



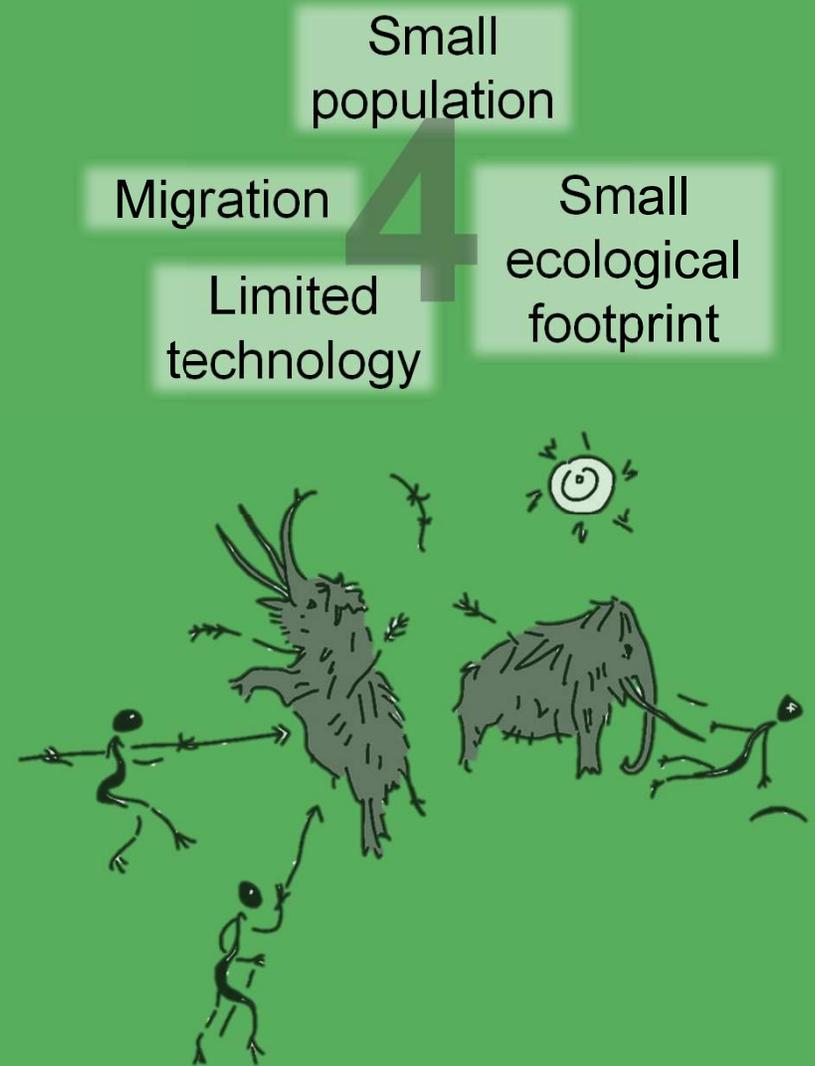
AGRICULTURE + PESTICIDES



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INITIATIVE

15,000 years ago

Hunter-gatherers survived collecting wild plants and hunting native animals. Generally nomadic. High infant mortality rate short life span (30-40 years). Advanced groups used more advanced tools, converted forests to grasslands, and contributed to the extinction of some large animals.



10,000 years ago

Agricultural Revolution

Shift from nomadic hunting and gathering to a settled community.



- Farmers provided more food than needed by their own family
- Towns and villages formed (Urbanization)
- Increased life span
- Habitat destruction/slash-and-burn
- Soil erosion and overgrazing
- Pollution



1775

Industrial Revolution

Began in England and spread to the United States in the early 1800 's. Shift from renewable resources such as wood and water to nonrenewable fossil fuels.



- Centralized factories to mass-produce goods
- Improved agricultural technology led to increase in urban population

- Air pollution
- Dangerous work conditions



Industrial Agriculture

The use of these four resources on a large-scale is known as **industrialized agriculture** or high-input agriculture.

