



Global Warming



- The earth climate is a balance between determining factors such as solar radiation, the earth's orbit, atmospheric composition, oceans, land and the reflectivity of the earth and the atmosphere. Humans interfere with the composition of the atmosphere.





Global Warming – What is it?



- Rise in earth's temperature
- Results from changes in the natural environment
- Caused by too much carbon dioxide





Composition of the atmosphere



- By volume, the composition of dry air can be broken down as follows:

78% Nitrogen (N₂)

21% Oxygen (O₂)

0.9% Argon (Ar)

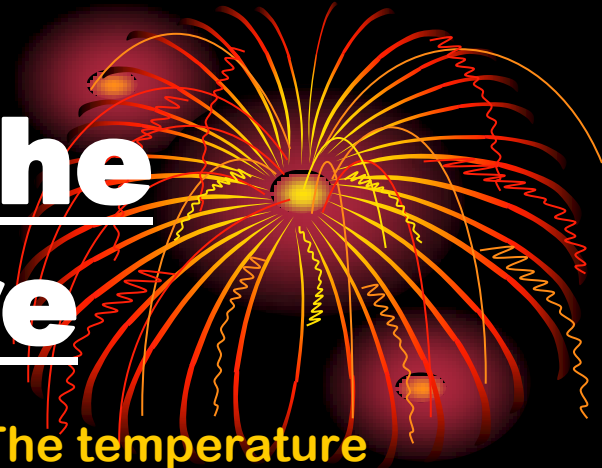
0.03% Carbon Dioxide (CO₂)

Trace amounts: Neon, helium, Krypton, Xenon, Methane, and Nitrous Oxide

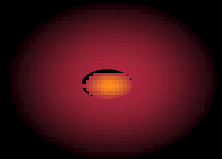




Regions of the Atmosphere



1. Troposphere. 10-17 km above sea level. (55 C). The temperature decreases with height in the troposphere. The upper limit of troposphere is called :Tropopause
2. Stratosphere. From 17 km up to 50 km above sea level. Temperature increases with altitude (0C). Contains Ozone Layer (O₃). The Ozone layer extends from about 10-30 miles, being most concentrated between 11-15 miles. The upper limit of stratosphere is called: Stratopause.
3. Mesosphere. The region above the stratosphere is called the mesosphere. From 50 Km up to 90 Km. Temperature begins to fall with increasing altitude. Here the temperature again decreases with height, reaching a minimum of about -90°C at the "mesopause".
4. Thermosphere. The thermosphere lies above the mesopause, and is a region in which temperatures again increase with height. This temperature increase is caused by the absorption of energetic ultraviolet and X-Ray radiation from the sun.



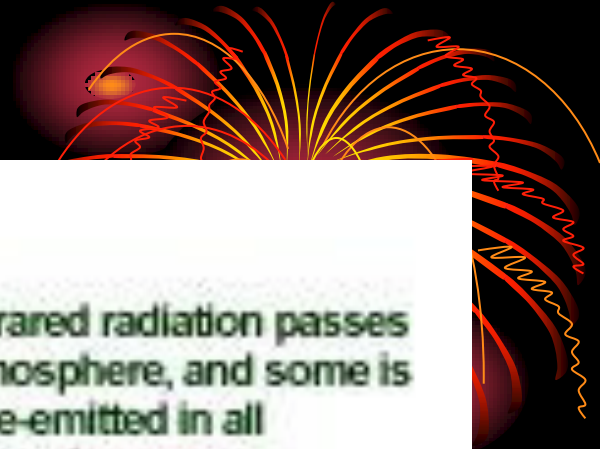


Regions of the Atmosphere



- 5. The Exosphere.** The region above about 500 km is called the exosphere. It contains mainly oxygen and hydrogen atoms, but there are so few of them that they rarely collide - they follow "ballistic" trajectories under the influence of gravity, and some of them escape right out into space.
- 6. The Magnetosphere.** The earth behaves like a huge magnet. It traps electrons (negative charge) and protons (positive), concentrating them in two bands about 3,000 and 16,000 km above the globe - the Van Allen "radiation" belts. This outer region surrounding the earth, where charged particles spiral along the magnetic field lines, is called the magnetosphere.





