

A photograph of a heavily polluted urban street. The foreground and middle ground are dominated by a massive, sprawling pile of trash, including plastic bags, cardboard boxes, and various pieces of debris. In the background, multi-story buildings line the street, and a concrete drainage ditch runs alongside the trash, filled with water and more refuse. The overall scene depicts a significant environmental and public health issue in an urban setting.

UNIT 8

Chapter 16

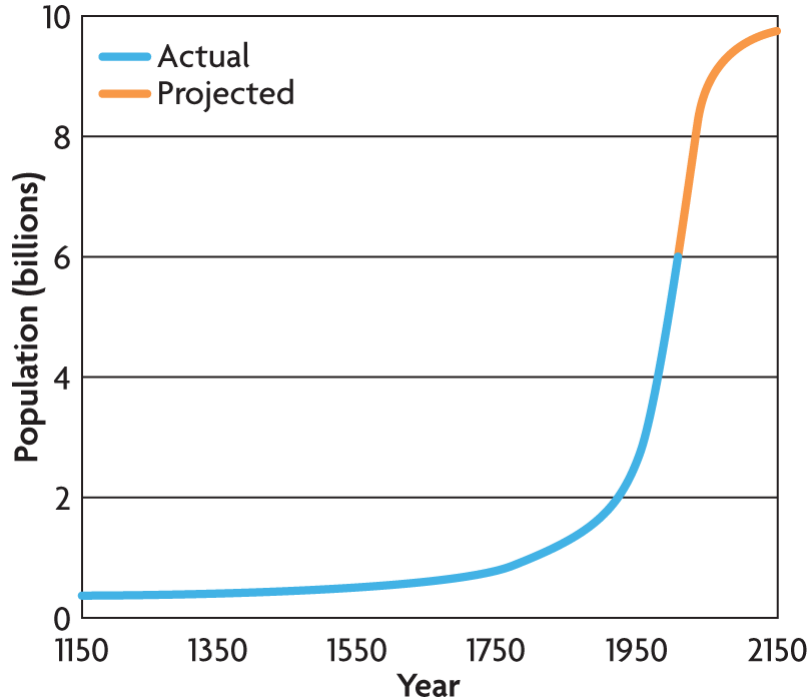
Human Impact on Ecosystems

Unit V: Ecology

Chapter 16: Human Impact on Ecosystems

I. Human Population Growth and Natural Resources (16.1)

A. Earth's human population continues to grow



1. Earth's Carrying Capacity

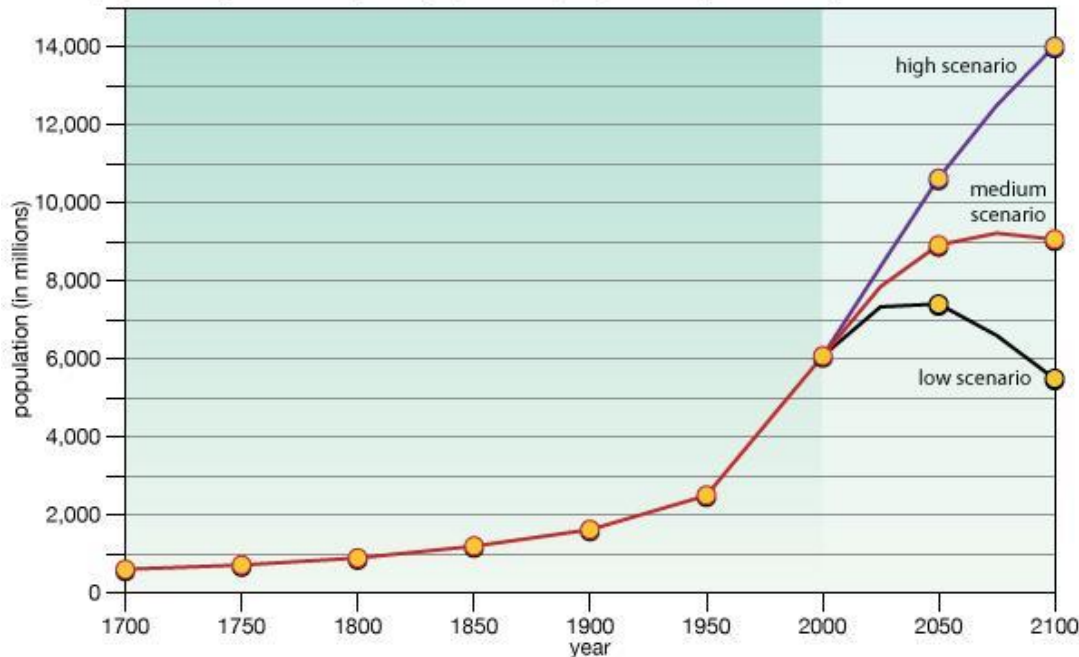
a. **Thomas Malthus** (late 1700's)- studied human population growth and said was growing faster than Earth's resources

b. Modern scientists use his observations and predictions when describing ecosystem's **carrying capacity**

c. Current human population is about 7 billion.

d. Not sure what the limit (carrying capacity) is for size of human population.

World population (1700–2000) and population projections (2000–2100)



Source: United Nations Department of Economic and Social Affairs/Population Division 2004

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2. Technology and Human Population

a. Humans have modified their environment through agriculture, transportation, medical advances, sanitation, etc. This increased the **carrying capacity**



b. **Technologies** have allowed Earth to support far more people than Malthus could have imagined.



B. The growing human population exerts pressure on Earth's natural resources



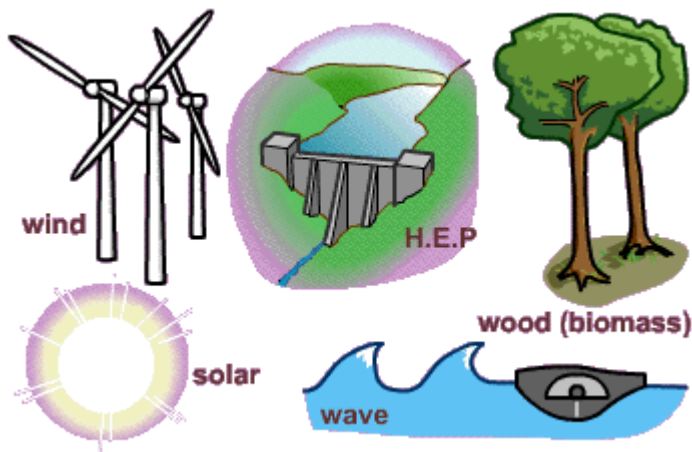
1. ***nonrenewable resources***- they are used faster than they are formed (e.g. oil, natural gas, coal)



2. **Renewable resources**- resources that cannot be used up or can replenish themselves over time (e.g. wind energy, solar, lumber, etc.)