Inorganic
fertilizer

Pesticide

Inexpensive
fossil fuel

Irrigation

4



1950-1970

Green Revolution (1950-1970)

Increased yields per unit of area of cropland

Involved three steps:

- developing and planting **monocultures** of key crops
- lavishing fertilizer, pesticides and water on crops to produce high yields
- increasing the intensity and frequency of cropping



Subsistence Agriculture

Farmers grow enough food for themselves and their families. Planting decisions are based on the family's need not the marketplace.

Intensive subsistence farming is common in India and China and enables farmers to produce excess that can be exchanged for other goods.



Slash-and-burn

Trees are cut down and burned in place. The ash is used to amend the soil. After a very short time, the soil is depleted of its nutrients and the cycle is repeated.



Modern Food Production

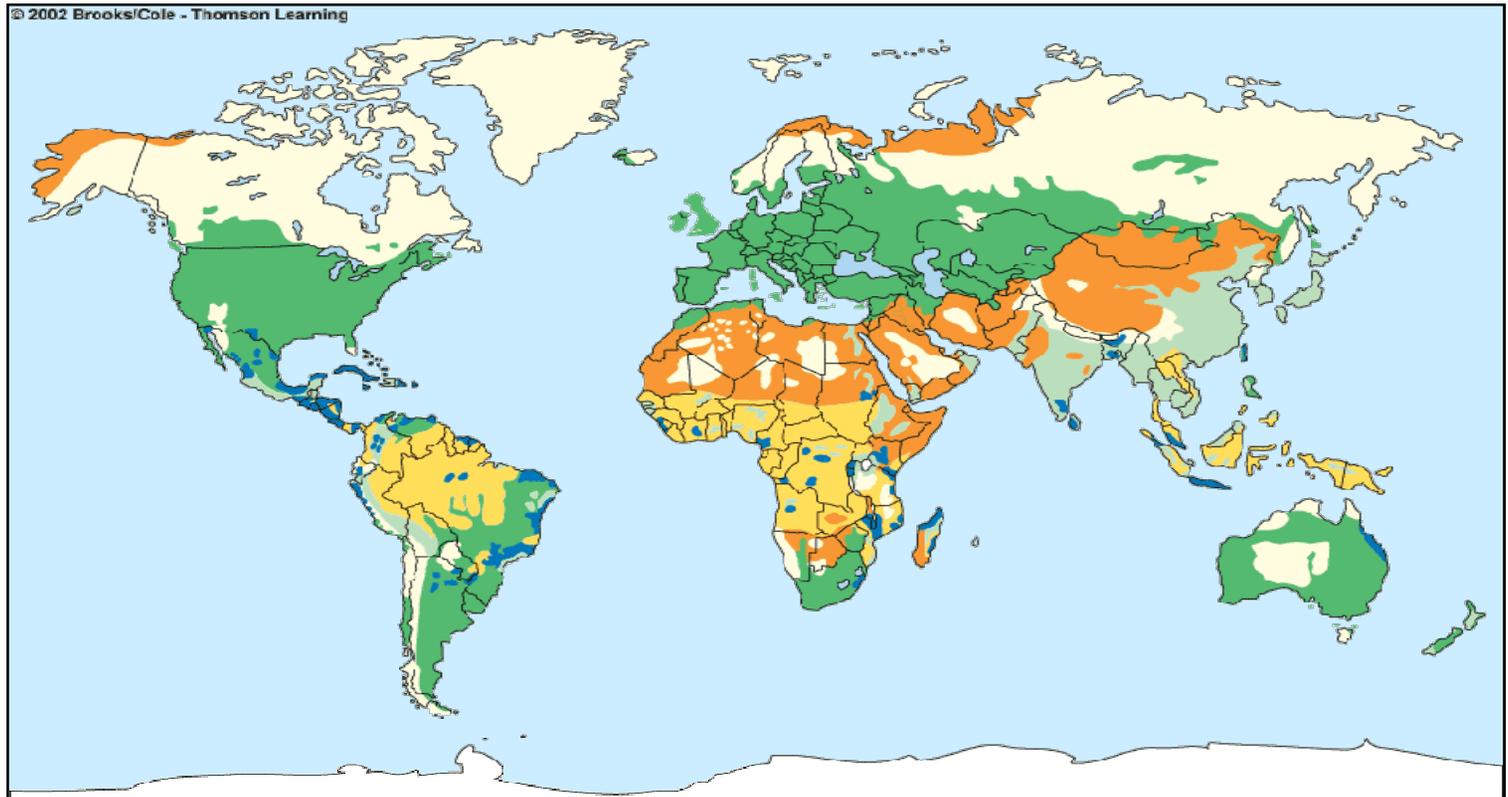
FACTS:

- 15 plant and 8 animal species supply 90% of our food
- wheat, rice and corn provide ~50% of the calories people consume; all three are **annuals**
 - 2/3 of the world's people live primarily on grains (rice, wheat and corn)
- Fish and shellfish supply 1% of the energy to the global population



Two Major Types of Food Production

1. Industrialized agriculture
2. Subsistence agriculture
 - a. Traditional
 - b. Intensive



Bad Farming Practices (led to soil depletion) + drought
=



Soil erosion, desertification, water deficits and loss of biodiversity all problems associated with modern agriculture



Solutions: soil conservation

Soil Conservation - involves reducing soil erosion and restoring soil fertility

- Keep the soil covered with vegetation
- Conventional-tillage farming vs. conservation-tillage farming (minimum-tillage or no-till farming)



Increasing World Food Production

Attempts to Increase Food Production:

1. Cross-breeding or artificial selection
2. The gene revolution – bioengineering –
Genetically Modified Organisms

An economically profitable and environmentally sustainable expansion of cropland is unlikely over the next few decades.



History of Pesticides

- Pesticides were first used 4,500 years ago (sulfur as an insecticide).
- During the 15th century, arsenic, mercury, and lead were being used as insecticides.
- Pyrethrum and rotenone (derived from plants) were introduced during the 19th century.
- After World War II, DDT, dieldrin, and 2,4-D became widely used.
- Early 1970' s, glyphosate emerged to become the most widely used herbicide in the United States.

CAUTION
PESTICIDES



Benefits of Pesticide Use

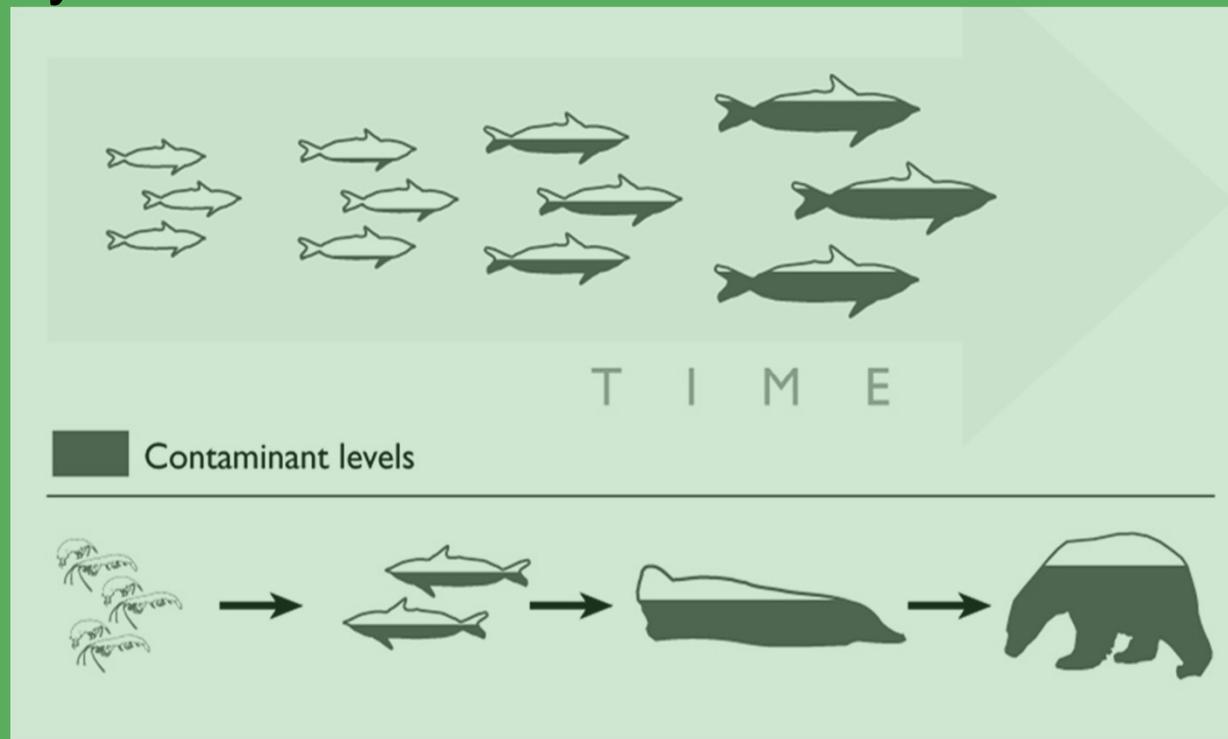
Pesticides **increase food production** while **lowering the cost**. It is estimated that the price of food in the US would increase by 50% if pesticides were not used. Pesticides also **increase farmers' profits** by minimizing losses.