The Greenhouse Effect



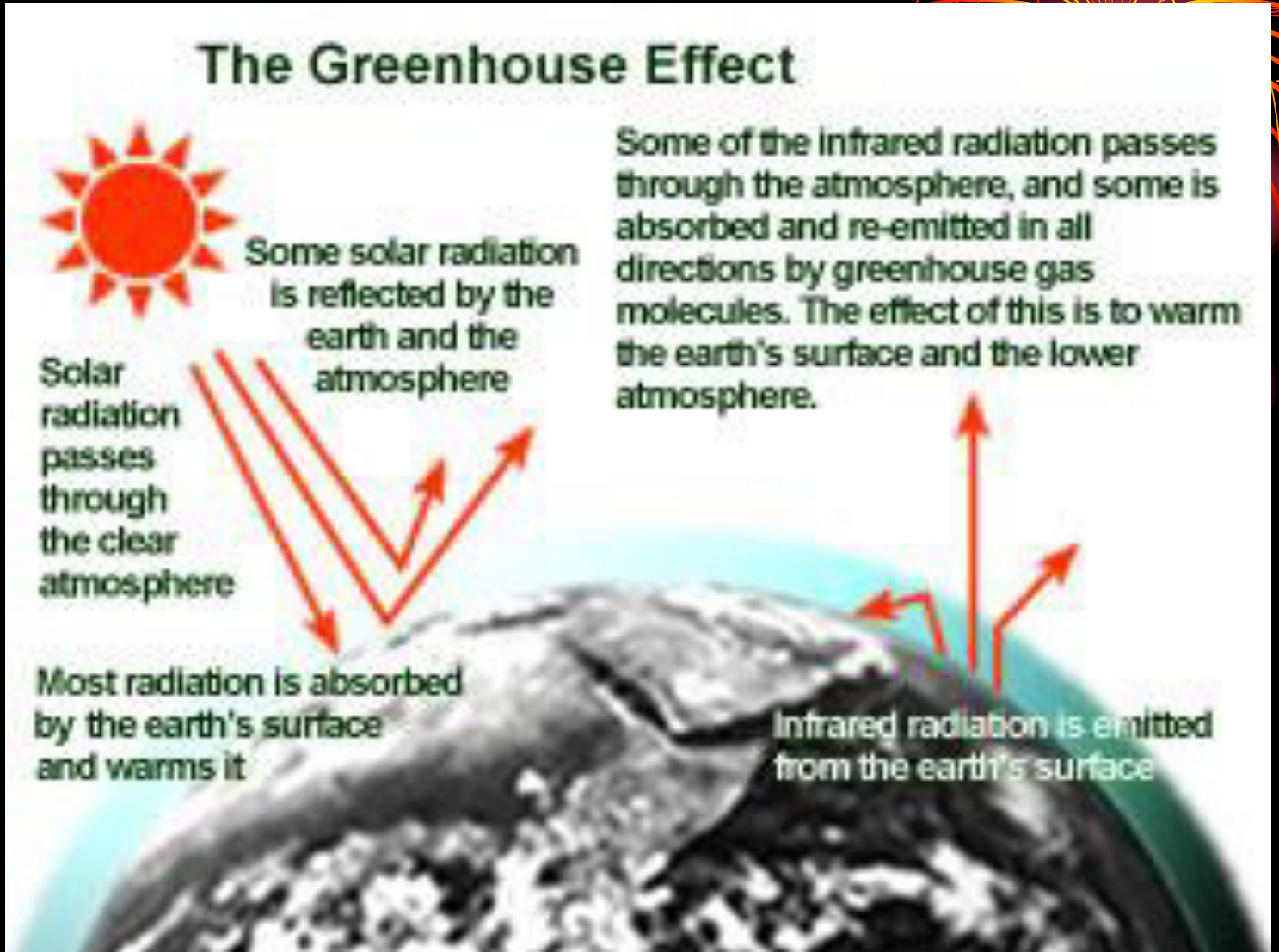
Some solar radiation is reflected by the earth and the atmosphere

Solar radiation passes through the clear atmosphere

Most radiation is absorbed by the earth's surface and warms it

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the earth's surface and the lower atmosphere.

