Announcements

- Field trip report, Nov. 28
- Nov. 20-26: FALL BREAK!!!!!!
- Final Dec. 12, 10-noon, NC 1535
- Criteria for Grading Reports

A. Organization: _____ 30% of total

Should include an introduction, ordered discussion of specific topics, and a summary.

- Title/Introduction (what I did, why it's important) _____ (10)
- Guidelines adhered to (title, page limits, page numbers spacing, font) _____(10)
- Summary (take home message of what was just shared) _____(10)

B. Content: _____ 40% of total

It should be informative, complete, accurate, and thoroughly discussed. You should include information about the field trip and how it relates to ecology.

- Well-researched (complete coverage)? _____ (20)
- Is the information relevant to ecology? _____ (10)
- Is the information accurate? _____ (10)

C. Presentation: _____ 30% of total

Material should be presented in a clear manner that properly stresses important points about the topic. A clear voice and visual aids enhance the presentation of materials.

- Well written paragraph and sentence structure _____ (10)
- Proper grammar and spelling _____ (10)
- Visual Aids (figures, tables, pictures, captions) _____ (10)

Pollution: The Other Face of Fertilizers and Pesticides

- What is pollution
- Pollution that increases growth
- Biological effects of pollution
- Why do we pollute?
- Pesticides
- Weds, we'll discuss alternatives to pesticides and environmental impacts of pesticides

What is pollution?

- In general, a pollutant is any physical, chemical, or biological agent that reduces the quality or utility of a habitat or resource
- One person's pollutant might be another person's treasure (e.g., DDT)
- Dependent on context (e.g., exotic species)
- Dependent on concentration (e.g., oxygen)
- Pollutants are typically "unnatural" changes in habitat (bird feces vs. human sewage)

Categories of Pollutants

- Source
  - Point source pollutants
  - Non-point source pollutants
- Persistence
  - Degradable
    - Biodegradable
    - Photo-oxidative
  - Persistent
    - Non-biodegradable
- Solubility
  - Water soluble
  - Lipophilic (fat soluble)

Pollutants That Increase Growth

- What do plants need to grow?
- When fertilizers wash into streams and lakes
- Eutrophication
  - the aging of a lake
  - a natural process
- Cultural eutrophication
  - eutrophication in fastforward
  - with undesirable consequences

When sewage enters a stream

•Biochemical Oxygen Demand (BOD): the amount of oxygen in water that is consumed by microbes in respiration and nitrification

•Dissolved Oxygen (DO): the amount of oxygen dissolved in water

21.2

Biological Effects of Pollutants

- Lethal effects: the "purpose" of pesticides
- Sublethal effects
  - birth defects
  - disease
  - weakened immune systems
- Biological accumulation
  - repeated exposure to pollutant causes an increase with age
- Biological magnification
  - when pollutants meet food webs
  - lipophilic, persistent chemical pollutants increase as you move up the food wed
- Minamata, Japan: biomagnification of mercury

Why Do We Pollute?

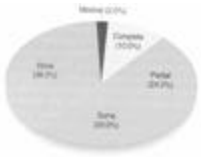
- The costs of not polluting are too great.
  - fertilizers allow us to feed the human population
  - industry, and the products it produces, requires resources
    - metals and mining
    - plastics and petroleum
    - energy and air pollution
  - biocides reduce our natural enemies
    - disease vectors
    - parasites
    - crop pests
- How much pesticide pollution is necessary and can it be reduced?

Pesticides

- What is a pest?
  - any organism that is living where we do not want it, or at population sizes that we do not want
- Types of pesticides
  - sterilant: interferes with reproduction
  - neurotoxin: interferes with the nervous system
  - hmmm, don't WE reproduce and have nervous systems?
- Types of herbicides
  - contact poisons: kills where it touches the leaf or stem
  - systemic poisons: absorbed through roots and kills plant
  - Soil sterilants: broad spectrum poison that kills all vegetation

Pesticides and People

- Every year, more than 500,000 metric tons of active ingredients used in USA alone
- Homeowners take scorched earth approach
- 600 active ingredients used in USA
- 1,200 presumably inactive ingredients
- 1 million people (worldwide) receive acute exposure annually
- 20,000 die



