Sustainability: A Global Perspective

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AAEA Conference

November 9, 2018

Sustainability: A Global Perspective

- The Colorado River
- The Mississippi River and the Louisiana Coast
- The Florida Everglades
- The Dallas Upper Chain of Wetlands
- The Wheat Fields of Saudi Arabia – Aquifer Depletion
- The Aral Sea

The Colorado River

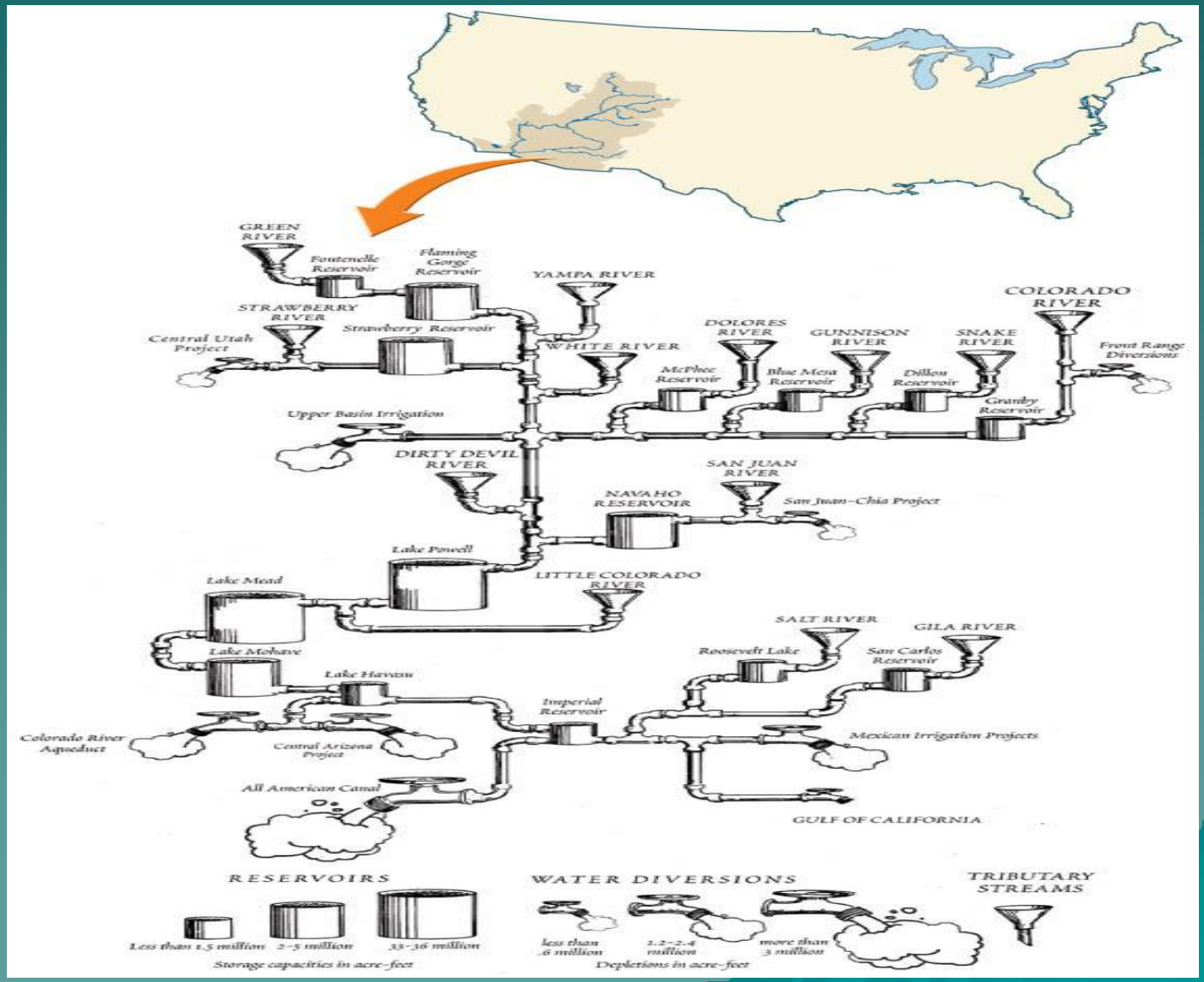
- One of the principal rivers of the Southwestern US
  - 1450 miles long
  - Spans a watershed that covers 7 U.S. States and 2 Mexican states
  - Discharges at the tip of the Sea of California in Mexico

The Colorado River

Colorado River Bed in Mexico

Water Diversion via Aquiducts

The Cause


GREEN RIVER
Fontenelle Reservoir
Flaming Gorge Reservoir
YAMPA RIVER
COLORADO RIVER
STRAWBERRY RIVER
Strawberry Reservoir
Central Utah Project
WHITE RIVER
DOLORES RIVER
GUNNISON RIVER
SNAKE RIVER
Front Range Diversions
McPhee Reservoir
Blue Mesa Reservoir
Dillon Reservoir
Granby Reservoir
Upper Basin Irrigation
DIRTY DEVIL RIVER
SAN JUAN RIVER
NAVAHO RESERVOIR
San Juan–Chia Project
Lake Powell
LITTLE COLORADO RIVER
Lake Mead
SALT RIVER
GILA RIVER
Roosevelt Lake
San Carlos Reservoir
Lake Mohave
Lake Havasu
Imperial Reservoir
Colorado River Aqueduct
Central Arizona Project
Mexican Irrigation Projects
All American Canal
GULF OF CALIFORNIA
RESERVOIRS
Less than 1.5 million
2–5 million
33–36 million
Storage capacities in acre-feet
WATER DIVERSIONS
less than .6 million
1.2–2.4 million
more than 3 million
Depletions in acre-feet
TRIBUTARY STREAMS