Infrared radiation is emitted from the earth's surface





Greenhouse gases

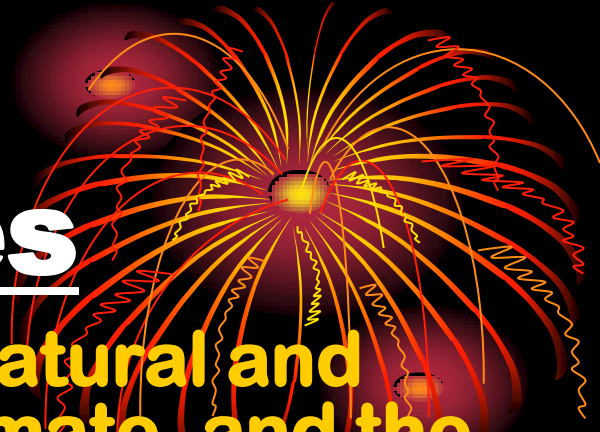


- It has become increasingly clear that humans are changing the chemical composition of the atmosphere in ways that can affect conditions at the Earth's surface – with potential consequences for all Earth's inhabitants.





Greenhouse gases



- Greenhouse gases emitted from natural and human-related activities affect climate, and the climate system is warming. Human activities, such as combustion of fossil fuels, release gases and particles that can form harmful pollution in the troposphere, the atmospheric layer nearest to Earth's surface. Poor air quality prematurely kills more than 60,000 people in the United States every year, according to the U.S. Environmental Protection Agency. And in the stratosphere, a "blanket" of ozone – the "ozone layer" – shields us from the harmful effects of the Sun's ultraviolet radiation. Some chemicals released into the atmosphere by people can deplete this protective ozone layer, which in turn can lead to crop damage, harm to natural ecosystems, and skin





Burning of fossil fuels



- The burning of fossil fuels releases Carbon dioxide in the atmosphere.
- In the past 150 years, burning fossil fuels has caused a 25 % increase in Carbon dioxide emissions.

In the last 200 years:

- Nitrous oxide has increased 17%.
- Methane gas has increased 150%!!





Greenhouse Gases



- **Carbon dioxide**
 - **combustion of solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products**
- **Methane:**
 - **production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic wastes in municipal solid waste landfills, and the raising of livestock.**
- **Nitrous oxide**
 - **agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels.**
- **hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6),**
 - **industrial processes.**

Source: <http://www.epa.gov/globalwarming/emissions/index.html>





The Major Contributors to Global Warming



<u>Contributor</u>	<u>% of Total warming Effect</u>
Carbon Dioxide (CO ₂)	61%
Methane (CH ₄)	15%
Nitrous Oxide (N ₂ O)	4%
Other Nitrogen Oxides	6%
Chlorofluorocarbons (CFCs) (CFC-11 and CFC-12)	9%
Other Gases	5%





Greenhouse Effect



- Carbon Dioxide, together with Ozone, Methane, Nitrous Oxide and Chlorofluorocarbons (CFCs) are called greenhouse gases. The presence in the atmosphere has led to an increase in temperature and changes in climate creating the so called “Greenhouse Effect”.
- Carbon Dioxide and other greenhouse gases in the atmosphere are transparent to visible light but are relatively opaque to long wave Infrared Radiation. These gases act the same way as glass in greenhouse. Greenhouses are much warmer inside than the air outside.





