Oceans and Coasts Ecosystem Health: Priority Issues in the Gulf of Mexico and Mexico´s Caribbean Sea

1) POLLUTION
   a. Hypoxia
   b. Nutrients
   c. Eutrophication & algal blooms
   d. Oil spills
   e. Microplastics

2) LIVING MARINE RESOURCES
   a. Illegal fishing, Ghost fishing, IUU
   b. Invasive species, noise pollution

3) CLIMATE CHANGE (Hydrometeorological extreme events, hurricanes, flooding, sea leverl rise, erosion, storm surge)

Pollution is not just hazardous chemicals--

Pollution -"the introduction by man, directly or indirectly, of substances or energy into the marine environment, resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fisheries, impairment of quality for use of seawater, and reduction of amenities."

(GESAMP, Joint Group of Experts on the Scientific Aspects of Marine Pollution, a United Nations sponsored advisory group)

The list of pollutants grows, *many are persistent, and they influence social and natural ecosystems, especially in populated, coastal urban areas.*

- Organic loading, waste products
- Greenhouse gasses
- Pathogens
- Petroleum hydrocarbons
- Polycyclic aromatic hydrocarbons
- Halogenated hydrocarbons
- Heavy metals
- Nutrients
- Radionuclides
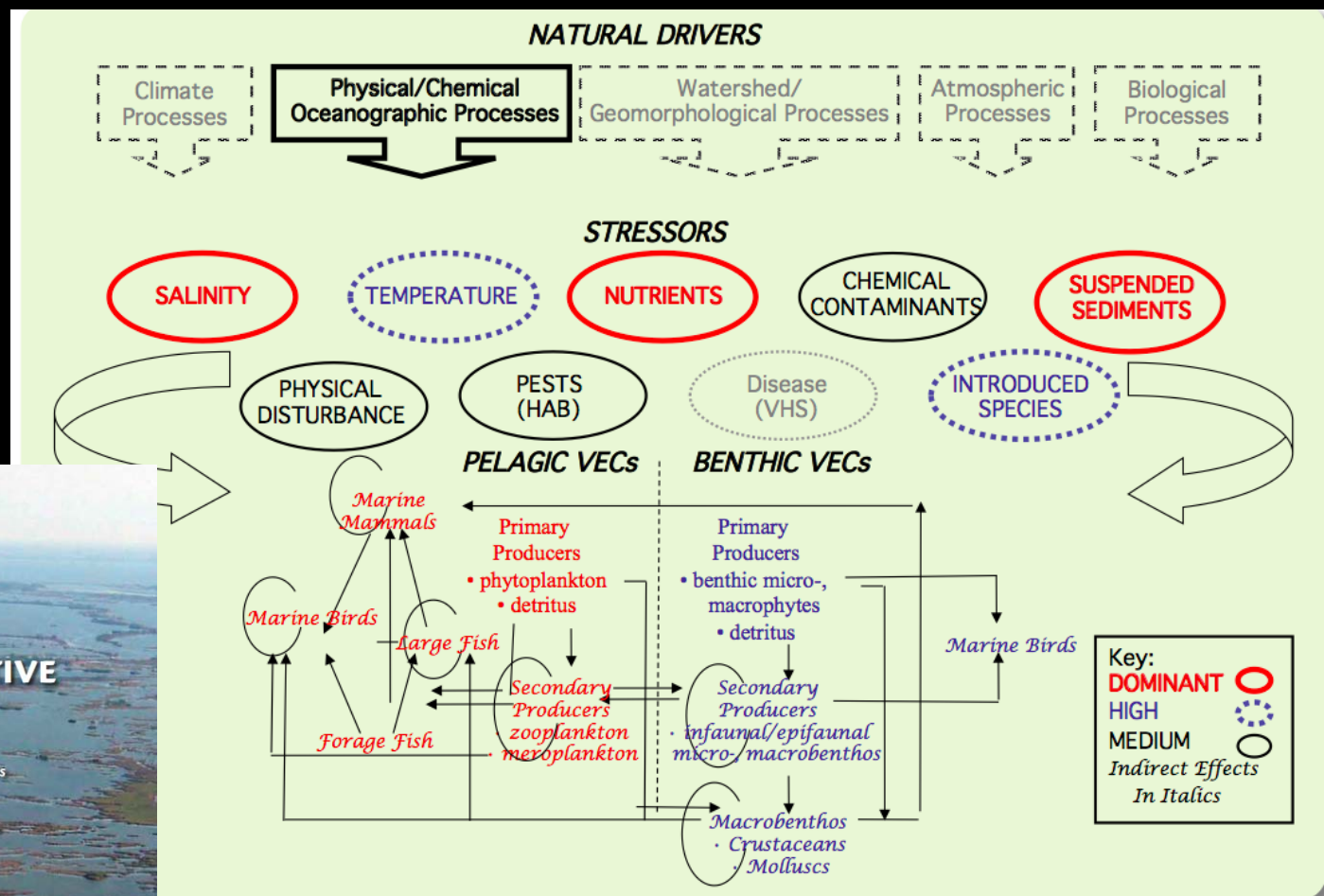- Endocrine disruptors
- Litter
- Light
- Noise