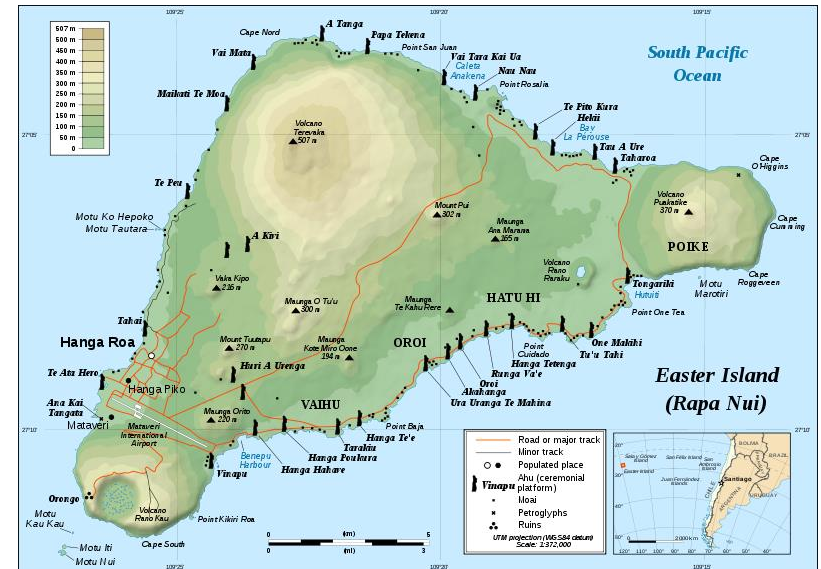
a. As human population continues to grow, management of renewable and nonrenewable resources will play important role

b. Today, the U.S. uses more resources and generates more waste than any other country (1 ton of waste per person per year)



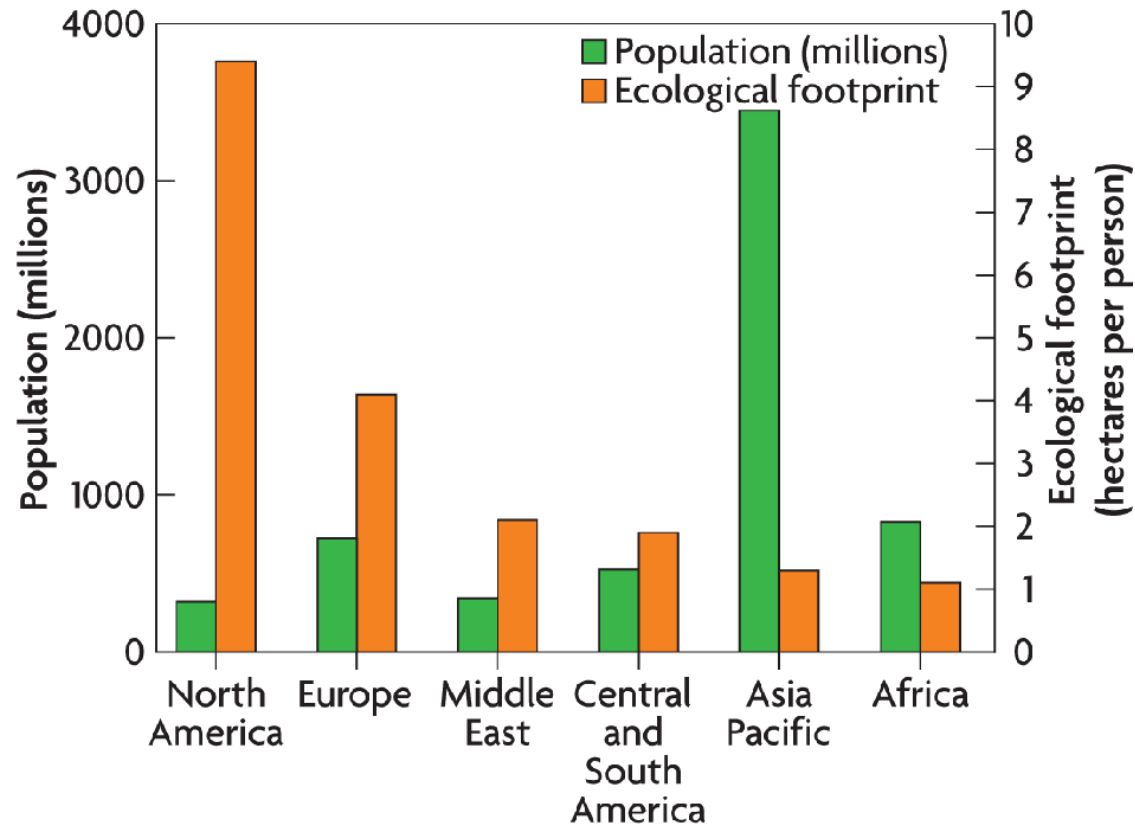
C. Effective management of Earth's resources will help meet the needs of the future

1. Effects both current and future generations
2. **Ecological footprint**- The amount of land necessary to produce and maintain enough food and water, shelter, energy and waste



a. Varies from country to country (smaller in developing countries)

b. Developing countries like China and India have smaller footprint per individual, but many more people



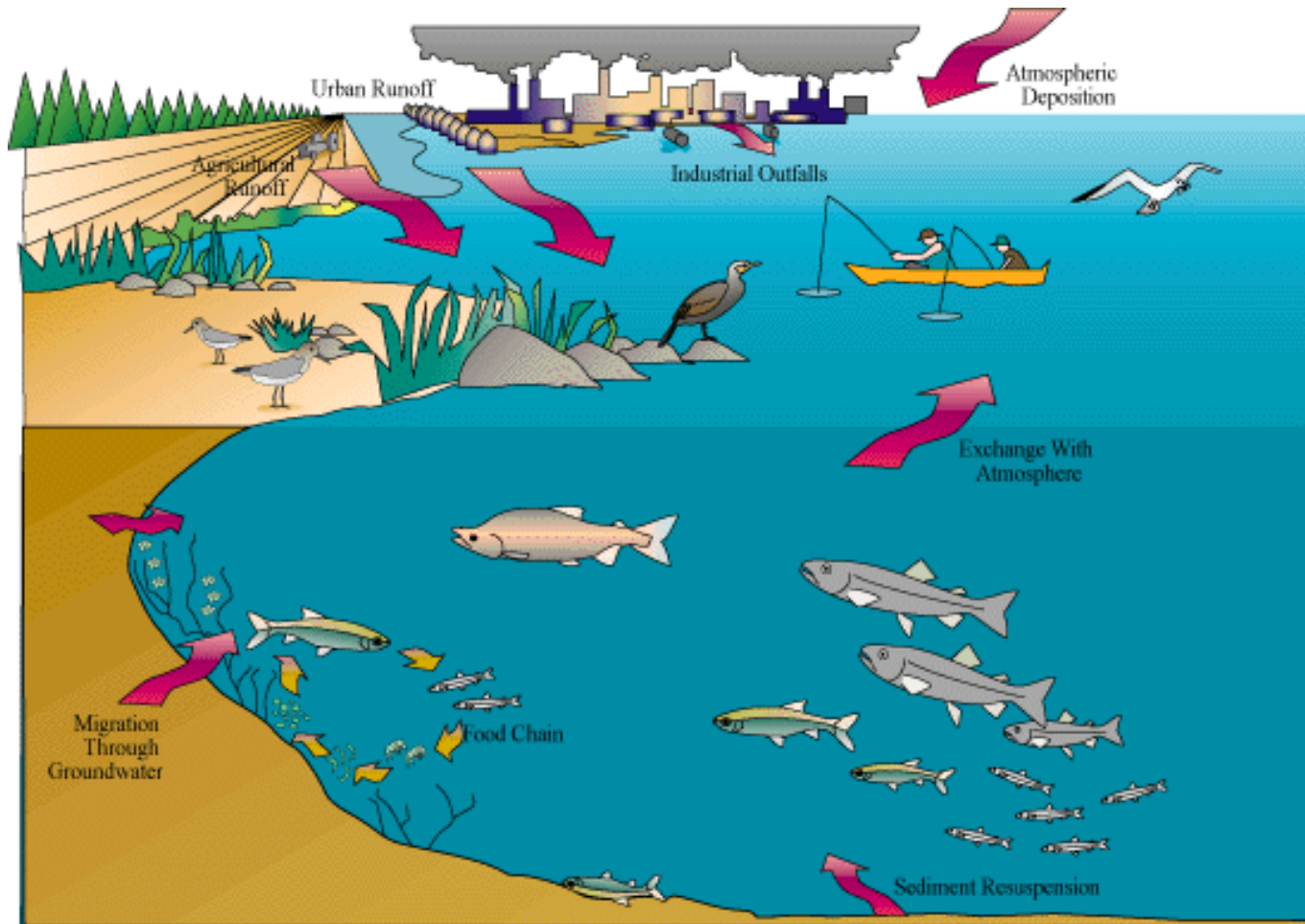
II. Air Quality (16.2)