Bioaccumulation & Biomagnification

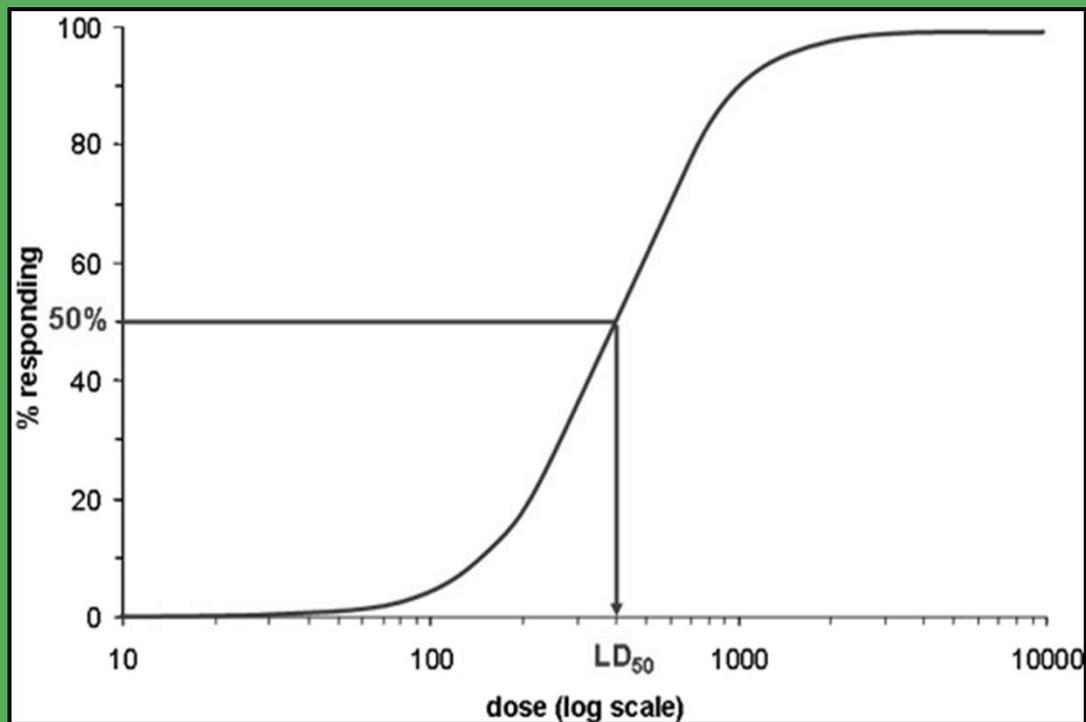
Bioaccumulation occurs when an organism accumulates a material in its body at a concentration greater than the environment.