NATURAL DRIVERS

| Climate Processes | **Physical/Chemical Oceanographic Processes** | Watershed/ Geomorphological Processes | Atmospheric Processes | Biological Processes |

STRESSORS

SALINITY   TEMPERATURE   NUTRIENTS   CHEMICAL CONTAMINANTS   SUSPENDED SEDIMENTS

PHYSICAL DISTURBANCE   PESTS (HAB)   Disease (VHS)   INTRODUCED SPECIES

PELAGIC VECs   **BENTHIC VECs**

Marine Mammals

Primary Producers
• phytoplankton
• detritus

Primary Producers
• benthic micro-, macrophytes
• detritus

Marine Birds

Large Fish

Marine Birds

Secondary Producers
zooplankton
meroplankton

Secondary Producers
• infaunal/epifaunal micro-/macrobenthos

Forage Fish

Macrobenthos
· Crustaceans
· Molluscs

Key:
DOMINANT
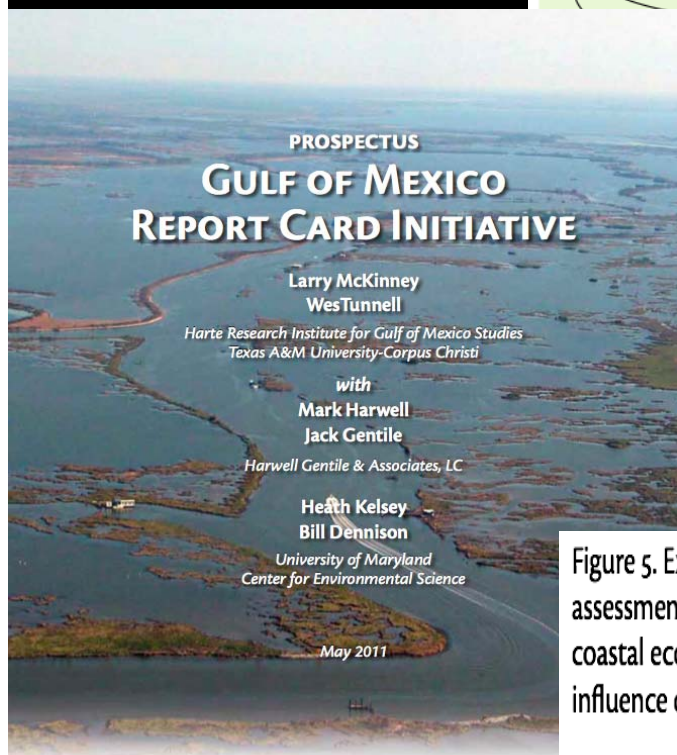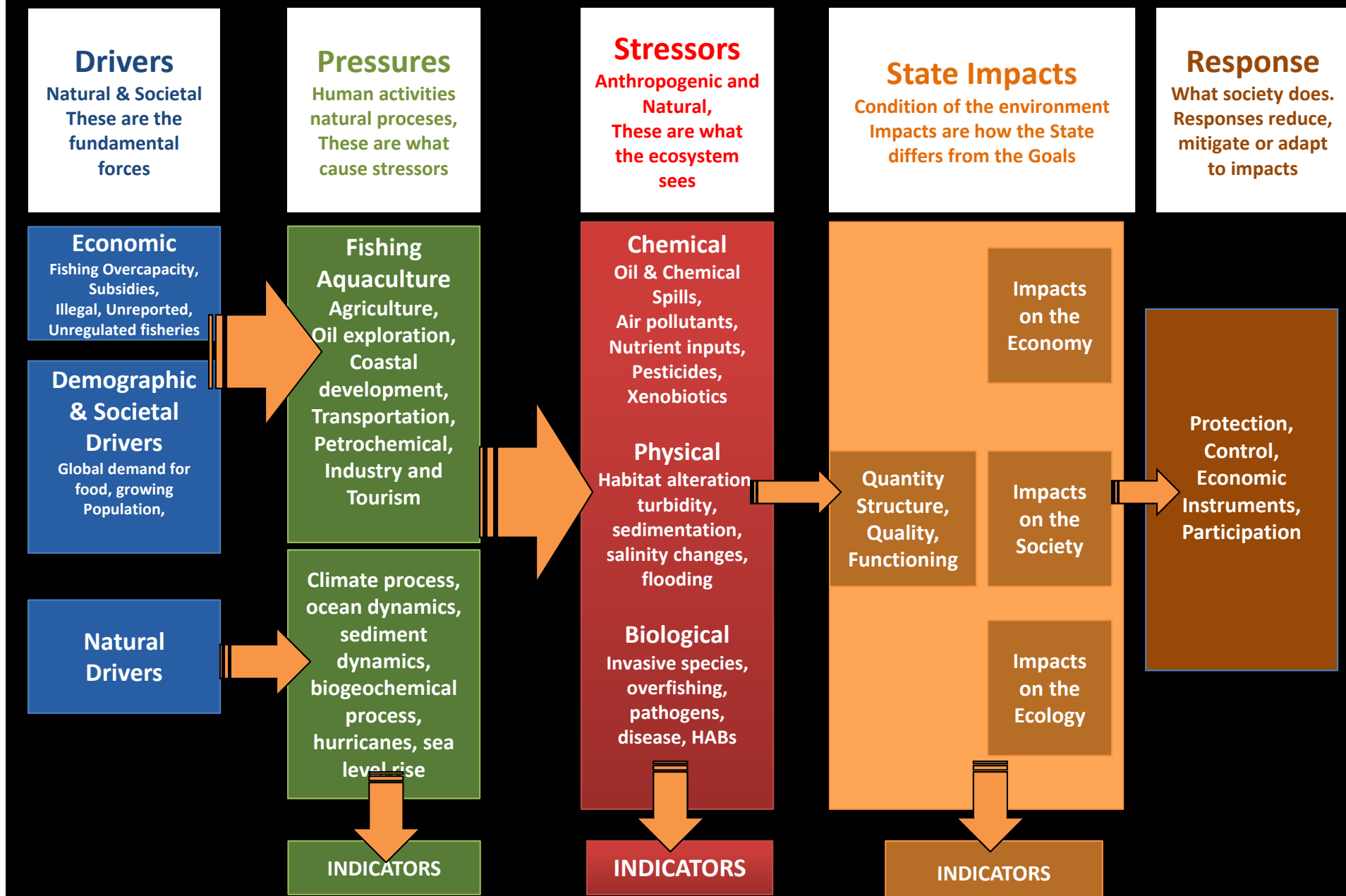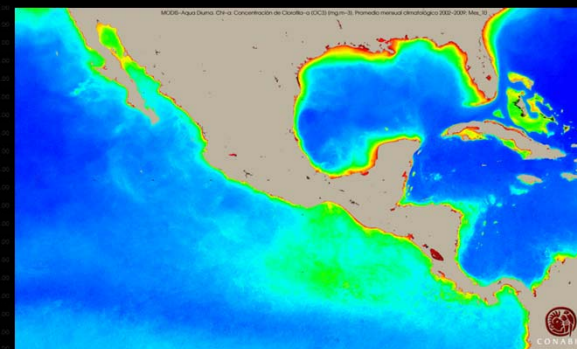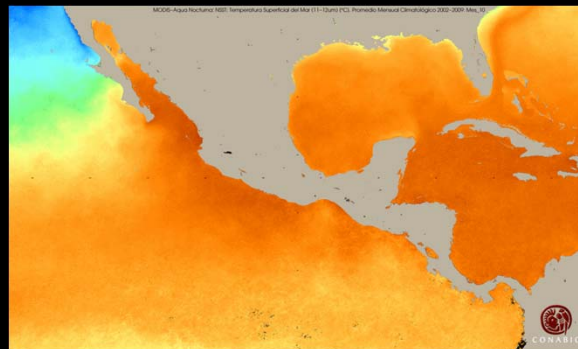HIGH
MEDIUM
*Indirect Effects
In Italics*