A. Pollutants accumulate in the air

1. **Pollution**- describes any undesirable factor, or pollutant, that is added to the air, water, or soil



- a. Effect can be immediate or delayed
- b. Effects may add up over time and disrupt functions of ecosystems



2. Smog and Ozone

a. **Smog**- type of air pollution caused by interaction of sunlight with pollutants produced by fossil fuel emissions

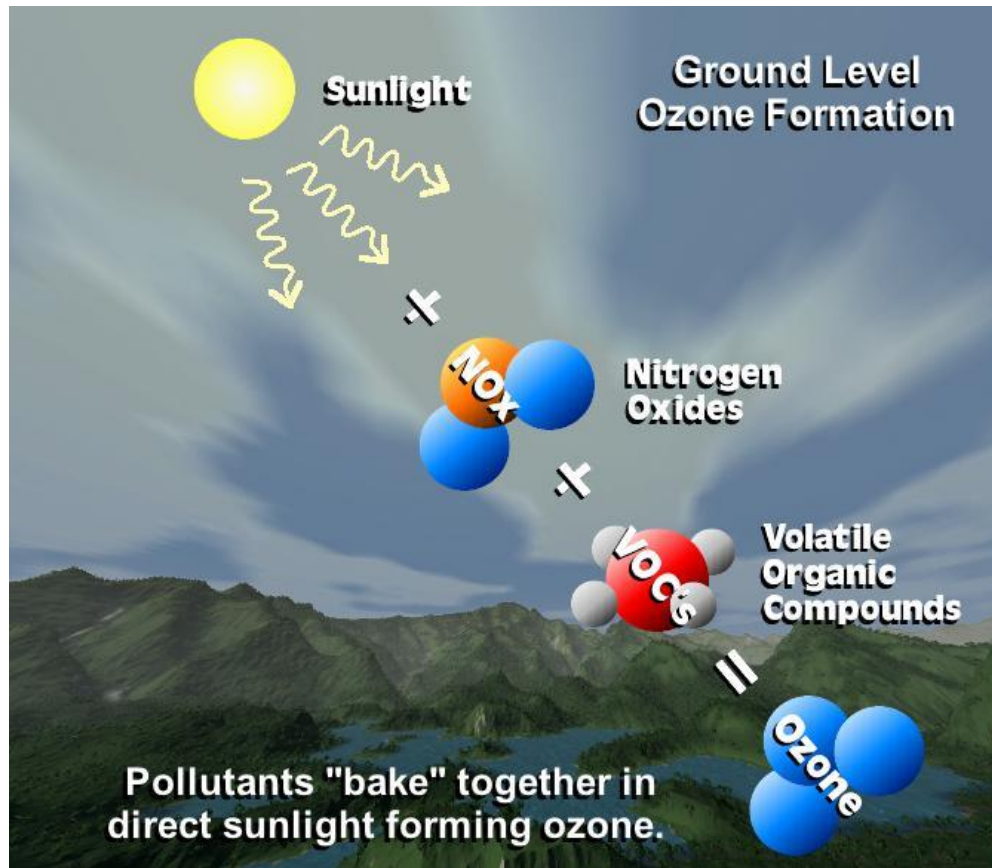


b. **Particulates**- microscopic bits of dust, metal, and unburned fuel (1-10 microns in size) that are produced by many different industrial processes



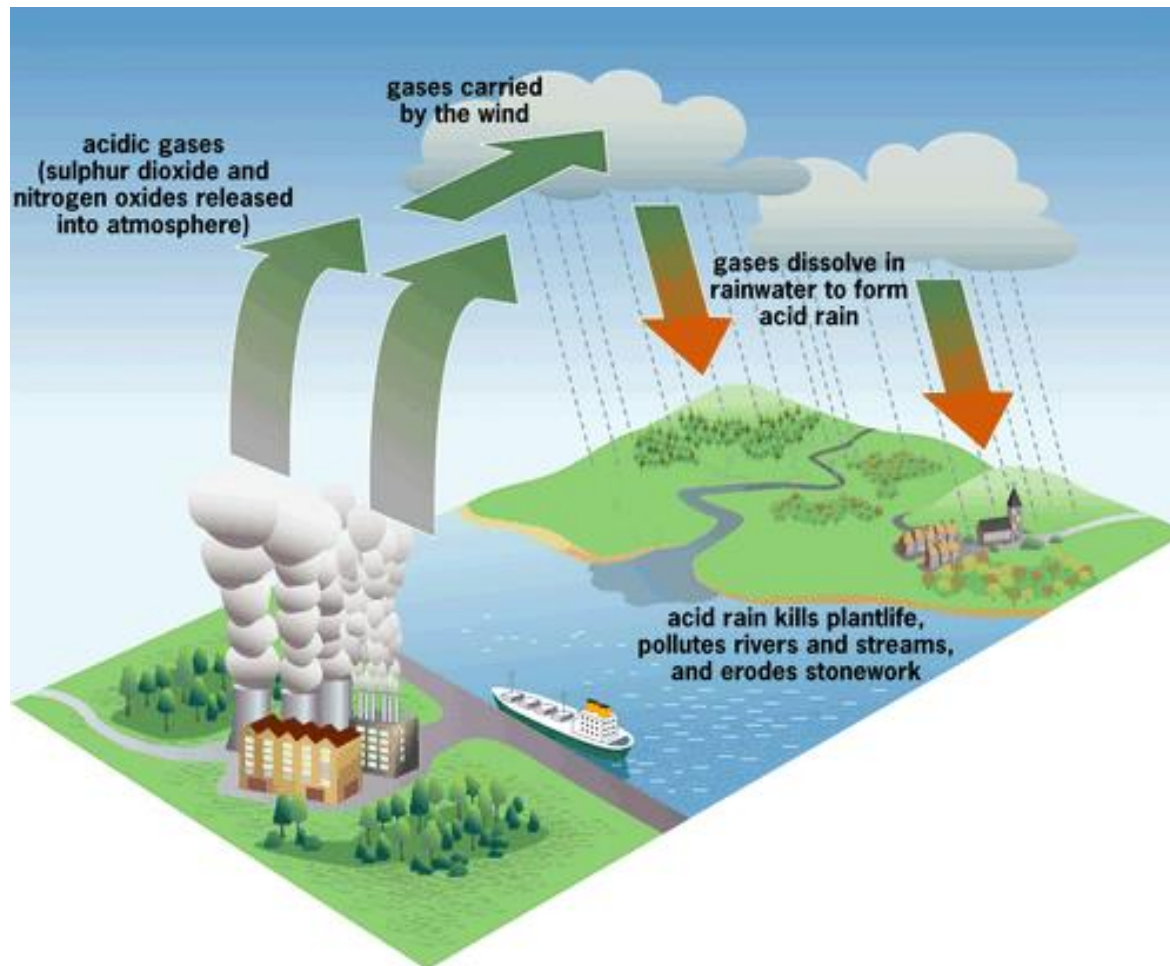
c. **Ozone**- produced by reactions of nitrogen oxide and oxygen forming ozone (O₃)

