

# Sustainability



Main Entry: **sus-tain-able** 🗨️

Pronunciation: s&·stA-n&·b&l

Function: *adjective*

1: capable of being sustained

2 **a**: of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged <*sustainable techniques*> <*sustainable agriculture*> **b**: of or relating to a lifestyle involving the use of sustainable methods <*sustainable society*>

- **sus-tain-abil-i-ty** 🗨️ /-'stA-n&·'bi-l&-tE/ *noun*

- **sus-tain-ably** 🗨️ /-'stA-n&·blE/ *adverb*

## World Commission on Environment and Development "Brundtland Commission"

Our Common Future (1988)

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

## UN Leadership



Rio de Janeiro, 1992

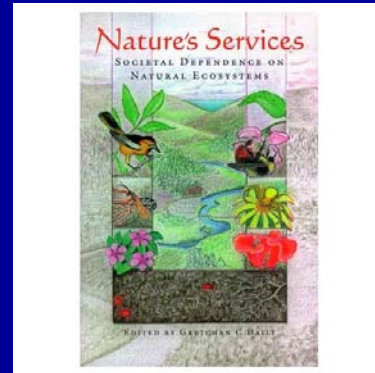


Johannesburg, 2002

- Convention on Biological Diversity;
- Framework Convention on Climate change;
- Principles of Forest Management;
- Agreement to restore world fisheries
- General frameworks for sustainable development



## Resource Wars

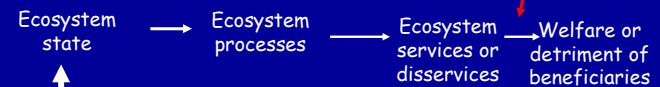


## Ecosystem Services

- The benefits people attain from ecosystems
- The ecological functions that sustain and improve human life

1. Quantify relationship between use, state, and function (ecology, physics, chemistry, etc.)

2. Value ecosystem states (economics)



Ecosystem user

payments or charges

3. Institutional frameworks (politics)

Slide adapted from: Pagiola and Platais, 2005, World Bank

The State of The Nation's Ecosystems 2008

Measuring the Lands, Waters, and Living Resources of the United States

Millennium Ecosystem Assessment

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Guide to the Millennium Assessment Reports

Full Reports

The Working Group assessment reports are between 500-800 pages in length, with a volume of summaries of about 120 printed pages. [Learn more](#)

- Current Status & Trends
- Scenarios
- Policy Responses
- Multi-scale Assessments

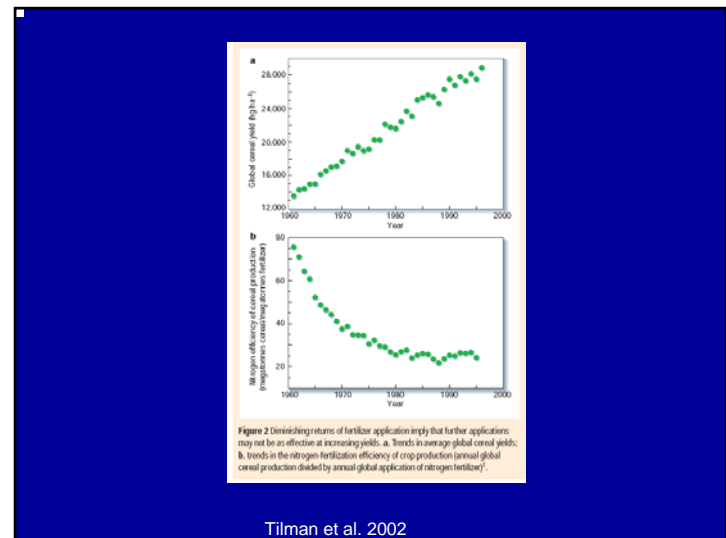
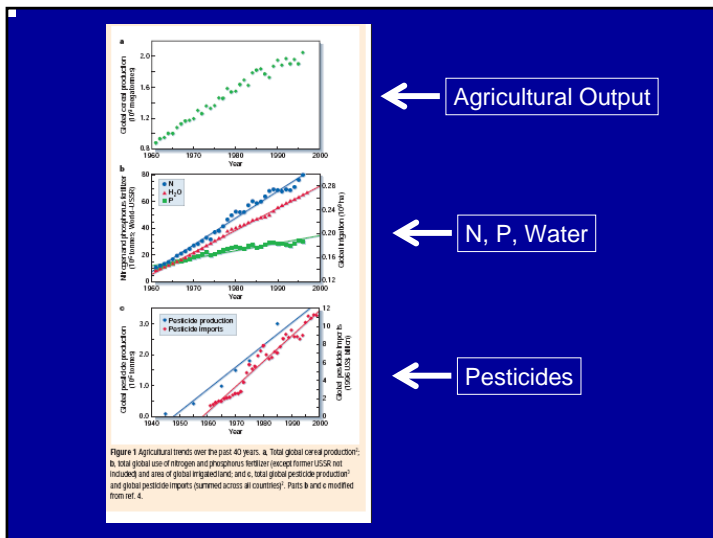
Synthesis Reports