Figure 5. Example Conceptual Ecosystem Model of Prince William Sound and the Gulf of Alaska. This illustrates an ecological risk assessment-based conceptual ecosystem model, integrated with a trophodynamical conceptual model, as applied to a large-scale coastal ecosystem (from Harwell MA, Gentile JH, et al. 2010. A conceptual model of natural and anthropogenic drivers and their influence on the Prince William Sound, Alaska, ecosystem. *Human and Ecological Risk Assessment* 16(4): 672-726).

PROSPECTUS
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May 2011

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE FOR GULF OF MEXICO STUDIES

Developing indicators for the Gulf of Mexico

Drivers
Natural & Societal
These are the fundamental forces

Pressures
Human activities natural proceses,
These are what cause stressors

Stressors
Anthropogenic and Natural,
These are what the ecosystem sees

State Impacts
Condition of the environment
Impacts are how the State differs from the Goals

Response
What society does. Responses reduce, mitigate or adapt to impacts

Economic
Fishing Overcapacity, Subsidies, Illegal, Unreported, Unregulated fisheries

Demographic & Societal Drivers
Global demand for food, growing Population,

Natural Drivers

Fishing Aquaculture
Agriculture, Oil exploration, Coastal development, Transportation, Petrochemical, Industry and Tourism

Climate process, ocean dynamics, sediment dynamics, biogeochemical process, hurricanes, sea level rise

Chemical
Oil & Chemical Spills, Air pollutants, Nutrient inputs, Pesticides, Xenobiotics

Physical
Habitat alteration turbidity, sedimentation, salinity changes, flooding

Biological
Invasive species, overfishing, pathogens, disease, HABs

Impacts on the Economy

Quantity Structure, Quality, Functioning

Impacts on the Society

Impacts on the Ecology

Protection, Control, Economic Instruments, Participation

INDICATORS

INDICATORS

INDICATORS

Identified main priorities and challenges under a climate change scenario
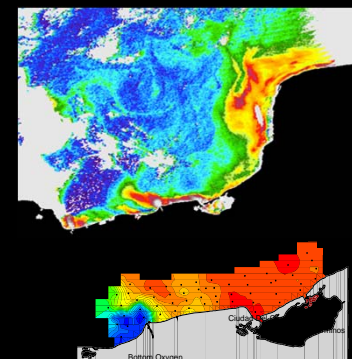
Sea Level Rise Flooding

