


Introduction to Environmental Health



Lesson 4.
Ecology:
Basic Principles
& Concepts

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ENV H 311: Lesson 4: Ecology

Announcements

❖ DEOHS Seminar:

- Date: Thursday, 5 April 2012
12:30-1:30 pm, T-435 HSB
- Seminar Title: *Health & Safety Issues for Truckers*
- Speaker: Drew Bossen, PT, MBA
Atlas Ergonomics

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Lesson Overview

❖ On Friday:

- Human Population Growth
- Limits to Growth ?
- Impacts of human activities

❖ Today: Basic Principles of Ecology

- Ecosystems
- Energy & Food Webs
- Bio-geo-chemical cycles


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Lesson Objectives

- ❖ Know the basic principles of ecology
- ❖ Understand how ecological concerns can impact human health and well being
- ❖ Examine the influence of human population growth and the potential effects on regional and global ecosystems

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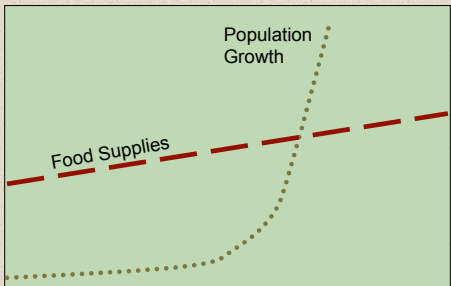
Thomas Malthus (1766-1834)



- ❖ *An Essay on the Principle of Population* (1798)
- ❖ Population Growth is exponential
- ❖ Increase in food supplies is arithmetic.

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Malthusian World



The graph illustrates the Malthusian model. The vertical axis represents population and food supply, and the horizontal axis represents time. A dashed red line labeled 'Food Supplies' shows a steady, linear increase. A dotted green line labeled 'Population Growth' shows an exponential increase. The two lines intersect, after which the population growth curve rises sharply above the food supply line, indicating a state of resource scarcity.

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Prophets of Doom?

- ❖ Malthus & Ricardo
- ❖ Club of Rome
- ❖ Paul Ehrlich
- ❖ Garret Hardin
- ❖ Lester Brown
- ❖ James Lovelock

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Limits to Growth

- ❖ Club of Rome
- ❖ Computer model looking at trends in
 - > Population
 - > Food Production
 - > Natural Resource Use
 - > Industrial Output
 - > Pollution

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Conclusions of TLG Model

- ❖ Within 100 years, society will run out of non-renewable resources leading to a precipitous collapse of the economic system decreased food production and increasing death rate.
- ❖ A piecemeal approach to solving the problem will not work
- ❖ Overshoot and collapse can only be avoided by limiting population and pollution.

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Criticism of the Limits to Growth

- ❖ Pessimistic Assumptions
- ❖ Technological Advances
- ❖ Social and Political Factors

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The Optimist's View

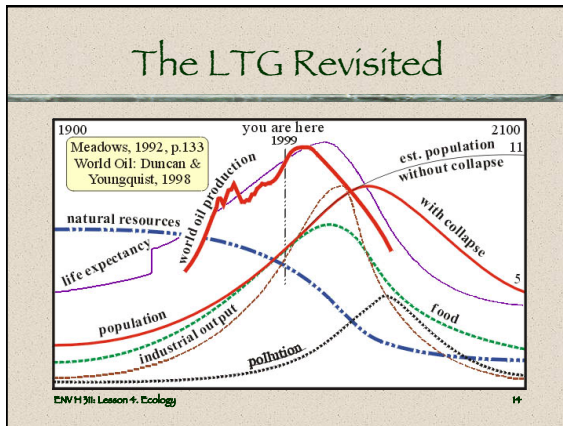
- ❖ . . . 200 years ago almost everywhere human beings were comparatively few, poor and at the mercy of the forces of nature, and 200 years from now, we expect, almost every-where they will be numerous, rich and in control of the forces of nature [p. 1].
 - Kahn H. *The Next 200 Years: A Scenario for America and the World*, 1976.

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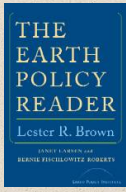
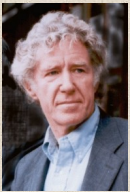
Criticism of the Limits to Growth

- ❖ Pessimistic Assumptions
- ❖ Technological Advances
- ❖ Social and Political Factors
- ❖ The Predictions Haven't Happened Yet

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Lester Brown



- ❖ Started the World Watch Institute
- ❖ Devoted to the analysis of global environmental issues.