The first set of assessment reports consists of an overall synthesis and 9 others that integrate the MA findings for specific audiences. [Learn more](#)

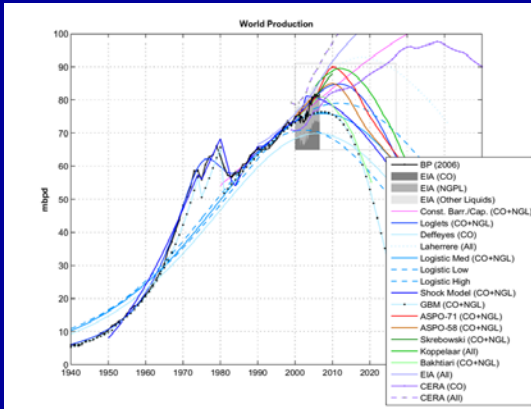
- Overall synthesis
- Biodiversity
- Desertification
- Business & Industry
- Wetlands and Water
- Health

Statement of the MA Board      A Framework for Assessment

- How do we maintain global food security?
  - Given increasing constraints on water, land, fertility, energy, climate change, etc.



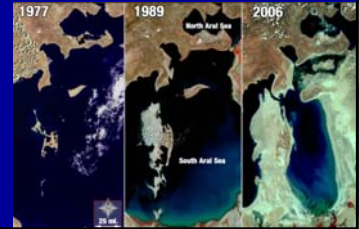
# Oil



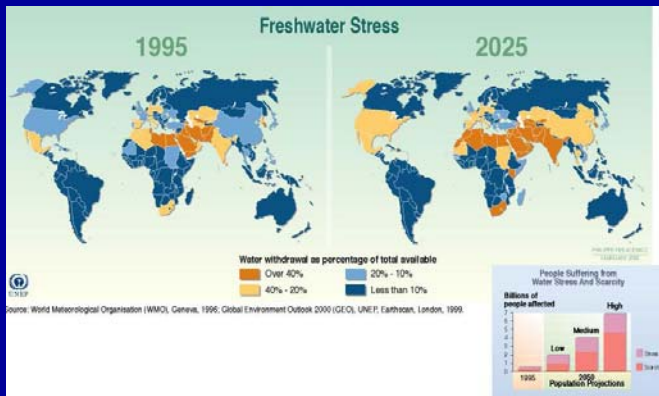
# Water



Aral Sea



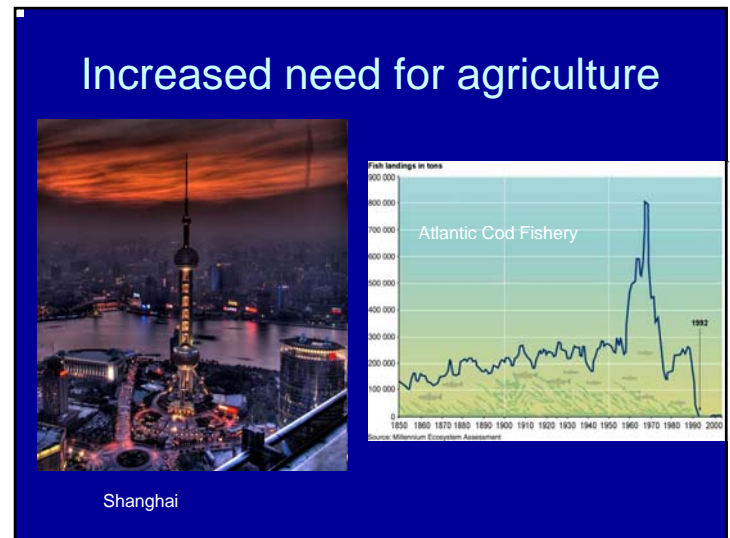
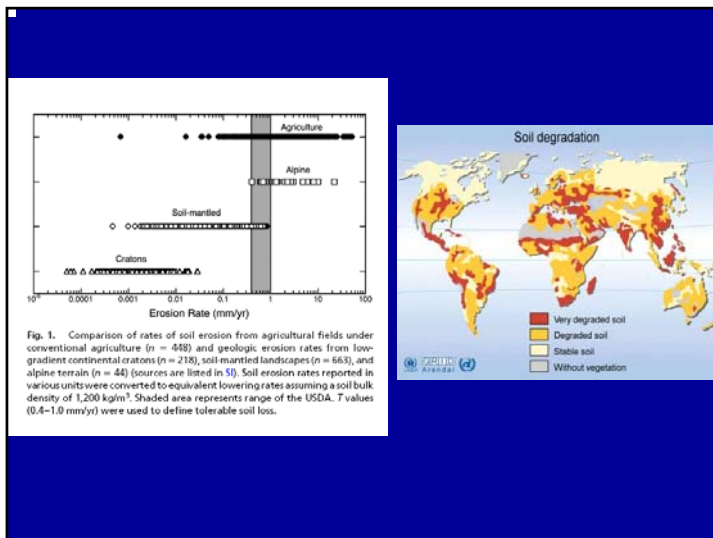
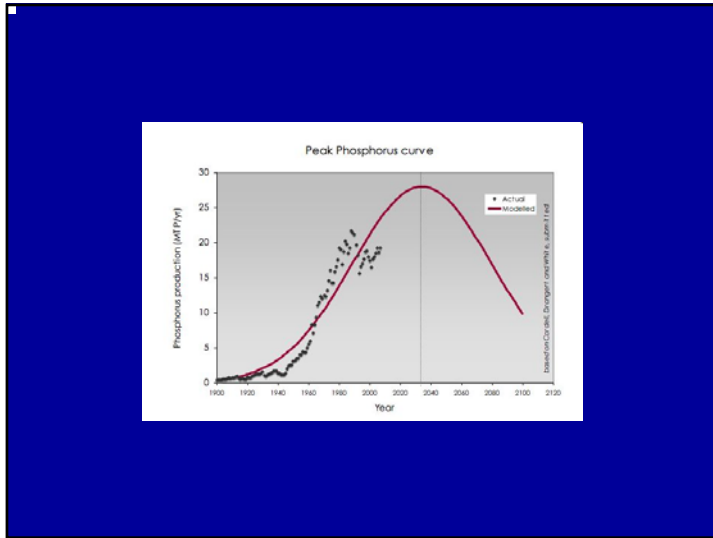
# Freshwater Stress