The Mississippi River and the Louisiana Coast

- Louisiana loses 65 km^2 (25 mi^2) of coastal wetlands each year
  - These ecosystems support a diversity of animals
  - Protect coastal cities from damaging storms
- Created by sediments deposited at the end of the Mississippi River
  - The river accumulates material from water flowing off of its 3.2 million km^2 (1.2 million mi^2) watershed
- The wetlands naturally compact, sink, and would vanish
  - New sediment is naturally added to maintain them

Starving the Louisiana Coast

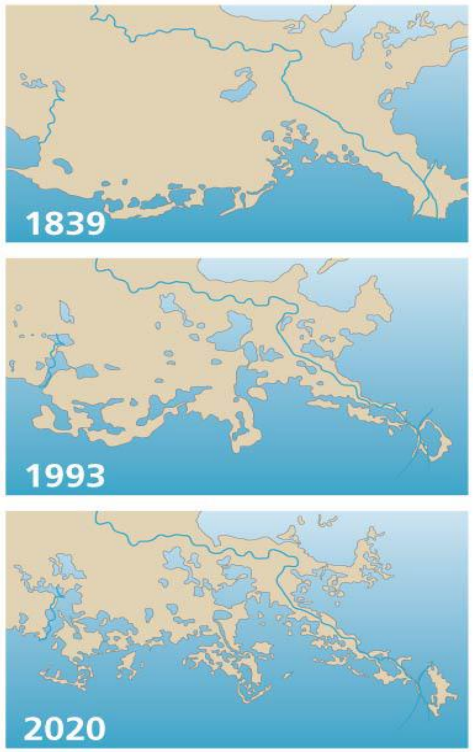
- The Mississippi River has been extensively modified
  - River's basin contains nearly **2000 dams**
  - The dams slow the water, and the sediment drops out
- Levees confine the river, making it deeper and faster
  - Sediments shoot out rather then settle in the wetlands
- Oil and gas extraction has increased the rate of soil compaction

Wetland Area Loss

Loss of Protection against Flooding

Seawater Intrusion

The Outcome …



(a) Coastal wetland area in 1839, 1993, and 2020

(b) Mississippi River watershed

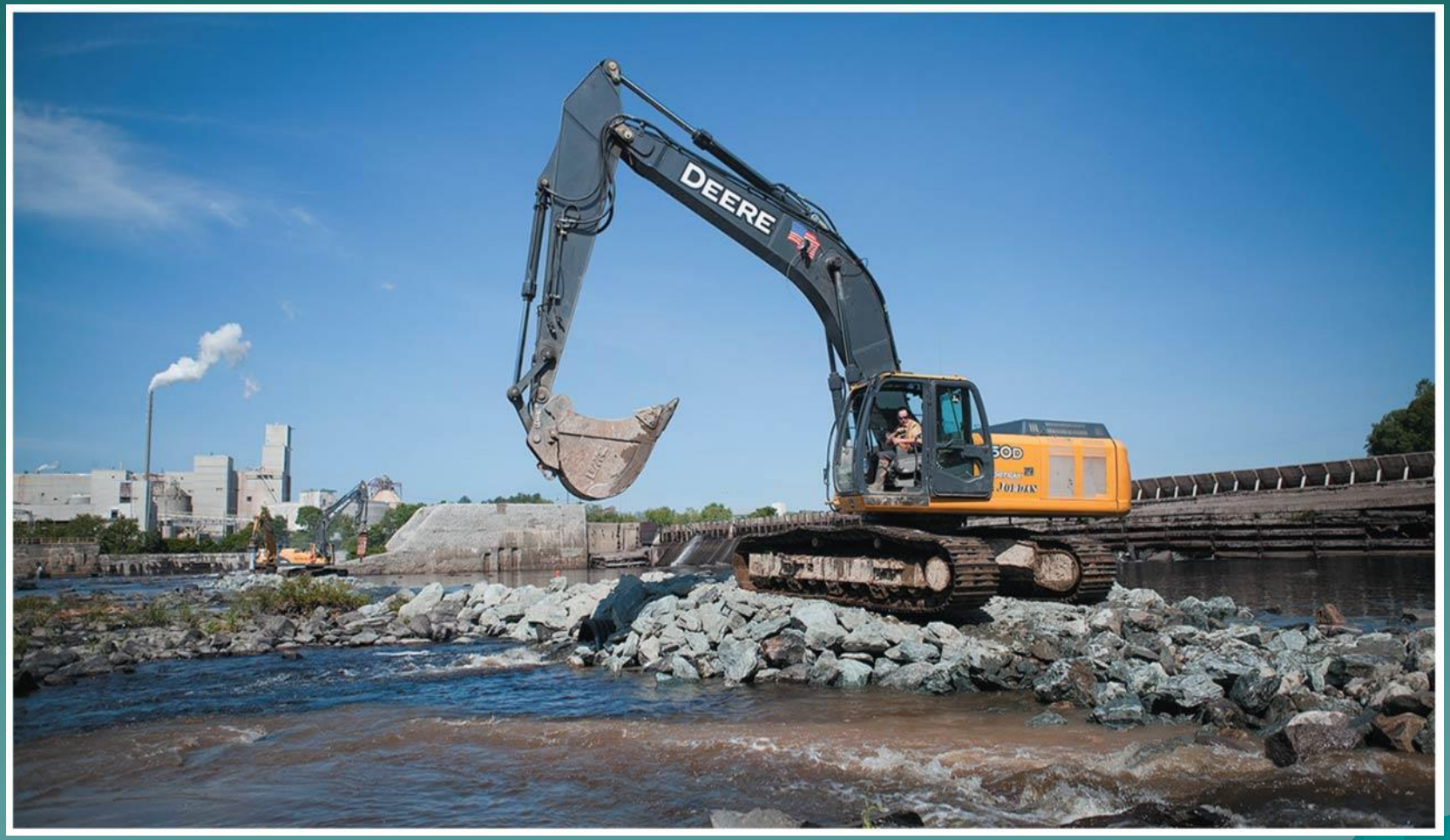
(c) Sediment plumes from Mississippi River entering Gulf