1). ozone harmful to organisms



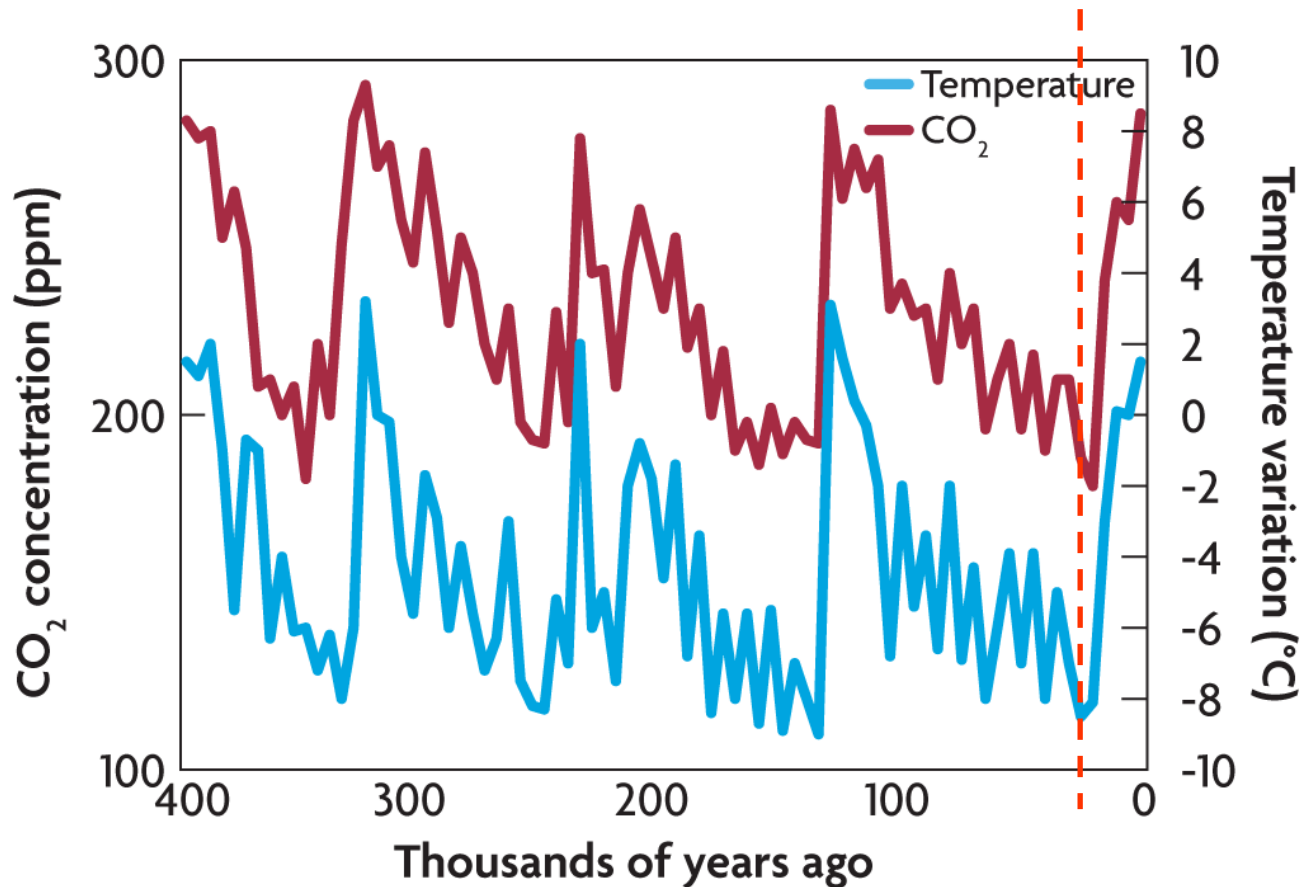
2). Also forms important protective layer in atmosphere to protect against **ultraviolet rays** found in sunlight

d. **Acid Rain**- chemicals from fossil fuel emissions can lead to formation of acid rain that can affect many environments



B. Air pollution is changing Earth's biosphere

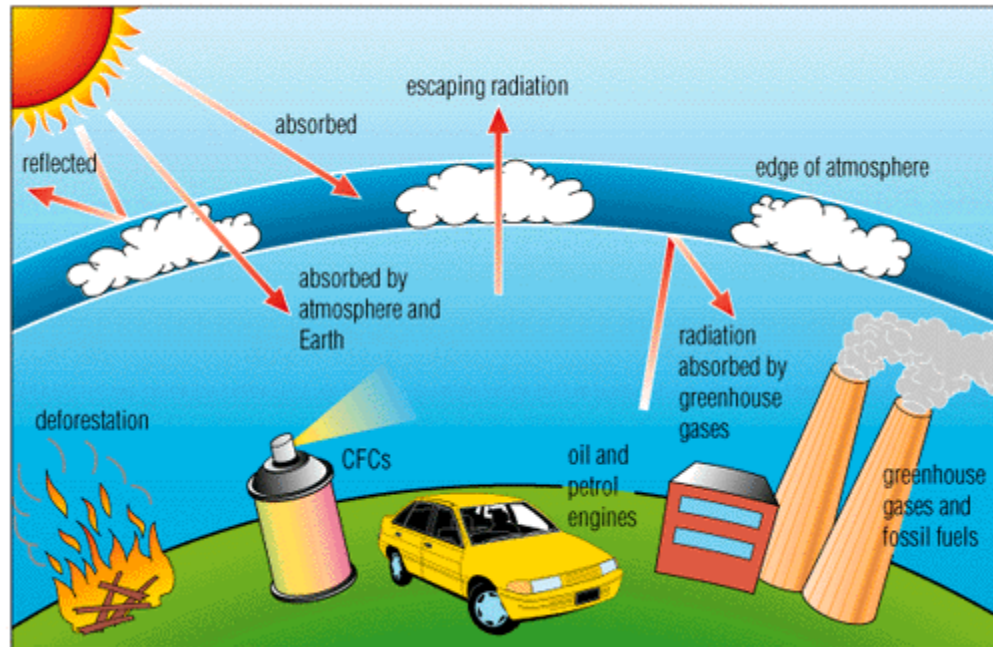
1. Scientists have been studying the periodic changes in Earth's **temperature** and relationship to **carbon dioxide** levels