Storm surge Marine Transgression

Hurricanes

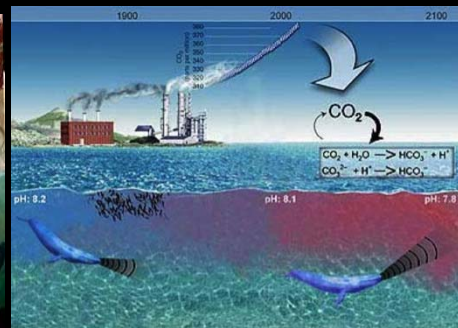**Pollution HABs, Hypoxia, Marine debris**
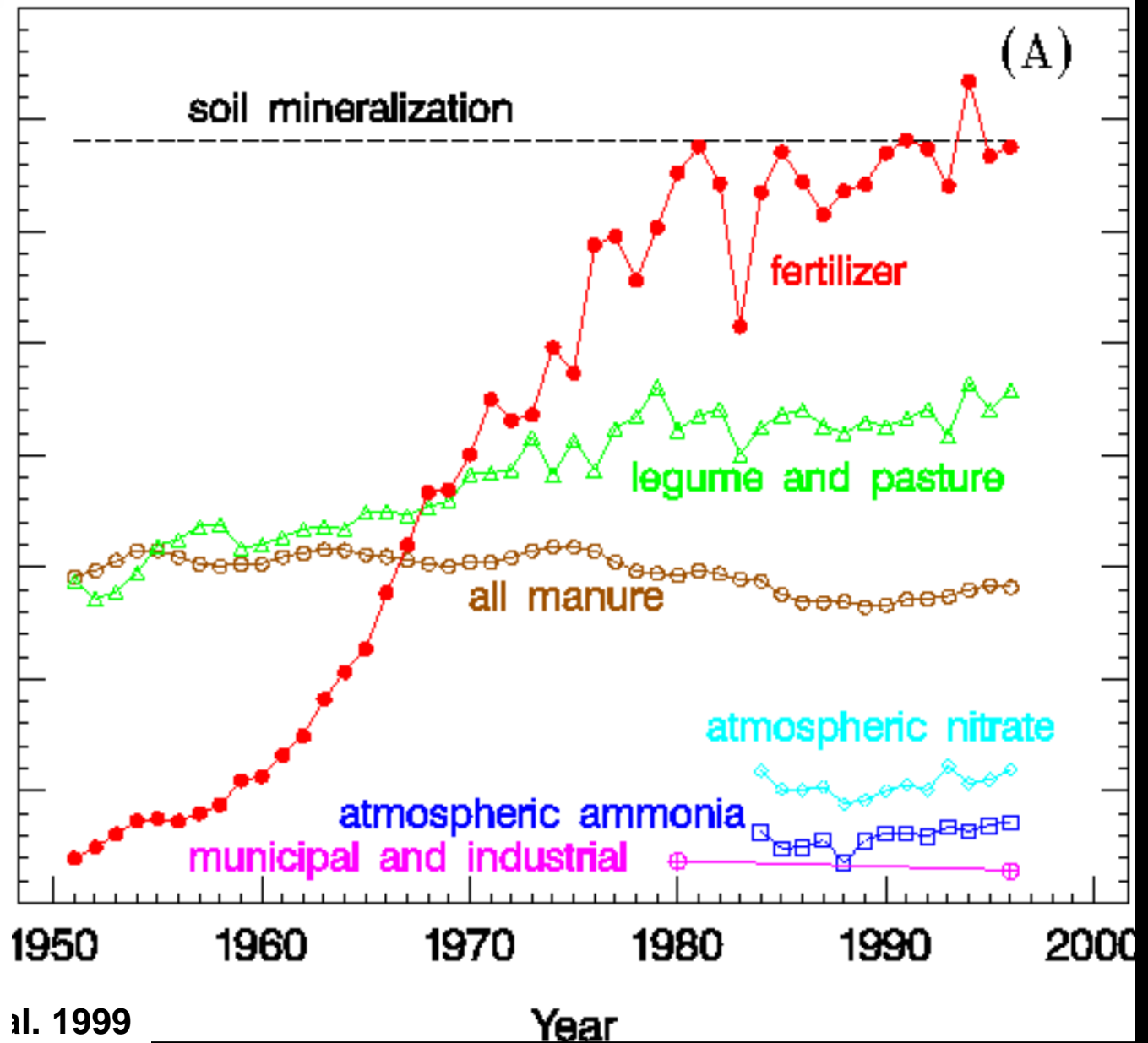
Erosion

Sediment management

Ocean acidification

Invasive species

en Inputs to the Mississippi Watershed

(A)

soil mineralization

fertilizer

legume and pasture

all manure

atmospheric nitrate

atmospheric ammonia

municipal and industrial

al. 1999

Year