Biological magnification occurs when a consumer has consumed a lot of biomass from the lower trophic level containing a pollutant, the pollutant will be taken up in large quantities by the consumer.



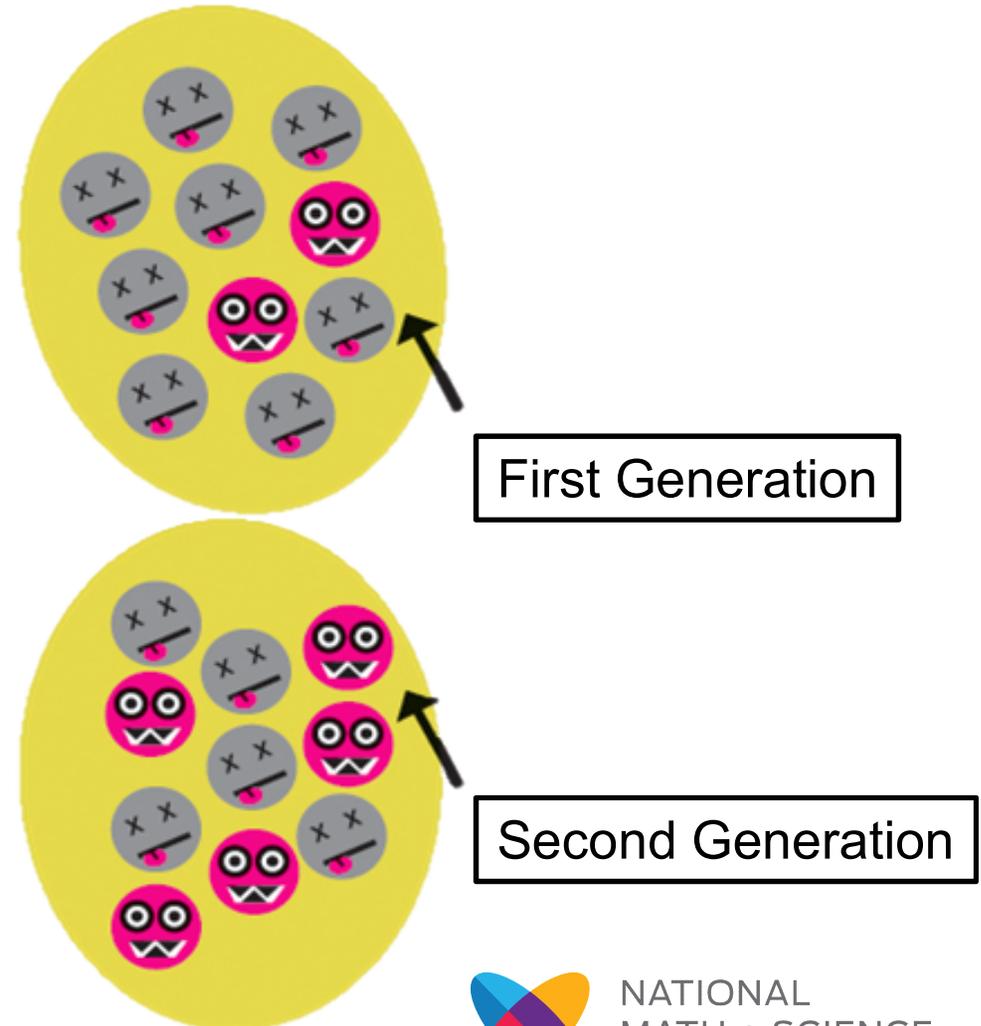
LD₅₀

Standard measurement of acute toxicity that is stated in milligrams (mg) of pesticide per kilogram (kg) of body weight. Represents the individual dose required to kill 50 percent of a population of test animals. The lower the LD₅₀ dose, the more toxic the pesticide.