Greenhouse Effect

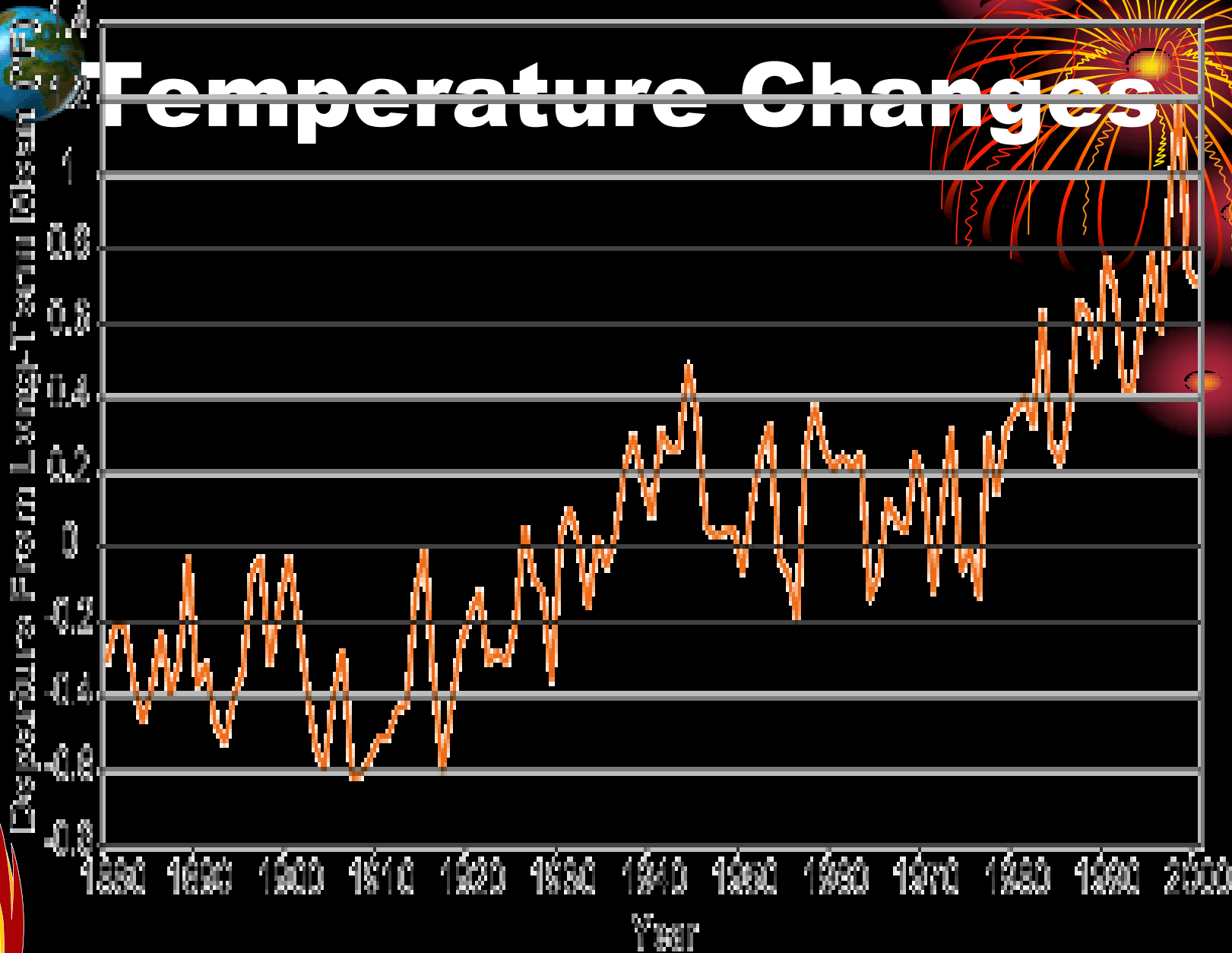


- The amount of heat trapped depends on the concentrations of greenhouse gases, and the length of time they stay in the atmosphere. If greenhouse gases are allowed to increase at an accelerating rate, then the environment will be at considerable risk from climate changes. For example, prolonged warming will cause the polar ice cover to melt and cause the oceans to rise. During the period from 1965 to 1980, the earth's average temperature rose 0.2 C. The world's mean sea level rose 12 cm in the 1970s due to thermal expansion of sea water and significant discharges of polar ice.