The Solution

- Allow water from the Mississippi into the coastal wetlands rather than shooting it into the Gulf
  - This approach is rebuilding the Atchafalaya delta
- The dismantling of dams if the studies show that the cost of these dams exceeds the benefits
- Better regulation of water releases from dams

The Dismantling of Dams

The Dismantling of Dams



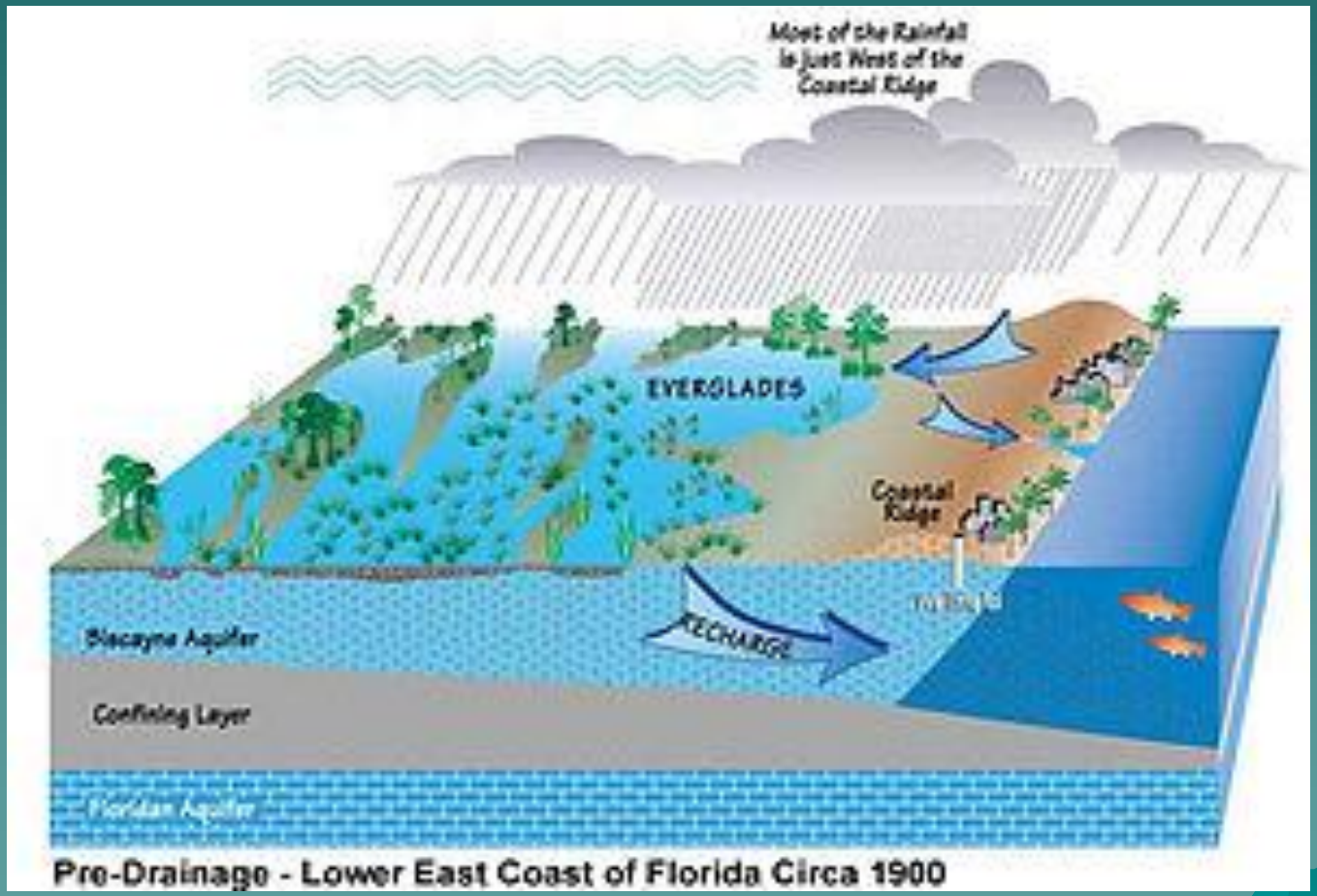
The Florida Everglades

The Florida Everglades Project

- Major flooding from hurricanes in the 1920s to 1940s prompted the establishment of the everglades project.
  - Constructing dikes around Lake Okeechobee
  - Constructing 1400 miles of canals and levees
  - Building Hundreds of pumping stations

