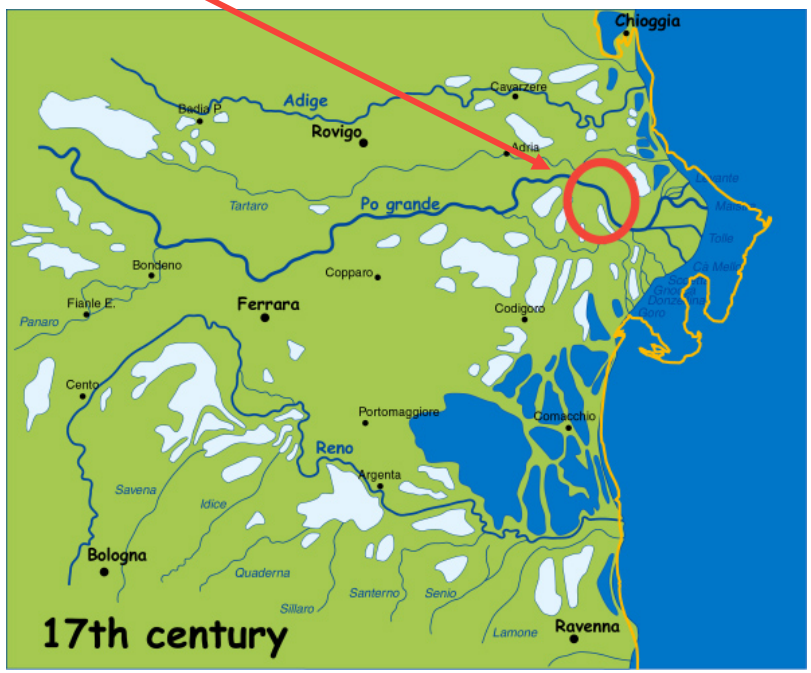
Before human control

- Natural rate of coastal progradation 4 m/y from 1000 B.C. to 1200A.D.
- Seven points of discharge described by Plinio il Vecchio

The artificial form of the modern delta

- abandonment of Po di Primaro
- 1152 AD a major natural avulsion
- northward shifting of distridutary channels
- Venice Republic is threatened by the potential infilling of the lagoon
- 1604 AD digging of a diversionary canal (Taglio di porto Viro)





Result of human changes to Po River mouth

River manipulation caused fast progradation and delta lobe switching

Rapid accumulation of a large amount of sediment caused by confining the Po discharge to a small area

The present delta is artificially held in position within context of the northern Adriatic oceanographic processes

Natural and artificial subsidence are enhanced by levee construction, which prevents overbank sedimentation

River-bed excavation and river damming in the drainage basin during the last 50 years led to a marked decrease in sediment supply

Despite the best intentions of humans...

October 2000 flood