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Food

- ❖ Food production is climbing
 - > Food/capita is relatively steady in most of the world
 - > In Africa food/capita is falling
 - > In Europe food/capita is rising
- ❖ 1.5 billion hectares of land under cultivation in 1990
- ❖ 4.0 billion possibly available
- ❖ All would be needed by 2050


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Global Food Production

- ❖ World-wide, most suitable land is already under cultivation
- ❖ Arable land in many countries is already under pressure due to soil degradation (erosion), deforestation and desertification.
- ❖ Effects of over-harvesting: may exceed reproductive rate
- ❖ Effects of habitat destruction

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Global Food Production



800 million severely malnourished people
One-third of children under 5 years old in developing countries are malnourished

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Water

- ❖ Only 10,000 km³ out of 40,000 km³ of fresh water is accessible.
- ❖ 3,000 km³ is polluted and undrinkable
- ❖ Current use ~ 4,000 km³
- ❖ In many places water tables are falling
- ❖ Desalination of sea water is possible but requires energy

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Industrialization

- ❖ Is growing exponentially (GNP)
- ❖ Use energy, materials, water
- ❖ Creates pollution
- ❖ Two options:
 - Industrial growth needs to stop
 - New technologies needed to decrease resource needs and pollution

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Pollution

- ❖ Pollution increases with
 - population growth, and
 - Industrialization
- ❖ Environmental pollution continues to climb.
- ❖ Health effects are subtle and difficult to measure

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Technological “Fixes”

- ❖ High-tech farming
- ❖ Solar power
- ❖ Recycling
- ❖ High efficiency production

“Necessity is the mother of invention”

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Coincidentally

University of Washington School of Public Health & Community Medicine Department of Environmental & Occupational Health Science



Environmental Health in the News . . .

April 1, 2009


Earth population 'exceeds limits'
 ENN From: Steven Duke, BBC News
 There are already too many people living on Planet Earth, according to one of most influential science advisors in the US government. Nina Fedoroff told the BBC One Planet programme that humans had exceeded the Earth's "limits of sustainability". Dr Fedoroff has been the science and technology advisor to the US secretary of state since 2007, initially working with Condoleezza Rice.

How Green Are Your Grocery Bags?
 Fox News By Jason Gurak
 The "recycling" epidemic is one from the Society of the Plastics Industry, based in Washington, D.C. "We don't live in a perfect world. There is a cost to the environment, regardless of which bag is used. To understand which bag is the greenest, we need to look at the life cycle analysis of each bag." The analysis follows each bag from raw material through production and distribution and the consumer's hands. It also takes into account whether it's reused, recycled or thrown in the garbage.

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James Lovelock



- ❖ 1979: Gaia
- ❖ The Earth is like a living organism
- ❖ Daisy World

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Limits To Growth?










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Principles of Ecology



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Definition: Ecology

- ❖ Literally – “*oikos*” or house + “*ology*” or study of
- ❖ The study the abundance and distribution of species, and their relationship to the environment

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What to Look For . . .

- ❖ Ecosystems, biomes & habitats
- ❖ Determining or limiting factors
- ❖ Biotic communities
- ❖ Biologic succession
- ❖ Food chains or webs
- ❖ Bio-geo-chemical cycles

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Webs & Cycles

- ❖ Food Chains & Webs
- ❖ Energy Cycle
- ❖ Bio-geo-chemical cycles
- ❖ Hydrologic Cycle

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Food Chain or Web

Consumers

Producers

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Energy Cycles

Energy from the Sun is taken up by the plants, which absorb that energy in their chloroplasts.

Plants can reuse these products with the input of energy from the Sun.

Energy used in chloroplasts to create ordered, energy-rich sugar molecules.

In the process, they convert the highly ordered sugars into carbon dioxide and water, a disorganized form.