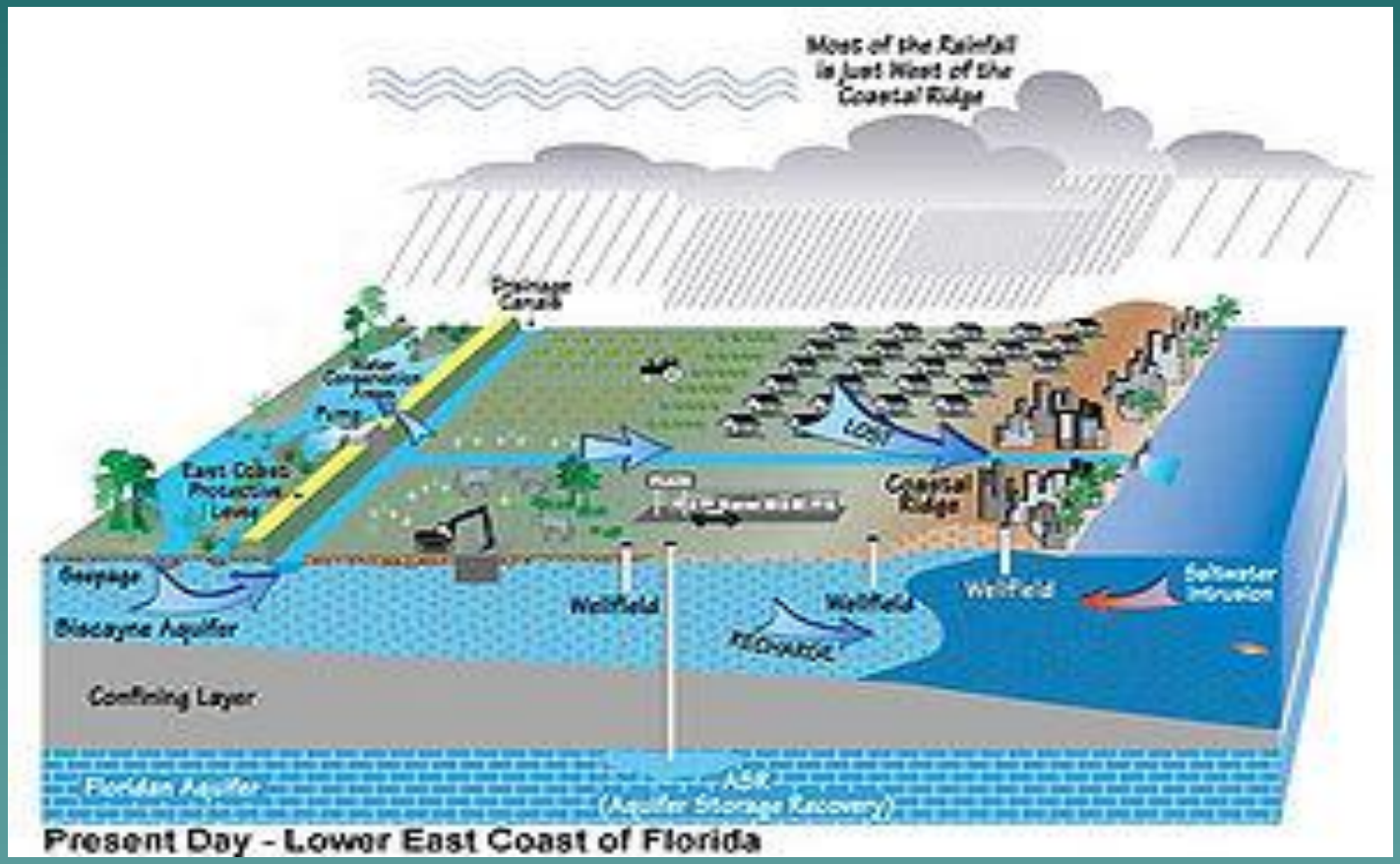
- In 1962 a project to straighten the floodplain of the Kissimmee River that feeds into Lake Okeechobee.
  - A 92-mile winding river is replaced by a 52-mile straight channel
  - Supplanting 45,000 acres of marshland and replacing it with Ag land - ***resulting in the washing of insecticides and pesticides into the everglades***