Temperature Changes





Global Warming



- **Cut your utility bills by purchasing energy-efficient appliances, fixtures, and other home equipment and products. The average house is responsible for more air pollution and carbon dioxide emissions than is the average car.**

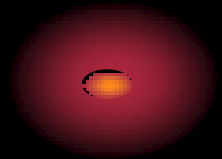
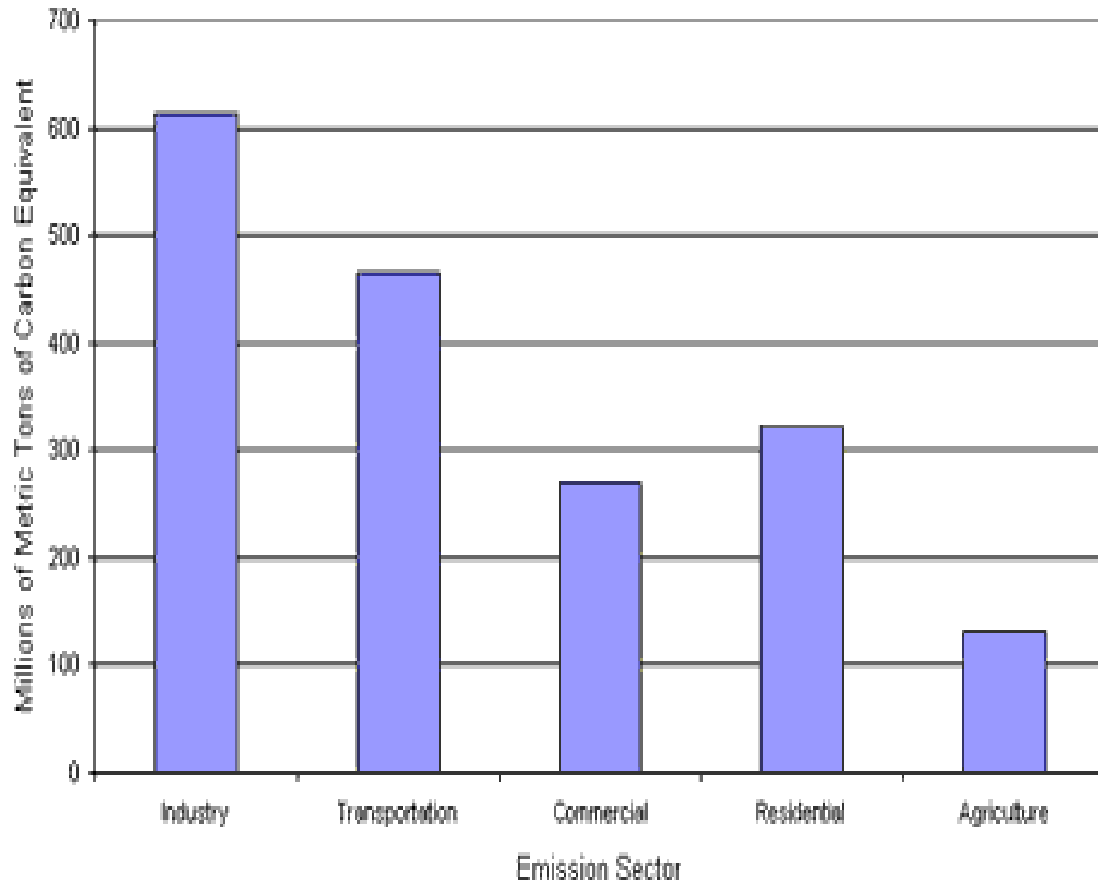