2. **Greenhouse effect**- greenhouse gasses act like insulator to slow loss of heat through atmosphere

a. Include: **water vapor, carbon dioxide, methane**

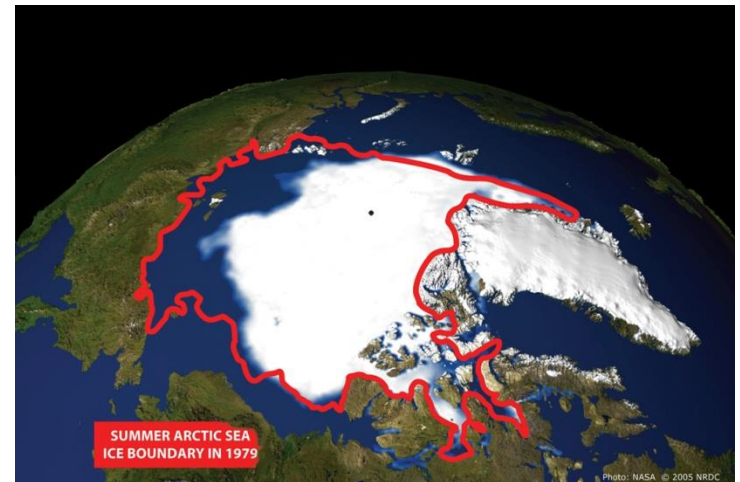
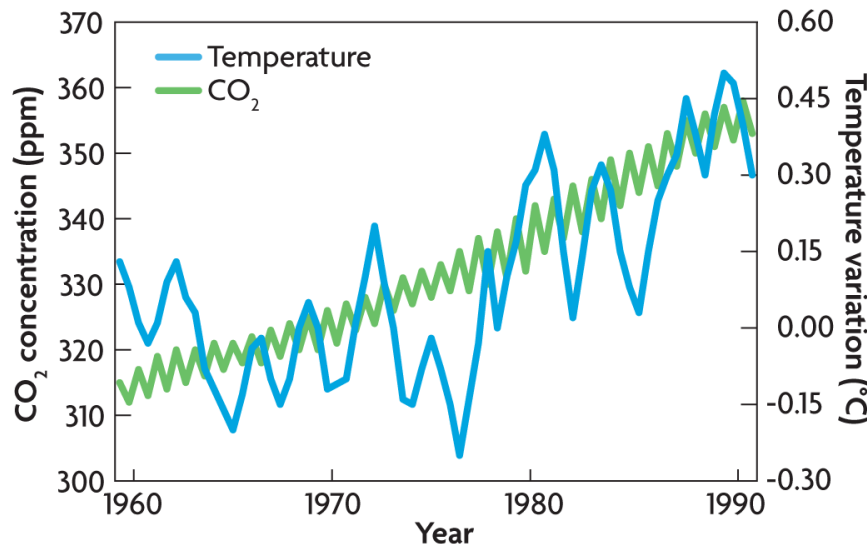
b. Absorb **infrared radiation** trying to escape into space from Earth's surface



3. **Global warming**- the trend of increasing global temperatures

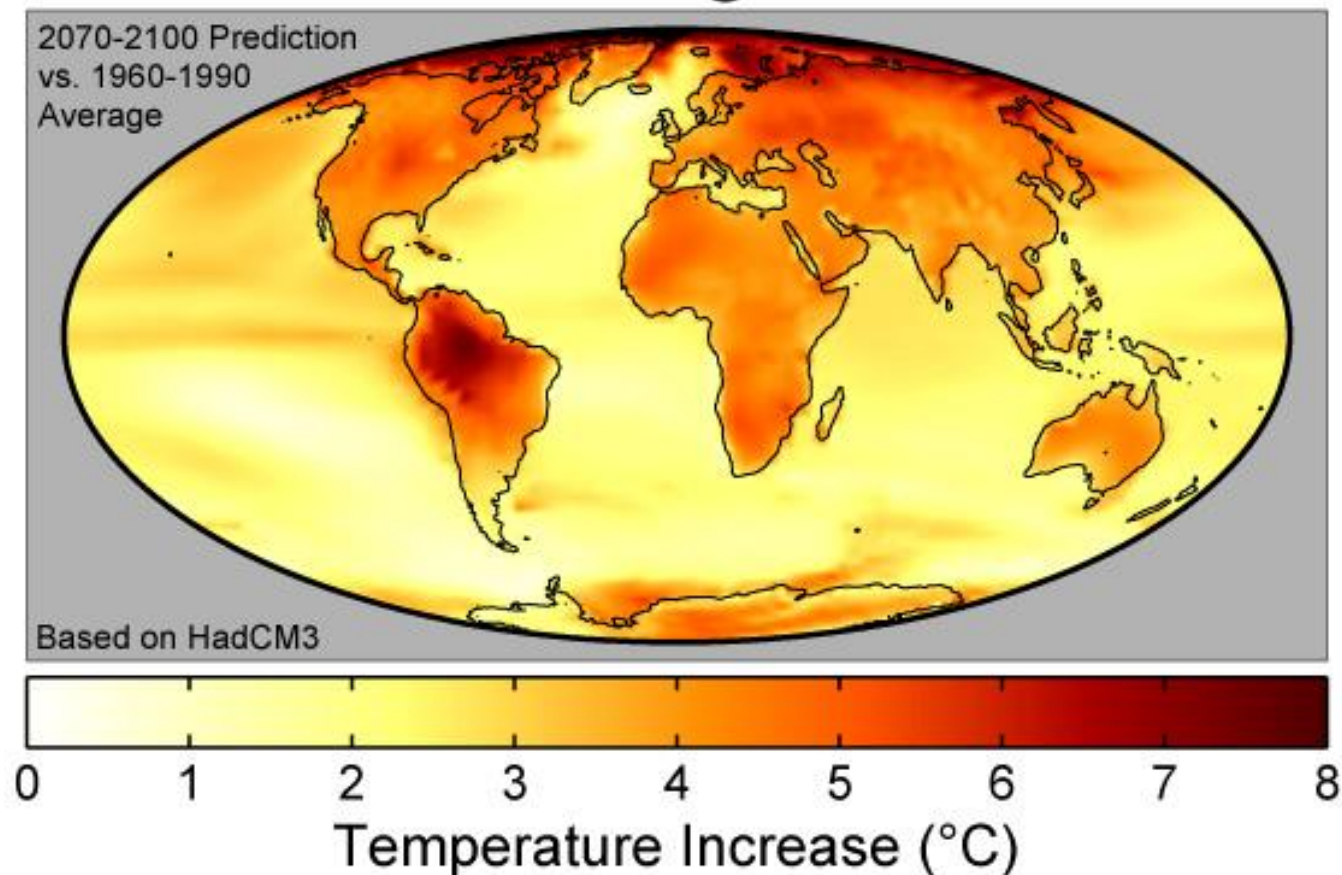
a. Changes are normal part of Earth's climate cycle