Pre Drainage – circa 1900



Pre-Drainage - Lower East Coast of Florida Circa 1900

Present Day

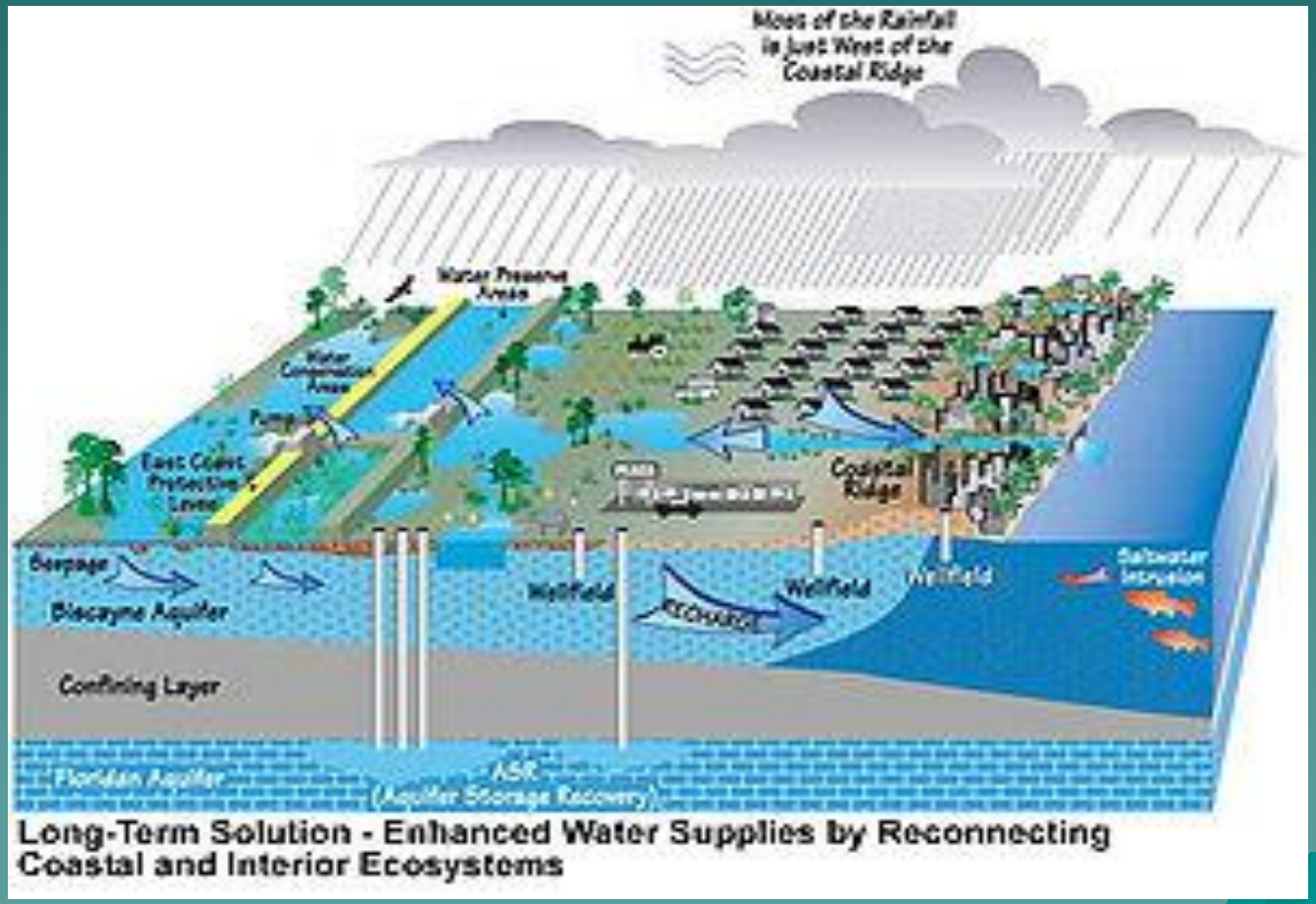


Present Day - Lower East Coast of Florida

The Solution

- Restoring the Everglades
  - Cost: 7.8 Billion Dollars over 20 years

Long Term Solution



Long-Term Solution - Enhanced Water Supplies by Reconnecting Coastal and Interior Ecosystems