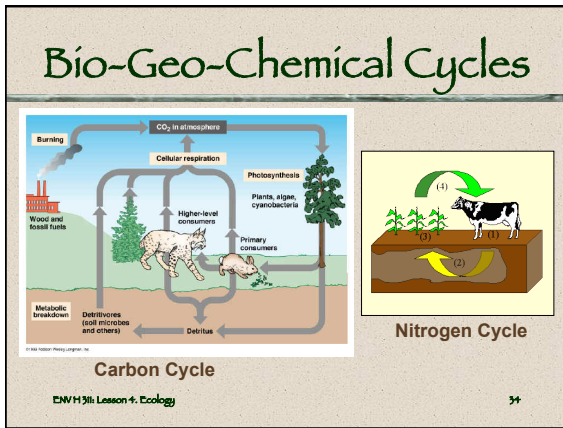
Animals use the sugars to produce their own "energy currency" through the mitochondria.

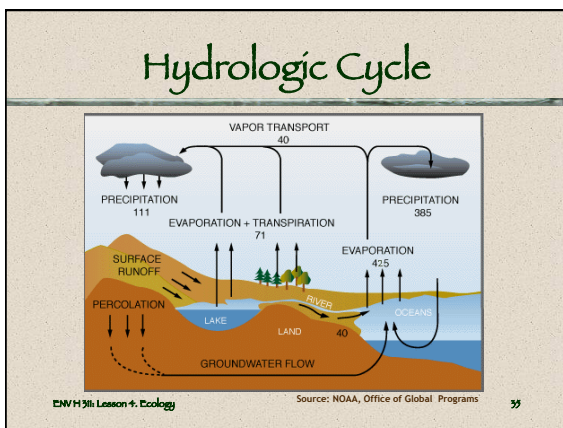
ATP The energy source for animal life processes.

Sugars available to plants to use for their own processes.

Sugars also available to the animals for food.

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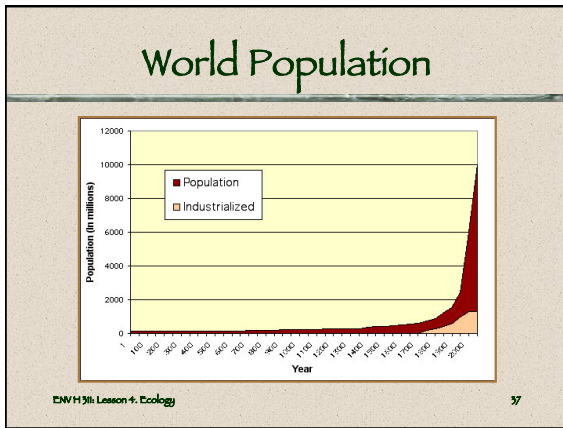


Thesis

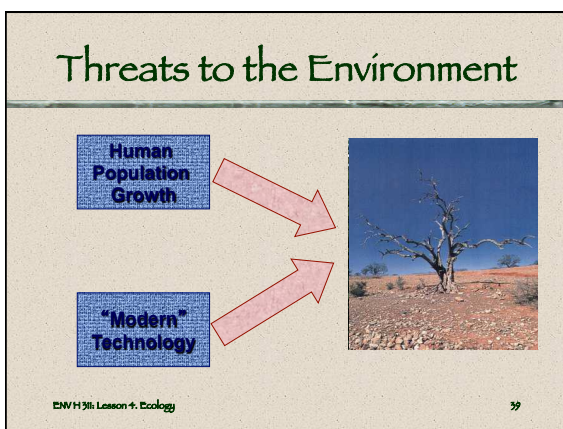
Environmental threats result from:

1. Increased Population
2. "Modern" Technology

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Environmental Threat



$I = P \times A \times T$

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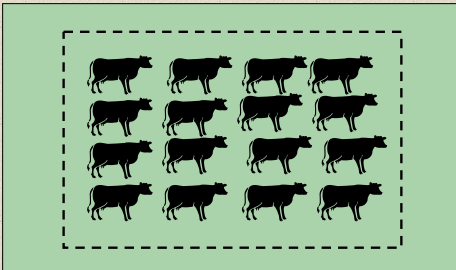
Garrett Hardin



- ❖ 1968 essay, *Tragedy of the Commons*
- ❖ In a crowded world with less than perfect humans, free resources will be overused.
- ❖ Ruin is inevitable unless controls are put in place.


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The "Commons"



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Environmental Threat



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Next Lesson

Principles of Toxicology

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