b. **Human impact** may be speeding up production of greenhouse gasses and global warming



c. Predicted temperature increase of 1.4 - 5.8° C by the year 2100. Could dramatically effect Earth's biosphere (as much as 8° Fahrenheit)

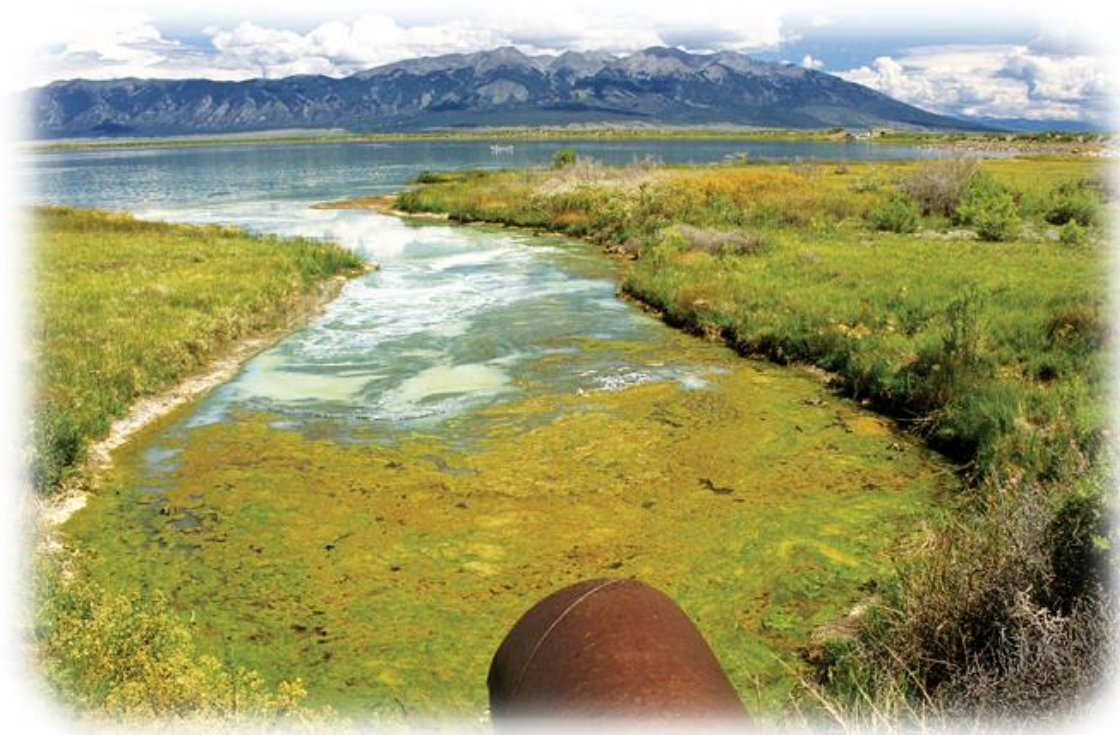
Global Warming Predictions



III. Water Quality (16.3)

A. **Water pollution** affects ecosystems

1. Chemical contaminants, raw sewage, trash, etc. end up in rivers, lakes, and aquifers all over the world





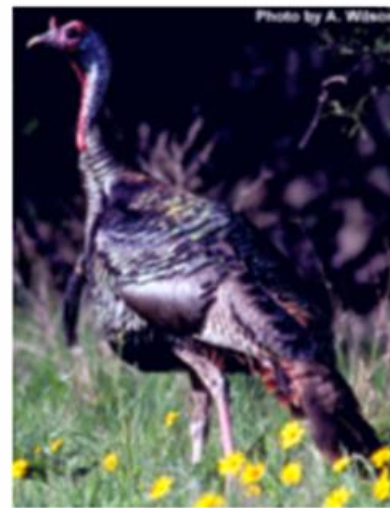
2. **Indicator species**- a species that can provide a sign, or indication, of the quality of the ecosystems environmental conditions