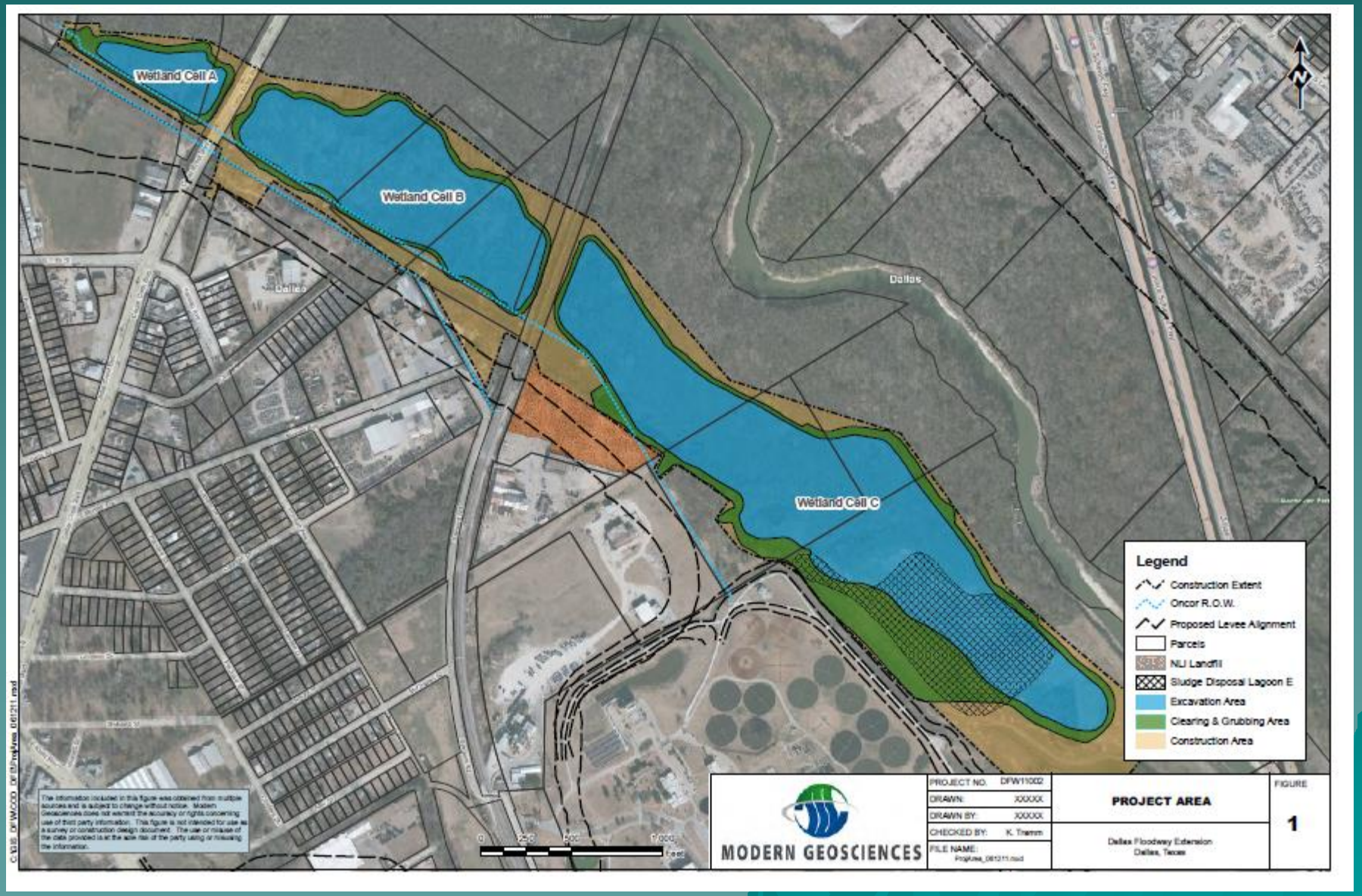
The Dallas Upper Chain of Wetlands

- What used to be wetland areas filled with a variety of industrial solid wastes over an extended period of time. Early to mid 1900s.
  - Lead, Arsenic, and Mercury were among the heavy metals identified in the fills.

- The objective: Remove the contaminated soils and debris and properly dispose of them. As well as render the rehabilitated areas clean enough to restore the wetlands.

- The project cleanup cost: ~ Eight Million Dollars (for cleanup excluding the rehabilitation costs)