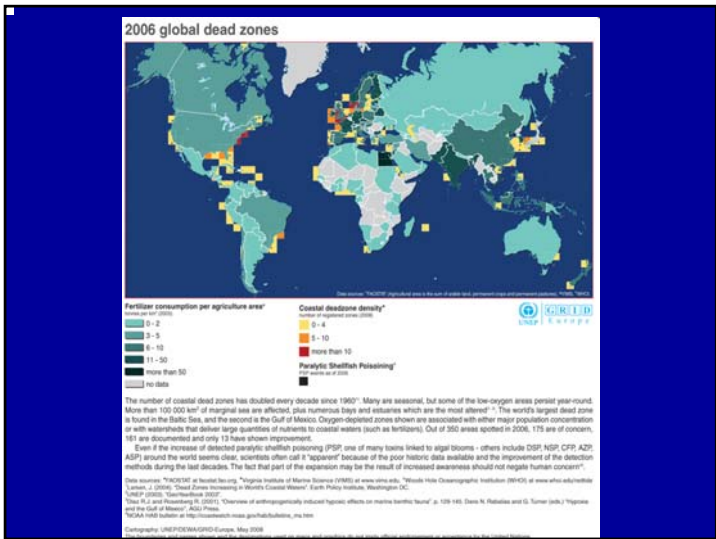
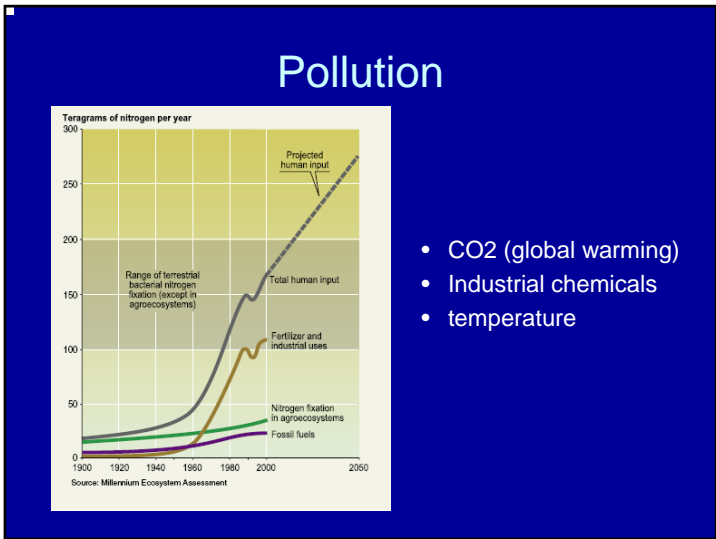
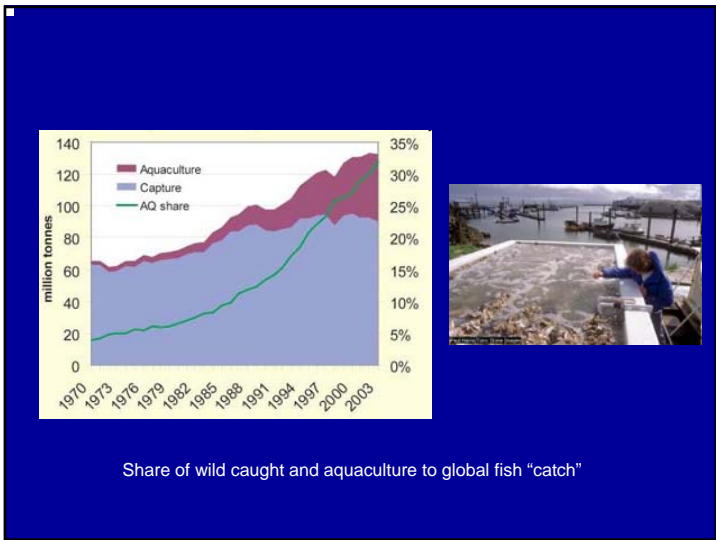