Pine warbler



Gray squirrel

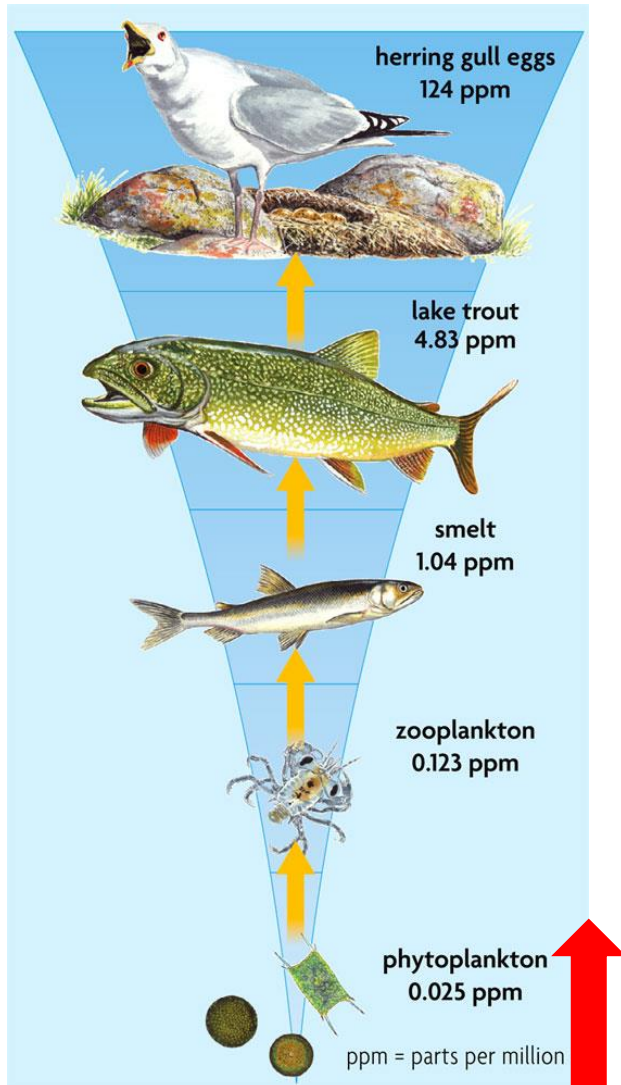


Wild turkey



Northern bobwhite

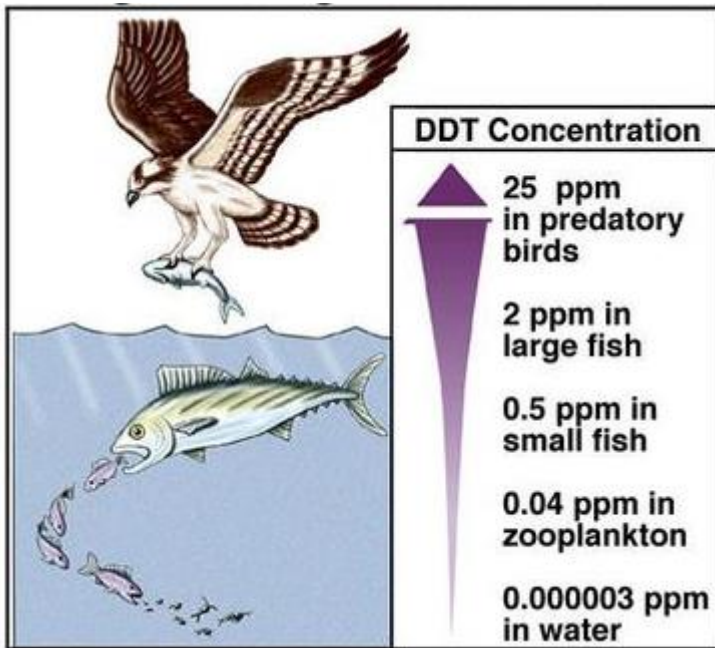
B. **Biomagnification** causes accumulation of toxins in the food chain



1. ***Biomagnification***- as pollutant moves up the food chain, it's concentration increases

2. Many pesticides dramatically effect top level consumers (**predators**)

Brown Pelican/Biomagnification/DDT- Shell-thinning resulted in the decimation of the **Brown Pelican** populations in much of North America and the extermination the Peregrine Falcon in the eastern United States and southeastern Canada. Shell-thinning caused lesser declines in populations of Golden and Bald Eagles and White Pelicans, among others.



IV. Threats to Biodiversity (16.4)

A. Preserving biodiversity is important to the future of the biosphere



1. The loss of **habitat** and growing **pollution** problems are affecting animal and plant population around the world

2. The loss of **biodiversity** has a long term effects on stability of ecosystems



B. Loss of habitat eliminates species

1. As human population grows and expands into new areas, they displace large numbers of wildlife



2. ***Habitat fragmentation***- when barrier forms that prevents an organism from accessing its entire home range



C. Introduced species (invasive species) can disrupt stable relationships in ecosystem

1. ***Introduced species***- any organism that was brought to an ecosystem as the result of human activities



- a. Can have detrimental effect on native species
- b. Can out-compete native species and drive them out





2. Economic damage- can have major impact on humans as well as ecosystems

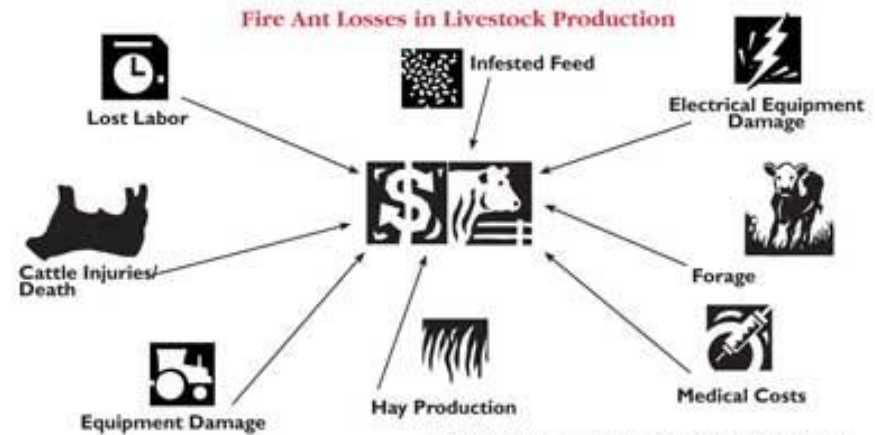
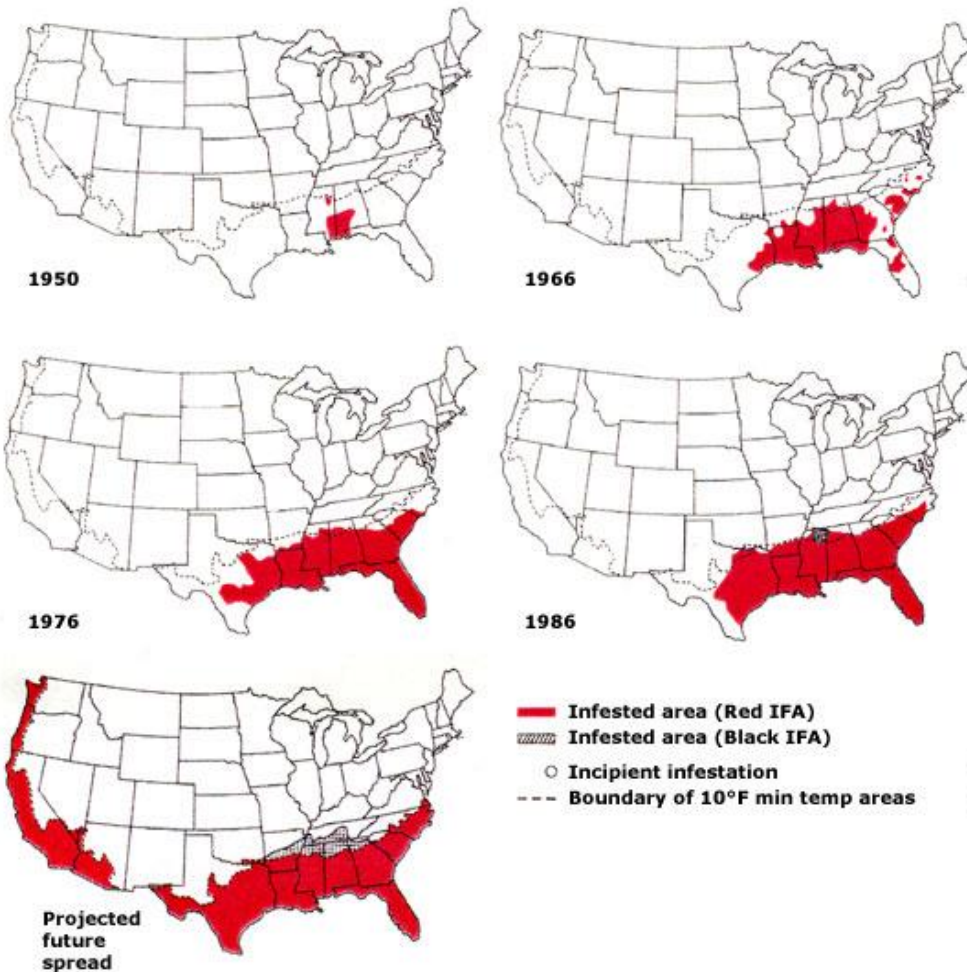
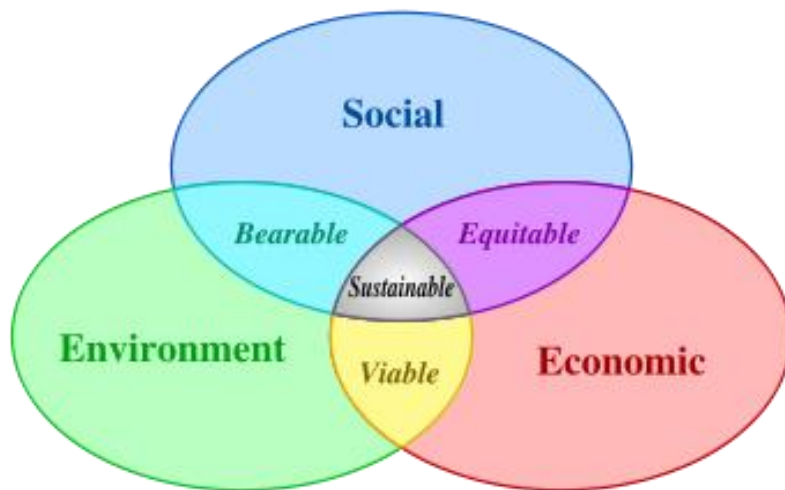