Pesticide Treadmill

Pest species evolve pesticide resistance via natural selection: the most resistant organisms are the ones to survive and pass on their genetic traits to their offspring.



Integrated Pest Management

Each crop and its pests are evaluated and a control program is developed that includes three methods of pest removal:

- **Physical**
- **Biological**
- **Chemical**

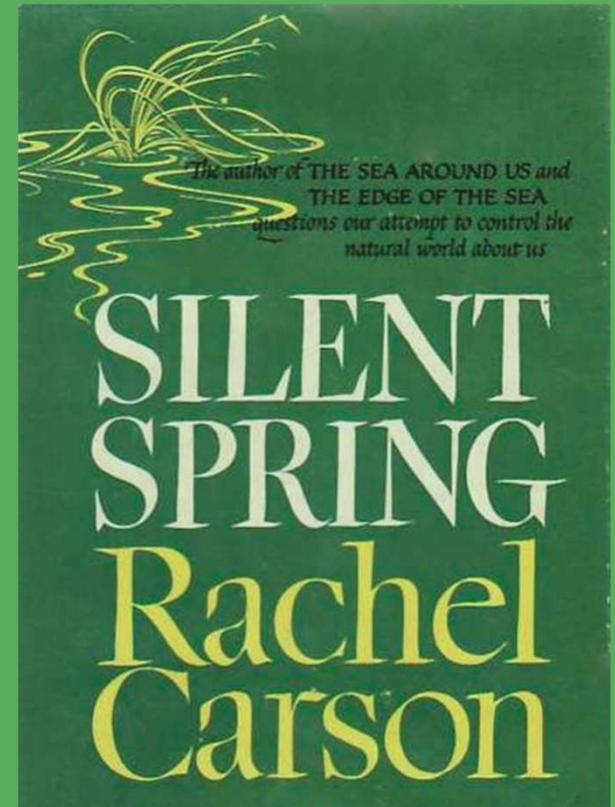
The goal is not to eliminate pest populations completely, but to reduce them to an economically acceptable level.



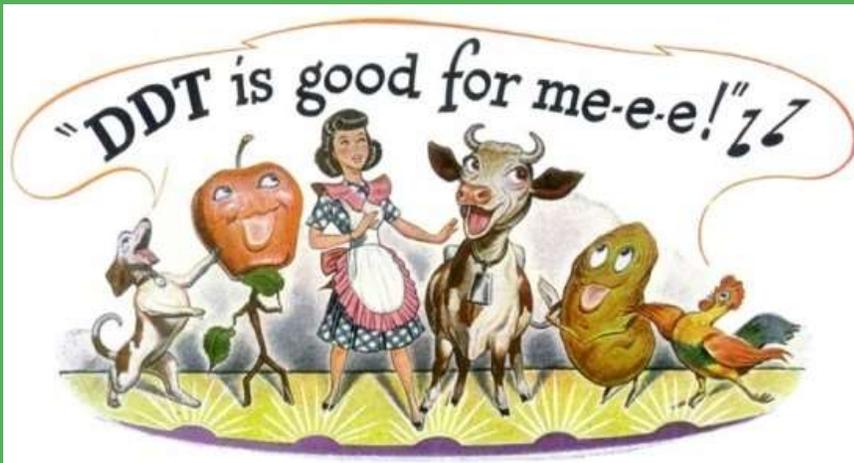
1962

The Modern Environmental Era (began in the '60's)

Rachel Carson
published Silent Spring
chronicling the affect of
DDT on the environment



“In nature nothing
exists alone.”



Federal Insecticide, Fungicide, and Rodenticide Act

The primary focus of **FIFRA** was to **provide federal control of pesticide distribution, sale, and use**. EPA was given authority under FIFRA not only to study the consequences of pesticide usage but also to require users (farmers, utility companies, and others) to register when purchasing pesticides.



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Food Quality Protection Act

Amended FIFRA and FFDCA. Fundamentally changed the way EPA regulates pesticides. The requirements included a **new safety standard-reasonable certainty of no harm-that must be applied to all pesticides used on foods.**



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