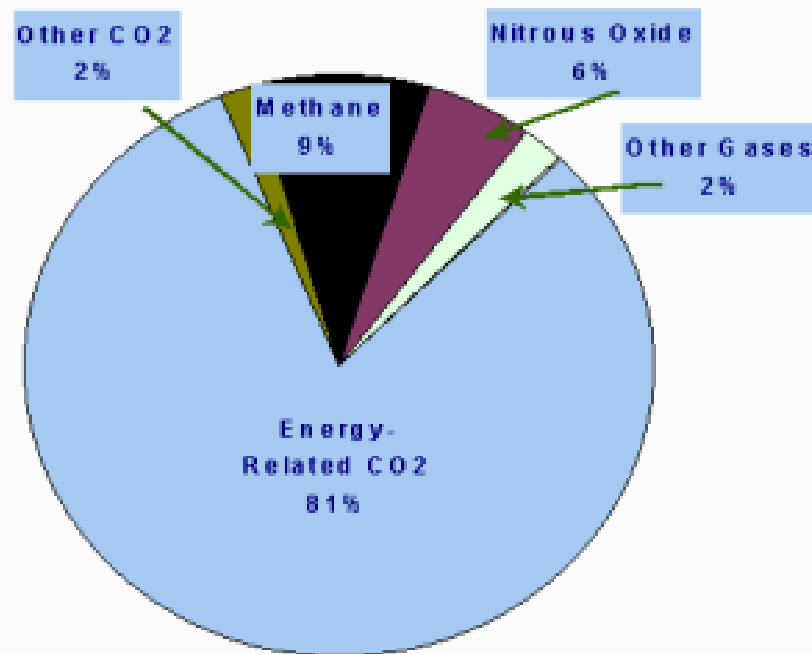
Emissions By Sector



1997 U.S. Greenhouse Gas Emissions by Sector



Distribution of U.S. Emissions by Greenhouse Gas, 1999



Source: EIA, *Emissions of Greenhouse Gases in the United States 1999*



Individual Emissions



- In the United States, approximately 6.6 tons (almost 15,000 pounds carbon equivalent) of greenhouse gases are emitted per person every year. And emissions per person have increased about 3.4% between 1990 and 1997. Most of these emissions, about 82%, are from burning fossil fuels to generate electricity and power our cars.



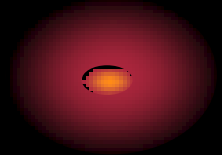
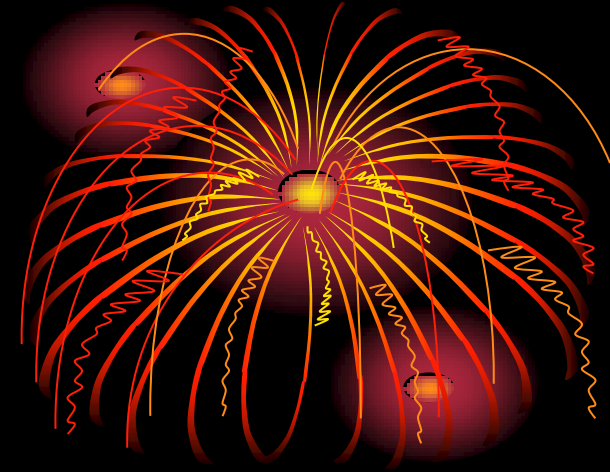


Effects

- Health
- Water resources
- Polar regions
- Mountains
- Forests
- Rangelands
- Deserts
- Coastal Zones
- Agriculture
- International

Required Reading:

<http://www.epa.gov/globalwarming/impacts/index.html>





Direct and Indirect Effects of Global Warming



- The indirect effects are:

1. Changes in food production, food supplies affected by changes in crop, livestock and fish farming productivity.
2. Local shortages of food.