UCOW Location

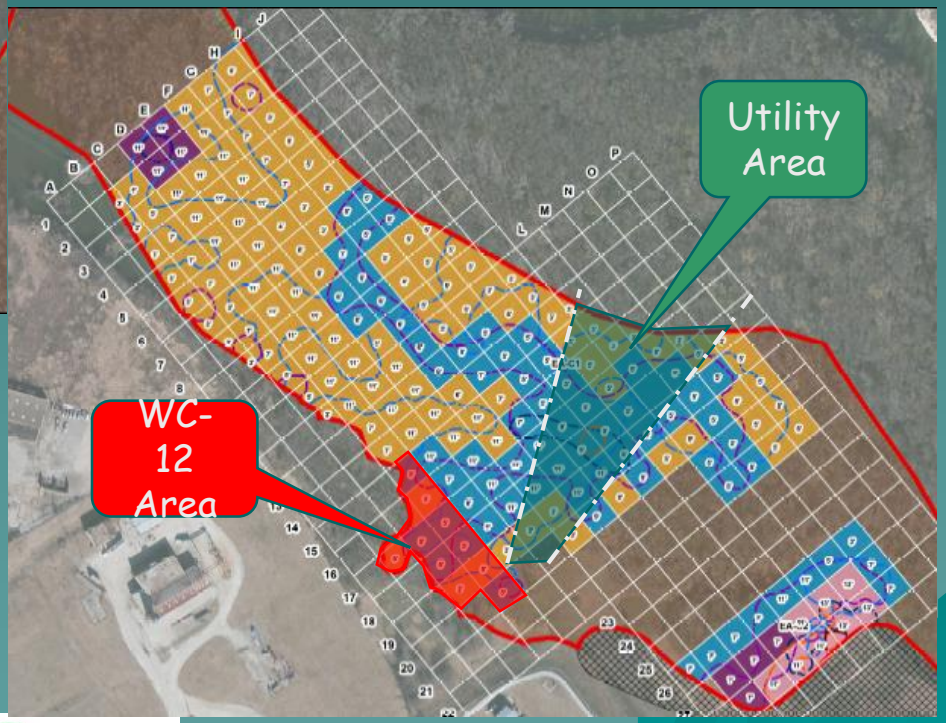


UCOW Waste Characterization

Project Areas

Cell B:
~20,000 cy to remove
COC: Lead
Class 2 NH

Cell C:
~130,000 cy to remove
COCs: Lead, Arsenic, Mercury
Class 2 NH



MAZIDJI GROUP
Civil Engineering & Environmental Professionals

MODERN GEOSCIENCES

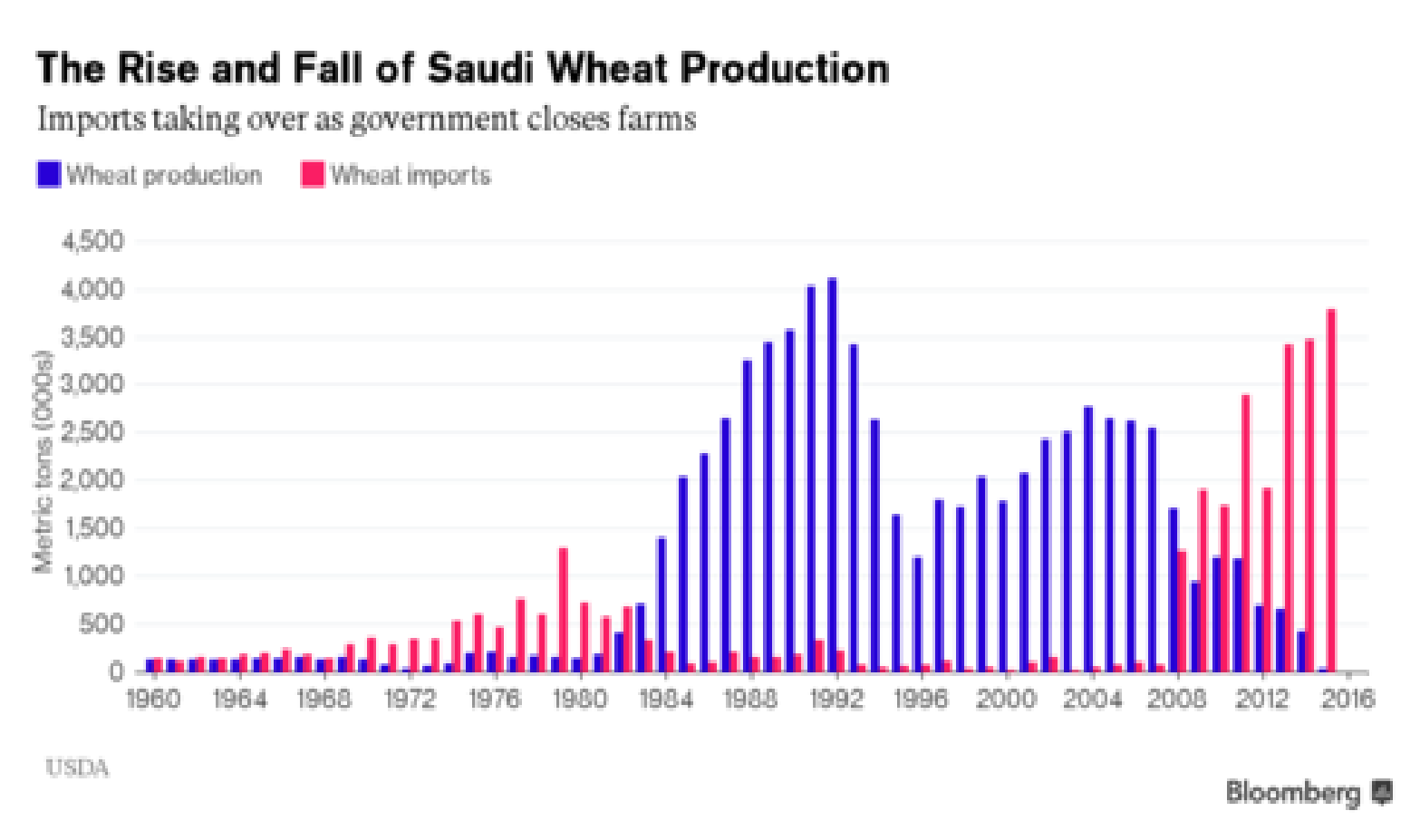
Southwest GEOSCIENCE

The Wheat Fields of Saudi Arabia

- Huge desert areas planted with wheat.
  - Creation of the Center for Research and Development in Arid Countries (RADAC)
  - Experts and Agronomists would shuttle weekly from American University of Beirut and Universities in UTAh to Saudi Arabia to support the project.
- The objective: Self sufficiency

