Future Washington

BIS 358 Winter 2008

Environmental Change:

Climate Change in Context

January 7, 2008

To understand environmental change* of ecosystems we first need to understand ecosystems themselves

* Often referred to as "global change"

A star indicates text has been omitted from the handout slide

What IS an "ecosystem" ?

What IS an "ecosystem" ?

Ecosystems consist of

1.

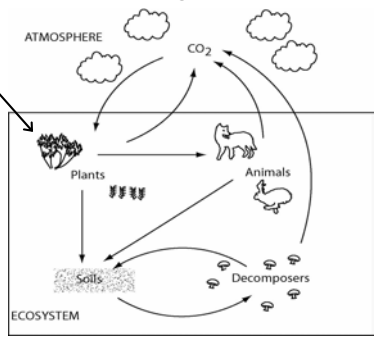
2.

Simple ecosystem model

What is the STUFF?

What are the PROCESSES?

What are the arrows?



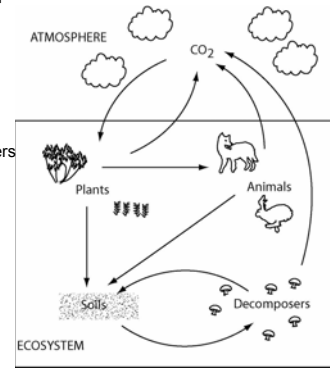
Ecosystem components: the "stuff"

BIOTIC

- Plants (Autotrophs)
- Animals (Heterotrophs) –
  - herbivores, predators, decomposers
- Fungi, Bacteria, etc.

ABIOTIC

- Soil (mineral elements)
- Water (where is it?)
- Atmosphere
- Temperature, etc.



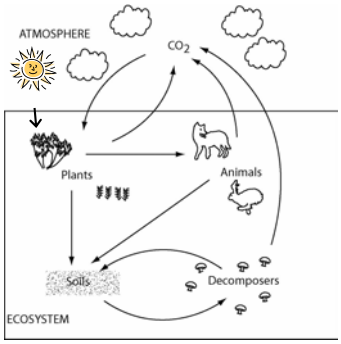
Ecosystem flows: the "processes"

TROPHIC: Energy flow

- Photosynthesis
- Herbivory
- Predation
- Decomposition

NUTRIENT CYCLING: Biogeochemistry

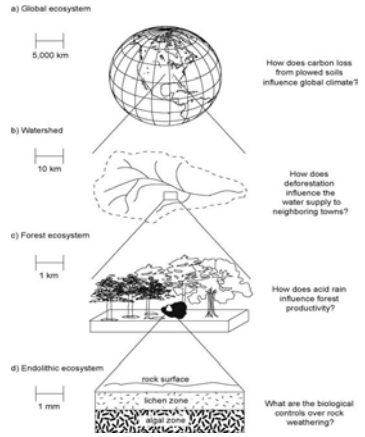
- Carbon cycling
- Nitrogen cycling
- Phosphorus cycling
- Etc.



How big are ecosystems?

Ecosystems vary in size ("spatial scale")

Ecological questions vary accordingly in size



Ecosystems vary in time also

- Seconds:
- Hours:
- Days:
- Seasons:
- Years:
- Decades:
- Centuries:
- Millennia:
- Epochs:

Why should we care about ecosystems?

1.

2.

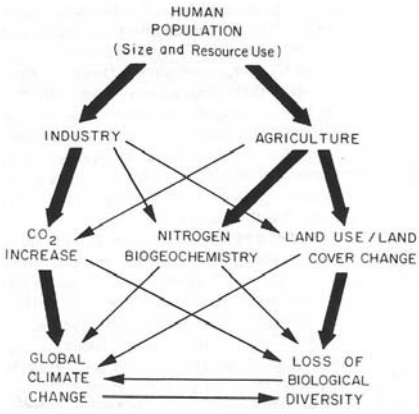
Ecosystems provide humans:

_____ _____

Human Impacts on Ecosystems

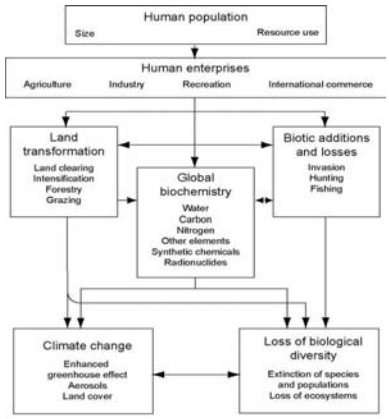



Anthropogenic Global Changes



Vitousek 1994

A slightly expanded look at global change



Vitousek et al. 1997

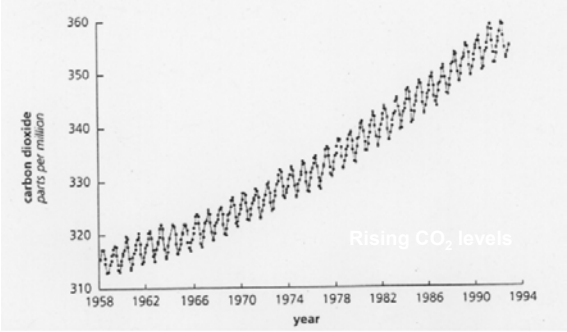
Global changes

- **Atmospheric Composition**
  - direct effects
  - climatic change
- **Nutrient cycles**
- **Species invasions**
- **Land use change**
  - type
  - intensity
- **Loss of biodiversity**

Global changes

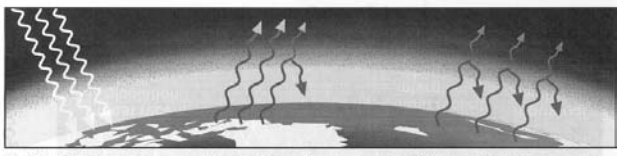
- **Atmospheric Composition**
  - direct effects
  - climatic change
    - **Carbon dioxide**
    - **Methane**
    - **Nitrous oxide**
    - **Ozone**
    - **Particulates**
    - **Water Vapor**
    - **Etc.**
- **Air pollutants & human health**
- **Acid precipitation**
- **Particulates**
- **Ozone**
- Etc.

Climate Change



Schlesinger 1997

Enhanced Greenhouse Effect



1. Sunlight warms earth's surface.
2. Earth's surface radiates heat.
3. When greenhouse gases build up, more heat is trapped near earth's surface.

Starr and Taggart 1997

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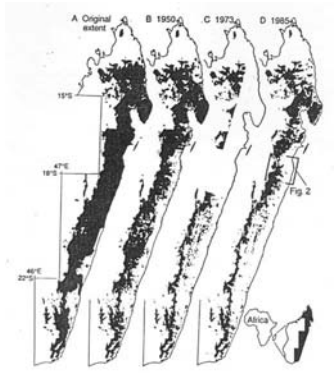
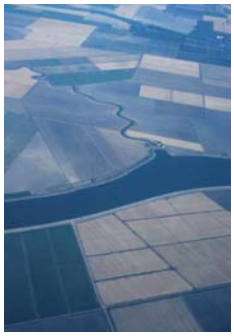
Land Use Change



Land Cover Change in Madagascar



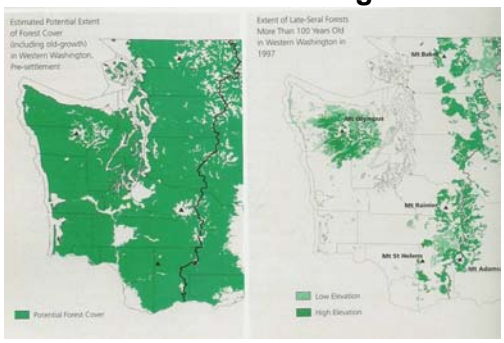
Intensity of land use – Sacramento Valley, CA