Direct effects on health from climate change are:

1. Increased human exposure to exceptional heat waves especially elderly and young people.
2. Heat stress may cause illness. Severe heat stress may lead to rapid deterioration in health, with effects ranging from mild syncope to fatal heat stroke.

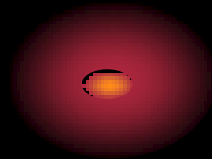
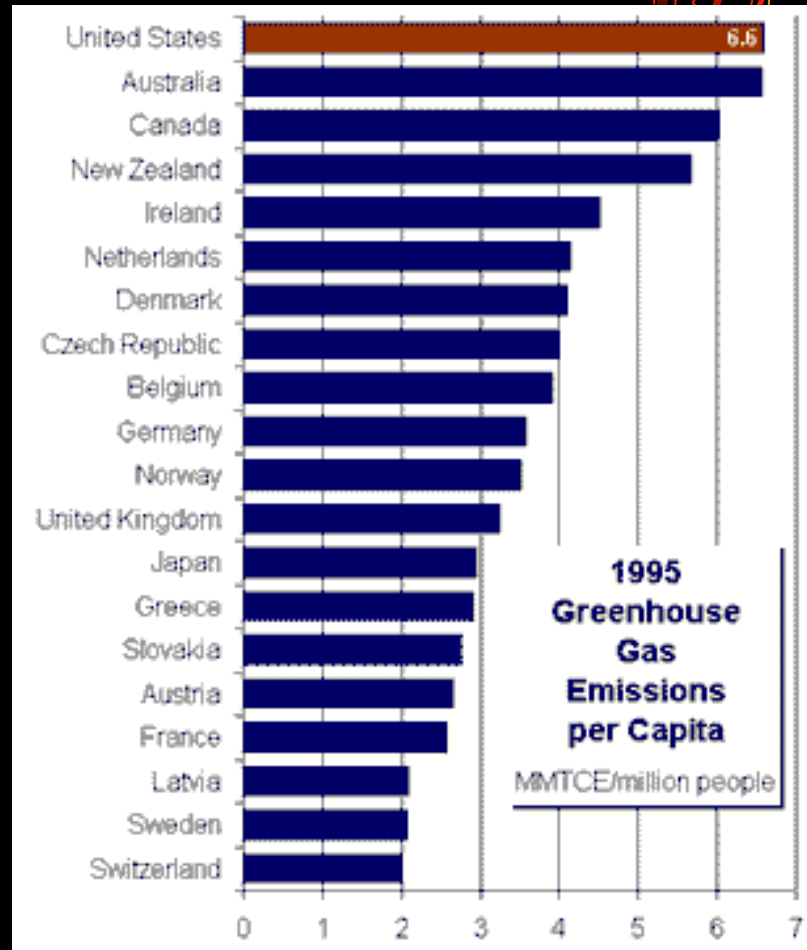
Indirect effects of atmospheric warming could be:

1. a change in the distribution of communicable diseases such as malaria, schistosomiasis.
2. Increase risk of waterborne - diseases.





Greenhouse Gas Emissions





Kyoto Protocol



The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC), an international treaty on global warming. Countries which ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases.

- A total of 141 countries have ratified the agreement. Notable exceptions include the United States and Australia.
- It was negotiated in Kyoto, Japan in December 1997, opened for signature on March 16, 1998, and closed on March 15, 1999.
- Current estimates are that even if successfully and completely implemented, the Kyoto Protocol is predicted to reduce the average global temperature by somewhere between 0.02°C and 0.28°C by the year 2050.



How To Prevent Global Warming:



- ❖ Plant trees
- ❖ Conserve energy:
 - ❖ (examples: 1. use low-energy, low-water-use washing machines, 2. use a solar heated system for hot water, 3. use an electric or push mower for gasoline powered mower)
- ❖ Buy energy efficient products
- ❖ Buy products that have reusable or recyclable packaging
- ❖ Reduce use of car (walk instead)





3R's of Saving Mother Nature



REDUCE,

REUSE,

RECYCLE!