The Wheat Fields of Saudi Arabia

The Wheat Fields of Saudi Arabia

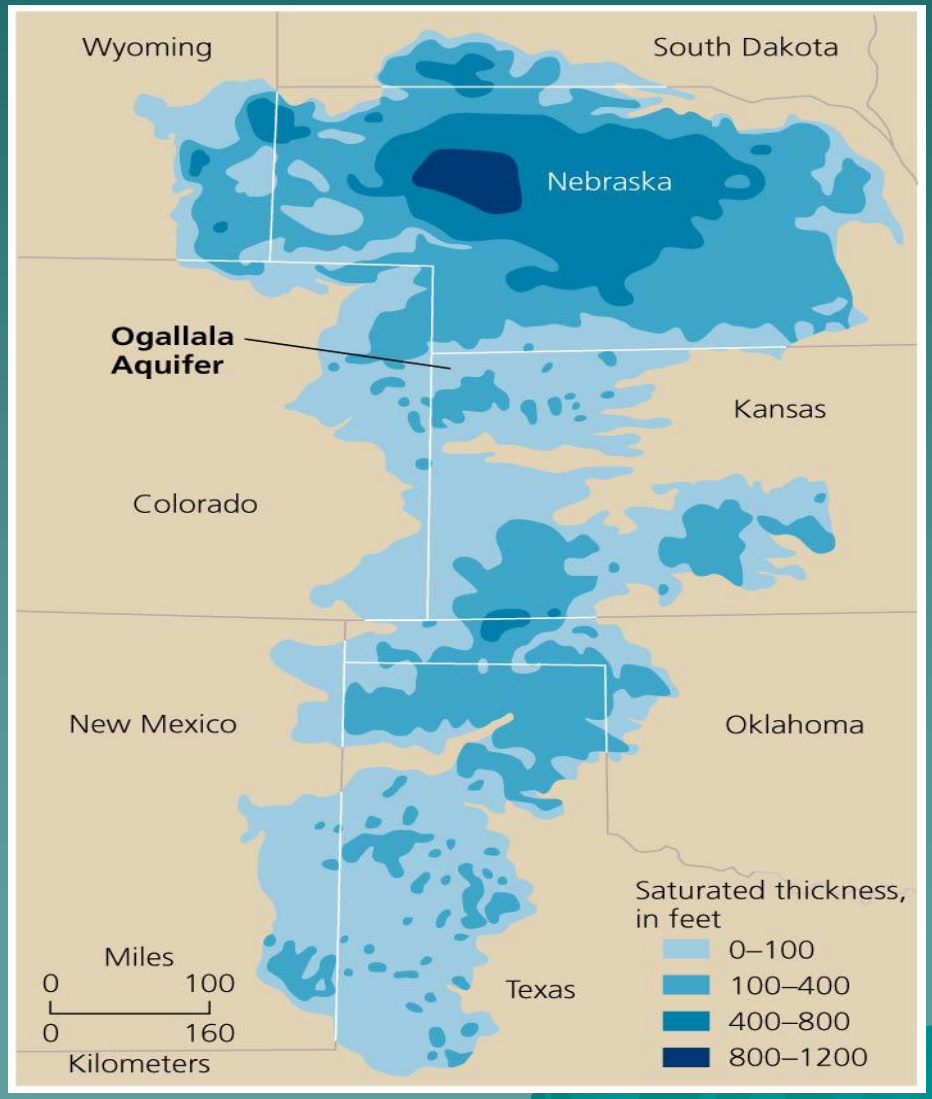


The Wheat Fields of Saudi Arabia

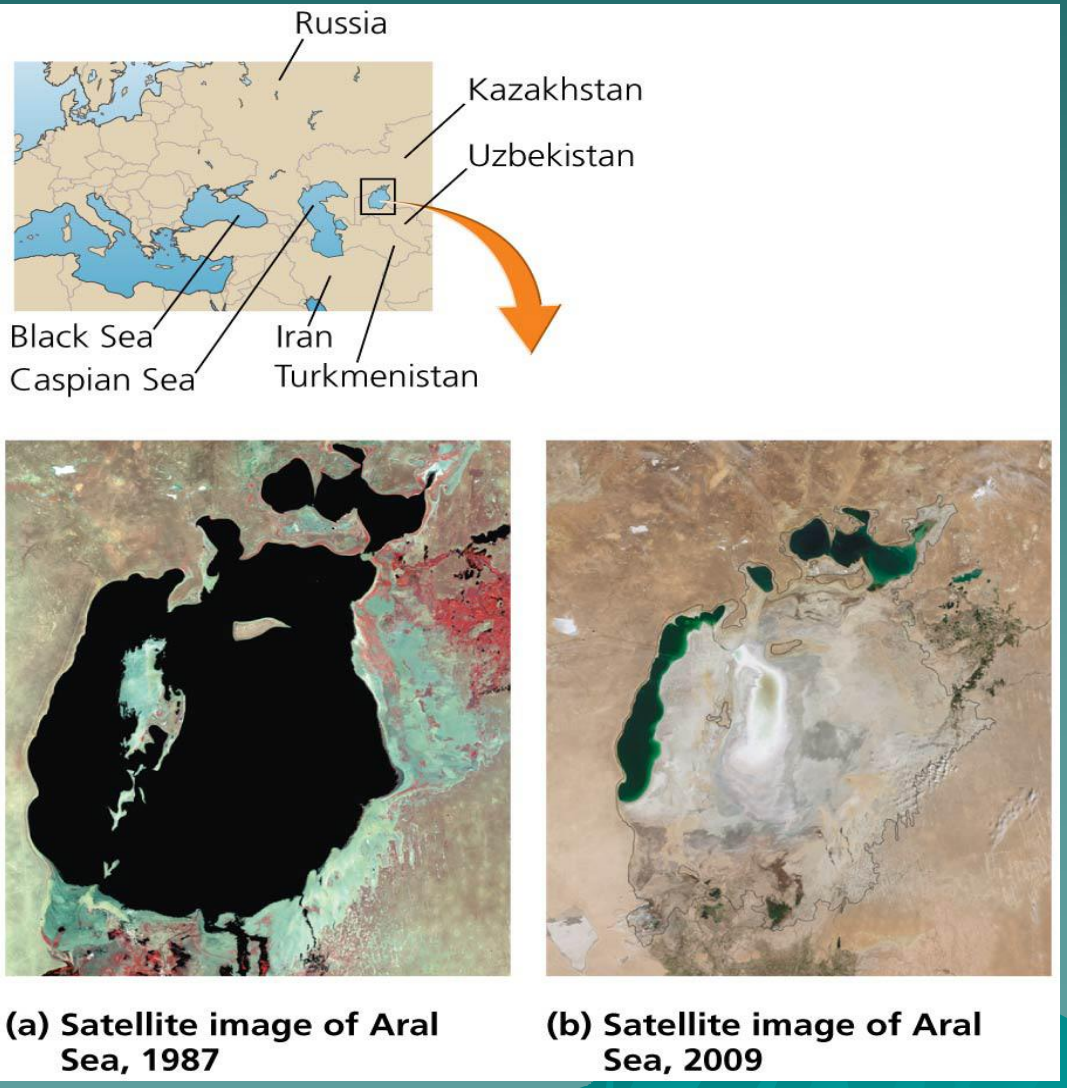
- The Problem:
  - Falling prices of wheat in the world (> $13 / bushel in 2008 to $5 / bushel today)
  - With self-sufficiency, the program became a victim of its own success with a quick depletion of the aquifer that has not been filled since ice age with a substantial impact on oases and other water bodies

- The Solution: Policy reversal and the importation of wheat, sorghum, and corn

The Ogalala Aquifer



The Aral Sea



(a) Satellite image of Aral Sea, 1987

(b) Satellite image of Aral Sea, 2009

Conclusion

- Before undertaking major projects, environmental impacts must be considered
- Conduct simulation and modelling studies to evaluate the impact in 50 – 100 years down the road
- Design projects to complement natural processes – not to counter these processes ***(John Bunker Sands Project)***
- Major awareness occurring regarding importance of project sustainability
- Major capital project financing worldwide by the World Bank or by the International monetary fund is linked to successfully demonstrating minimal or no impacts on the environment.

John Bunker Sands Wetland Center