# Phosphorous?

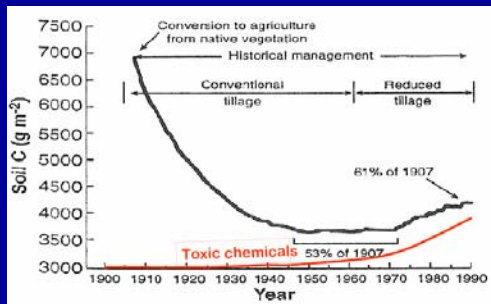


Nauru





## Climate change



## Transporting species



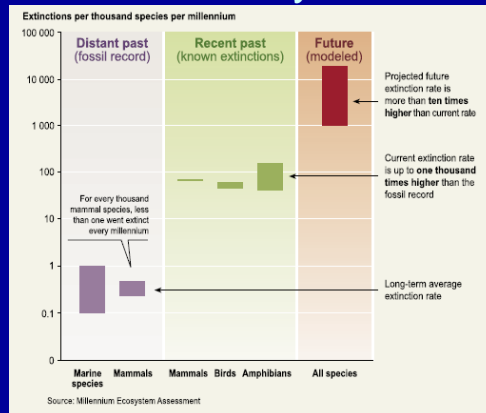
Fig. 2. Earth's shipping lanes and network of roads. Each shipping lane data point represents the location where an expendable probe was dropped for sampling of ocean temperature from 14 October 2004 to 15 October 2005. Shipping lanes map created from data downloaded at [www.joiml.noaa.gov/phaodrlanes/BBXX](http://www.joiml.noaa.gov/phaodrlanes/BBXX) from the SEAS BBXX database of the Global Ocean Observing System Center from the Atlantic Oceanographic and Meteorological Laboratory of the National Oceanic and Atmospheric Administration. The road network is a 1:1 million scale representation of the paved and unpaved roads of the world. Map created from Environmental Systems Research Institute's (ESRI) Digital Chart of the World (DCW) global vectors, created in 1992.

Kareiva et al. 2007



Flu pandemic

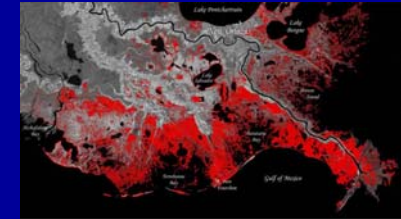
## Biodiversity loss



## Inadvertent loss of ecosystem services



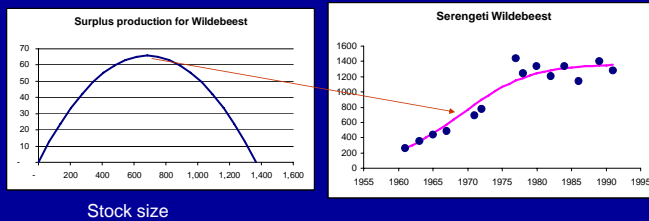
New Orleans, August 2005



Louisiana Wetland Loss between 1932-2060 (in red) of 25-35 square miles per year- source: USGS

## Toward sustainability

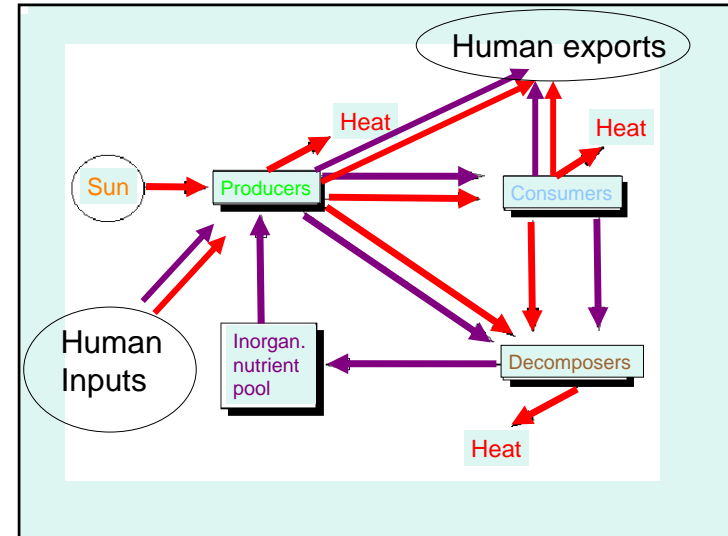
Maximum sustainable yield: about  $\frac{1}{2} k$



British Columbia  
Puget Sound  
Washington  
Columbia River  
Oregon  
California

### % of wild runs compared to 1820

< 3%  
8%  
< 2%  
< 2%  
7%  
5%



## “Life-Cycle” Analysis

Table 1. Energy output/cultural energy input ratios for corn production systems in Mexico (manpower only) and the United States (conventional)<sup>a</sup>

Item	Management system	
	Mexico	United States
	kcal/ha	
A. Cultural energy inputs	553,678	8,390,750
	kg/ha	
B. Grain yield	1,944	7,000
	kcal/ha	
2. Energy	6,901,200	24,500,000
C. Energy output/input ratio	12.5	2.9

<sup>a</sup>Pimentel, 1984.

Examples of ecosystem scale sustainability metrics:

Life cycle analysis  
Ecological footprint