Figure 3. Types of losses due to fire ants in cattle operations. (Based on a drawing by Charles Barr, Texas A&M University)

V. Conservation (16.5)

A. Sustainable development manages resources for present and future generations

1. ***Sustainable development***- a practice in which natural resources are used and managed in a way that meets current needs without hurting future generations



a. Covers wide range of resource management

b. Has changed way we harvest natural resources

B. Conservation practices focus on a few species but benefit entire ecosystems



1. ***Endangered Species Act***-
designed to protect individual
species by establishing
protection for organism and
its environment



2. Often called **Umbrella species** (listed species), because its protection also protect wide range of other species

3. As result, entire ecosystems can benefit from efforts to save a single species



B. Protecting Earth's resources helps protect our future



1. Climate change, pollution, and loss of biodiversity are only a few of the direct threats to our planet



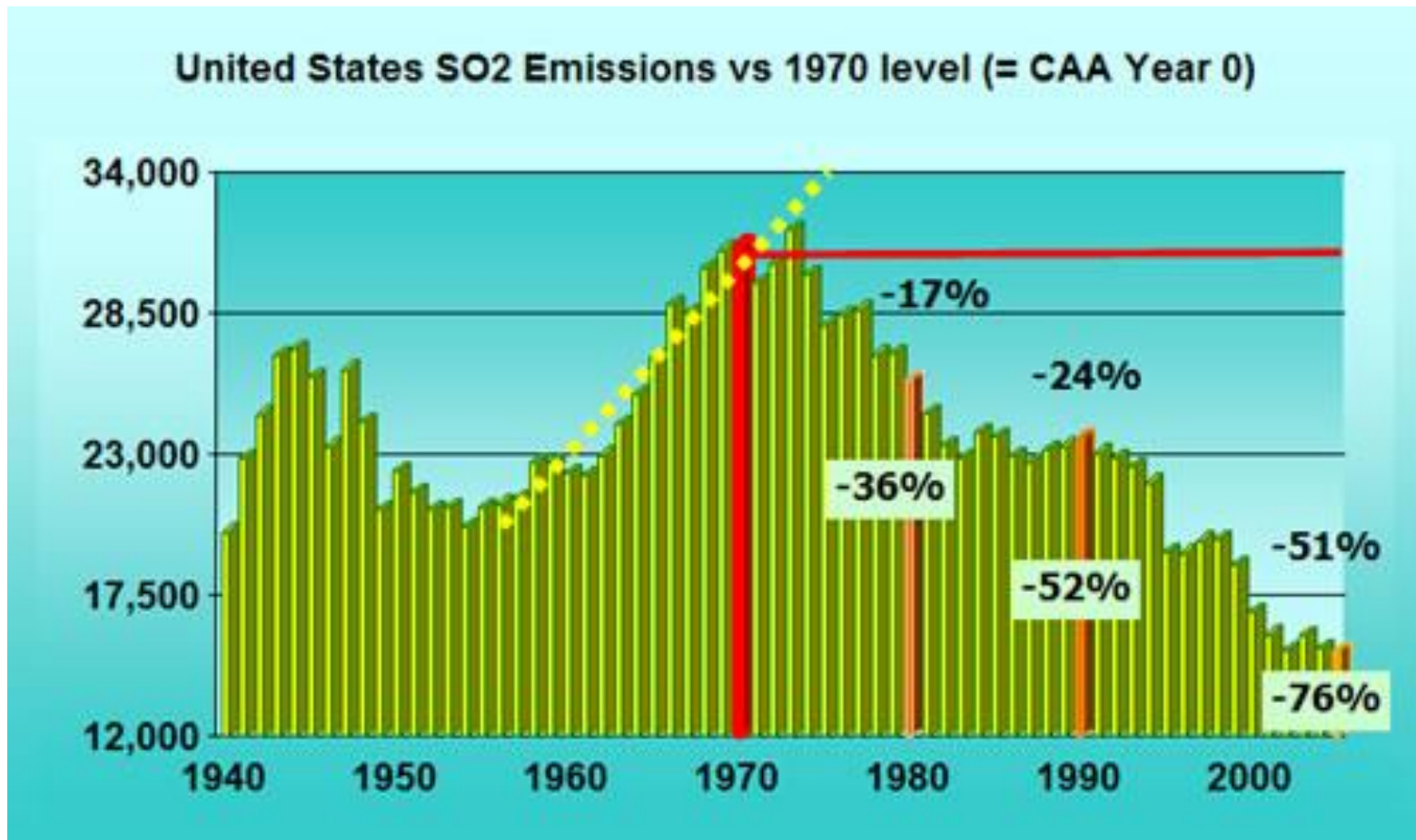
2. Protecting Natural resources

a. **Environmental Protection Agency (EPA)**- created as part of **National Environmental Policy Act** in 1970

b. Led to development of policies and regulations to protect environment across U.S.



- 1). **Clean Air Act, Clean Water Act, Endangered Species Act** have major impact on environment
- 2). Has greatly increased public awareness



c. Formation of **National Parks** to preserve large areas of wilderness has protected ecosystems



3. A sustainable Earth- **humans** represent an integral part of Earth's ecosystems



- a. We have ability to control how fast our **population** grows, through controlling birth rates
- b. We can develop **technology** to produce more food and produce less waste
- c. We have ability to change our **practices** and take **action** to protect and maintain ecosystems