1 Introduction to Environmental Science

EVPP 110

Fall 2002

Instructor: Largen

Lecture #1

2 What is environmental science?

✓ definition

- "the interdisciplinary study of humanity's relationship with other organisms and the non-living physical environment"
- interdisciplinary because it
  - uses & combines info from many disciplines
    - natural sciences: biology (ecology), geology, chemistry, physics
    - applied sciences: geography, agriculture, engineering
    - social sciences: economics, cultural anthropology, policy, politics, ethics, sociology

3 What environmental science is **not**

✓ we need to differentiate between

- environmental science
  - "science" aspect is emphasized
- environmental studies
  - "studying", becoming aware of current environmental issues, environmental ethics, environmentalism

4 Why is environmental science important?

✓ **Human domination of earth's ecosystems** (from Vitousek et al., 1998. Science: 277: 494-499)

- to of land surface has been transformed by human action
- atmospheric CO_2 concentration has increased by ~30% since the beginning of the Industrial Revolution
- more atmospheric nitrogen is fixed by humanity than all natural terrestrial sources combined
- more than of accessible freshwater is put to use by humanity
- 1/4 of bird species that ever lived on earth have been driven to extinction
- 2/3 of major marine fisheries are fully exploited, overexploited or depleted

5 Why is environmental science important?

✓ Sustainability

✓ Human population issues

✓ Challenges and complexity

6 Why is environmental science important?

✓ **Sustainability**

- environmental sustainability
  - "the ability of the environment to function indefinitely without going into a decline from the stresses imposed by human society on natural systems that maintain life"
  - enables humanity's present needs to be met without endangering the welfare of future generations
  - applies at many levels
    - individual, community, regional, national, global

7 Why is environmental science important?

✓ **Sustainability**

- most experts believe environmental sustainability is not currently being achieved because
  - non-renewable resources (such as fossil fuels) are being used as if supplies were unlimited
  - renewable resources (such as fresh water) are being used faster than they can be replenished naturally
  - pollutants & toxins are being released into the environment as if environment's capacity to absorb them was unlimited
  - human numbers continue to grow despite earth's finite ability to support us

8 Why is environmental science important?

✓ **Human population issues**

- human population surpassed 6 billion in 1999
  - placing unsustainable stresses on the environment
    - consuming more food and water
    - using more energy and raw materials
    - producing more waste and pollution
  - World Bank estimates that 1.3 billion people live in poverty
    - unable to meet their basic needs for food, shelter, clothing

9 Why is environmental science important?

✓ **Challenges and complexity**

- issues may seem simple
  - why don't we just stop over-consumption, population growth and pollution?
- Solutions are challenging & complex because of
  - multifaceted interactions between ecological, social, cultural and economic factors
  - inadequate scientific understanding of how
    - the dynamic environment works
    - how different human choices affect the environment

10 Intro to Some Current "Hot" Environmental Issues

✓Current "hot" environmental issues

- Endocrine disrupters
- Commercial fisheries
- Declining bird populations
- Ozone depletion
- Global warming

11 Intro to Some Current "Hot" Environmental Issues

✓ **Endocrine disrupters**

- chemicals that may interfere with actions of **hormones**
  - chemical messengers in organisms
  - regulate growth, reproduction, other activities
- appear to alter reproductive development in both genders in many species
  - >50% drop in sperm count from 1940-1990 in men (60 studies, 15,000 men, many nations)
  - juvenile alligator density in Lake Apopka (FL) declined 10 fold in 14 years following chemical spill

12 Intro to Some Current "Hot" Environmental Issues

✓ **Endocrine disrupters**

- river otters exposed to synthetic chemical pollutants were found to have abnormally small penises
- female seagulls in southern CA exhibited behavioral aberrations

- they paired with other females during mating season instead of paring with males
- many widely used chemicals fall into this category
- US EPA plans to test thousands of chemicals for their potential to disrupt endocrine system
  - results will help determine exposure levels, effects, limits

13 Intro to Some Current "Hot" Environmental Issues

✓ **Commercial fisheries**

- several have been fished to **commercial extinction**
  - = fish are harvested faster than they can replace themselves
    - increased world demand
    - high-tech methods increase catches
- Georges Bank closed in 1994
  - 16,500 sq km area off New England in North Atlantic
  - once one of world's richest fishing grounds
- Grand Banks cod fishery (off Newfoundland) closed in 1990s
- Peruvian anchovy fishery collapsed in 1970s

14 Intro to Some Current "Hot" Environmental Issues

✓ **Commercial fisheries**

- corrective measures
  - national level
    - 1997 Magnuson Fishery Conservation & Management Act
      - » requires National Marine Fisheries Service and 8 regional councils to devise quotas and other strategies to help fisheries recover
  - international level
    - 1995 UN Fish Stocks Agreement
      - » first international treaty to regulate marine fishing

15 Intro to Some Current "Hot" Environmental Issues

✓ **Declining bird populations**

- population declines seen across North America seen over past 2 decades
  - particularly among songbirds of forests, shrub lands, grasslands
    - many songbirds are **tropical migrants**
      - » winter in Central America, South America, Caribbean
      - » summer, migrate to North America to breed
    - changing environments in both habitats
      - » burning of tropical rainforests for cropland
      - » fragmentation of temperate forest for development

16 Intro to Some Current "Hot" Environmental Issues

✓ **Ozone depletion**

- evidenced as a large ozone "hole" over Antarctica
  - "hole" is area where ozone concentration is lowest of any place in the world
  - occur in layer of atmosphere called stratosphere
    - layer between 10-45km above earth
- caused by chlorofluorocarbons (CFCs)
  - previously widely used as cooling agents, still used some
  - now banned or under phase out by most countries

– but existing CFCs can survive in atmosphere for 120+ years

17 ☐ Intro to Some Current "Hot" Environmental Issues

✓ **Global warming**

- caused by "greenhouse" gases
  - allow solar radiation to pass through to earth
  - don't allow heat to radiate into space
- chief among these gases is carbon dioxide
  - CO_2 levels have dramatically increased over past 2 centuries due mainly to
    - burning of fossil fuels
      - » natural gas, coal, oil
    - clearing & burning of forests
- could cause increase in mean temperature (to levels higher than in past 100,000 years)