Land Use Change

Ocean Shores, Grays Harbor County

WA DNR 1998

Land Use Change



Old Growth Forests, western Washington

WA DNR 1998

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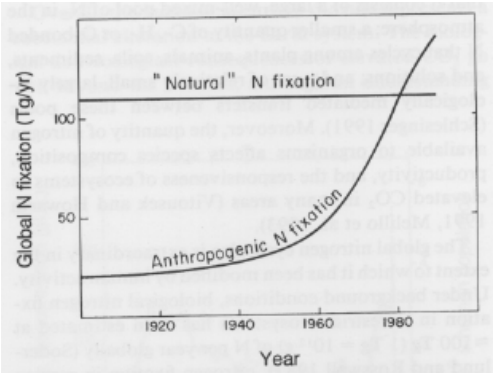
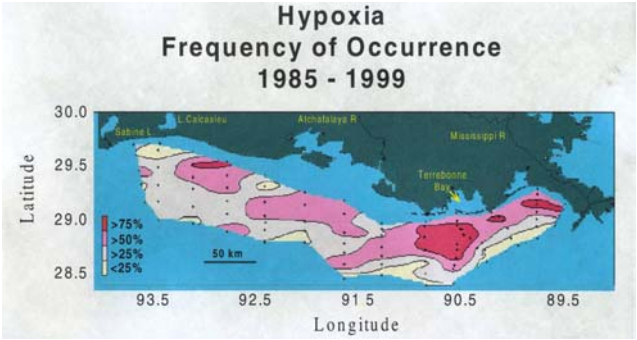
Global Nitrogen-fixation



Vitousek 1994

Eutrophication of aquatic ecosystems – "Dead zone" in the Gulf of Mexico



Low oxygen levels from eutrophication – changes in ocean circulation

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Source: Oregon State University
Date: August 10, 2004

Post to: del.icio.us, Digg, Furl, Netscape, Newsvine, reddit, Yahoo! MyWeb

New Hypoxic 'Dead Zone' Found Off Oregon Coast

CORVALLIS, Ore. For the second time in three years, a hypoxic "dead zone" has formed off the central Oregon Coast. It's killing fish, crabs and other marine life and leading researchers to believe that a fundamental change may be taking place in ocean conditions in the northern Pacific Ocean.

Seattle Times Aug. 2006

Is dead zone spreading to Washington?

Scientists have documented a large pool of oxygen-poor water off Oregon's coast, and reports of dead crab and fish from Washington suggest it may extend much farther north.

Moclips to the Quinault River: Several species of dead fish washed up on the beach. Tribal fishermen reported dead crab in pots.

Westport: Commercial fishermen also have reported dead crab in their pots.

Kalaloch to Copalis: Preliminary data show low dissolved oxygen levels. Volunteers report large numbers of dead crab on the beach.

Sources: ESRI, TeleAtlas, Oregon State University

MARK NOWLIN / THE SEATTLE TIMES

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Non-native Invasive Species

Scotch Broom
(*Cytisus scoparius*)
Fort Lewis

The 2004 Baltimore Declaration

Baltimore, Maryland, USA

Invasive alien species (IAS) represent one of the foremost challenges to the integrity of agriculture, natural ecosystems, and biodiversity in the new millennium. IAS cost human societies hundreds of billions of US dollars per year in control costs and losses to agricultural production, human health, and ecosystem services, far exceeding the combined cost of natural disasters such as floods, wildfires, oil spills, and earthquakes. The threat is global. The increasing movement of people and biological products in global travel and trade render every landscape on earth vulnerable to new infestations.

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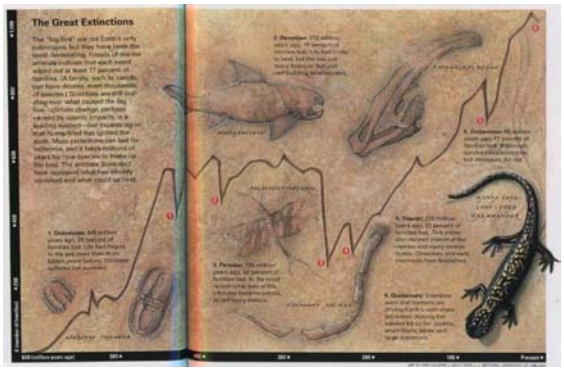
The "Sixth Extinction"?



National Geographic 1999

Future Washington : course focus

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Future Washington : course focus

However these effects need to be kept in CONTEXT of other changes in the world around us that influence the effects of climate change

Climate change

↓

Production Lands | Natural ecosystems