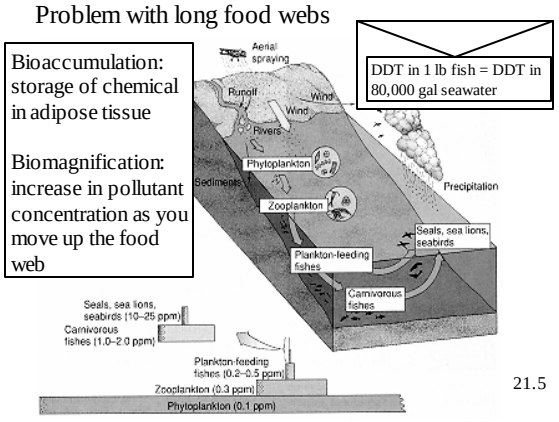
Toxins in Food Webs: Case of DDT

- "Ideal" pesticide - properties discovered in 1939 by Paul Muller
  - cheap, stable, soluble in diesel fuel, highly toxic to insects, non-toxic to people
  - Nobel Prize in 1948
- Developed prior to WWII, saved 1,000,000's lives
- WIDESPREAD use after war, sprayed everywhere! 1st produced in 1934, 50 million tons sprayed by 1950.
- banned in USA in 1972, but still manufactured here
- Found in Inuit breast milk.

Problem with long food webs

Bioaccumulation: storage of chemical in adipose tissue

Biomagnification: increase in pollutant concentration as you move up the food web



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What makes an Ideal Pesticide? (today's opinion differs from 50's)

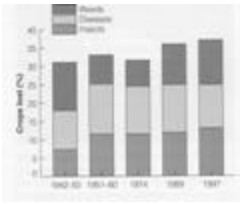
- Should be toxic to JUST the target organism
- Should be quick acting then degrade to harmless products
- Long-term exposure should not harm humans, nor any non-target organism
- It should not allow the development of resistance in the pest
- It should be inexpensive
- Bt (*Bacillus thuringiensis*) is close to ideal

Lethal Doses of Pesticides

- Ecotoxicology Bioassay
- LD50
- <100% mortality leads to pesticide resistance
  - pesticide resistance is evolution in action!
  - As of 1993, 520 spp. of insects and mites, 150 plant diseases, and 113 weed spp. were tolerant of pesticides
- Pesticide treadmill
  - pesticide resistance leads to the use of different, and often more toxic, pesticides just to keep up with pest loads
  - analogous to farmer running hard just to maintain position on a treadmill
- what happens if the pest becomes resistant, but its predators do not?

Have we been successful?

- Before pesticide use, about 30-35% of crops were lost to pests
- After decades of persistent pesticide use, about 30-35% of crops are lost to pests
- PLUS, we have exposed ourselves and nature to a multitude of poisons, with largely untested consequences
  - endocrine disruption hypothesis

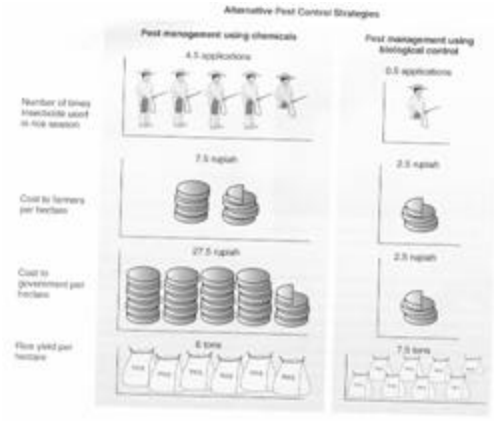


Biological control: An alternative to pesticides?

- Biological control: the use of living organisms to control the population size of pest usually via predation or parasitism
- Many pests are exotic species
- Classical biological control
  - going to the pest's native range to find a predator
  - treating an exotic species with a different exotic species
- Conservation biological control
  - control of exotic pest using a native biocontrol agent

Integrated Pest Management (IPM)

- The application of ecology to managing the population sizes of pests
- It uses a variety of tools
  - chemicals are used judiciously
  - trap crops
  - biocontrol agents are encouraged
  - crop rotation returns
  - monocultures replaced with polycultures
  - sterile males
  - vacuums



IPM in Indonesia