

CLIMATE CHANGE AND ACID RAIN

Mr. Banks

7th Grade Science

COMPOSITION OF AIR?



COMPOSITION OF AIR?

- ▶ 78% Nitrogen
- ▶ 21% Oxygen
- ▶ 0.93% Argon and other noble gases
- ▶ 0.04% carbon dioxide
- ▶ Variable amounts of water vapor
- ▶ Variable amounts of pollutant gases

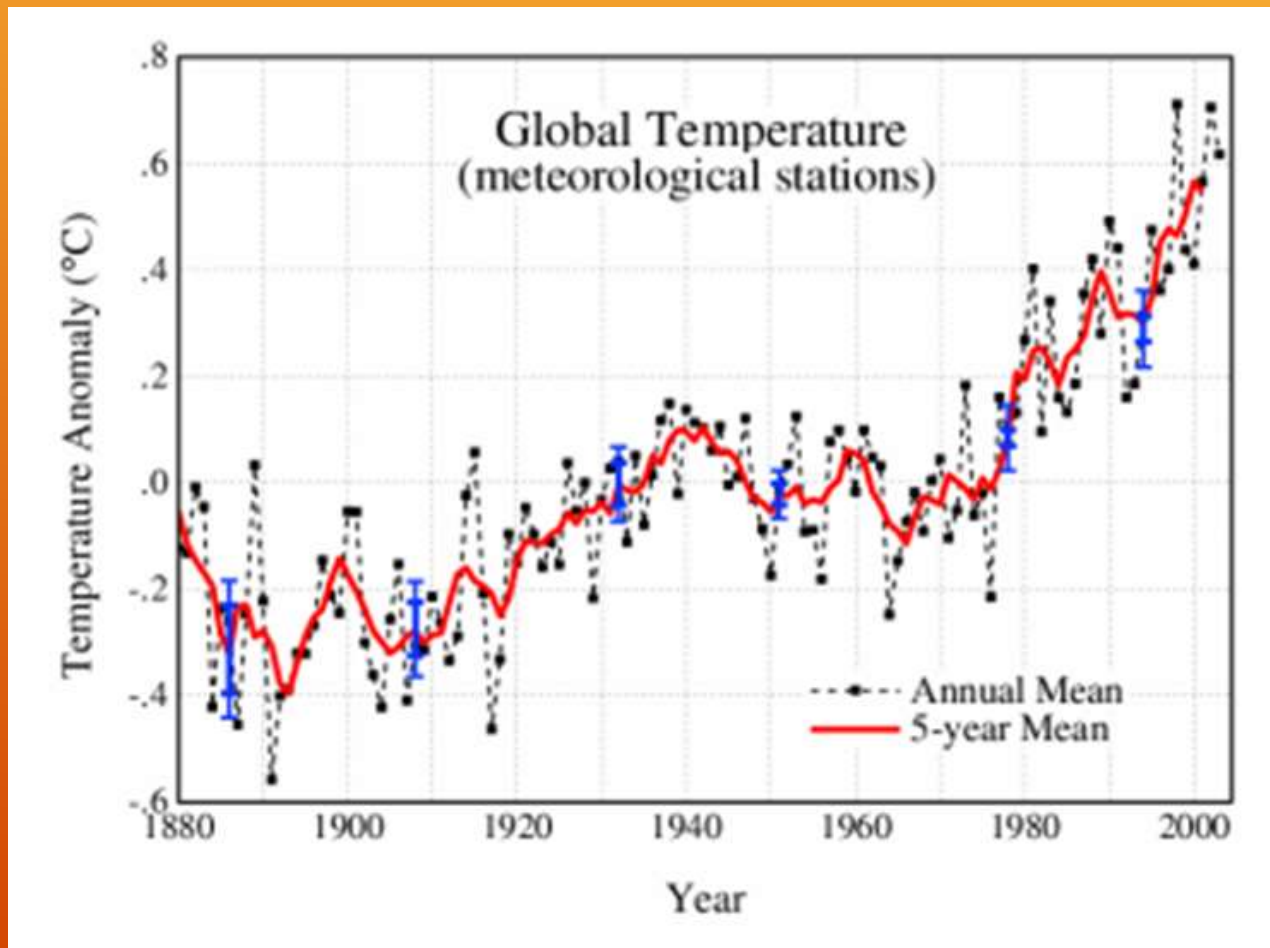
GLOBAL WARMING

- ▶ The rise in the overall average temperature of the Earth from year to year.
- ▶ Thought to be caused by more of the sun's heat getting trapped in the atmosphere due to an increase in certain pollutants.



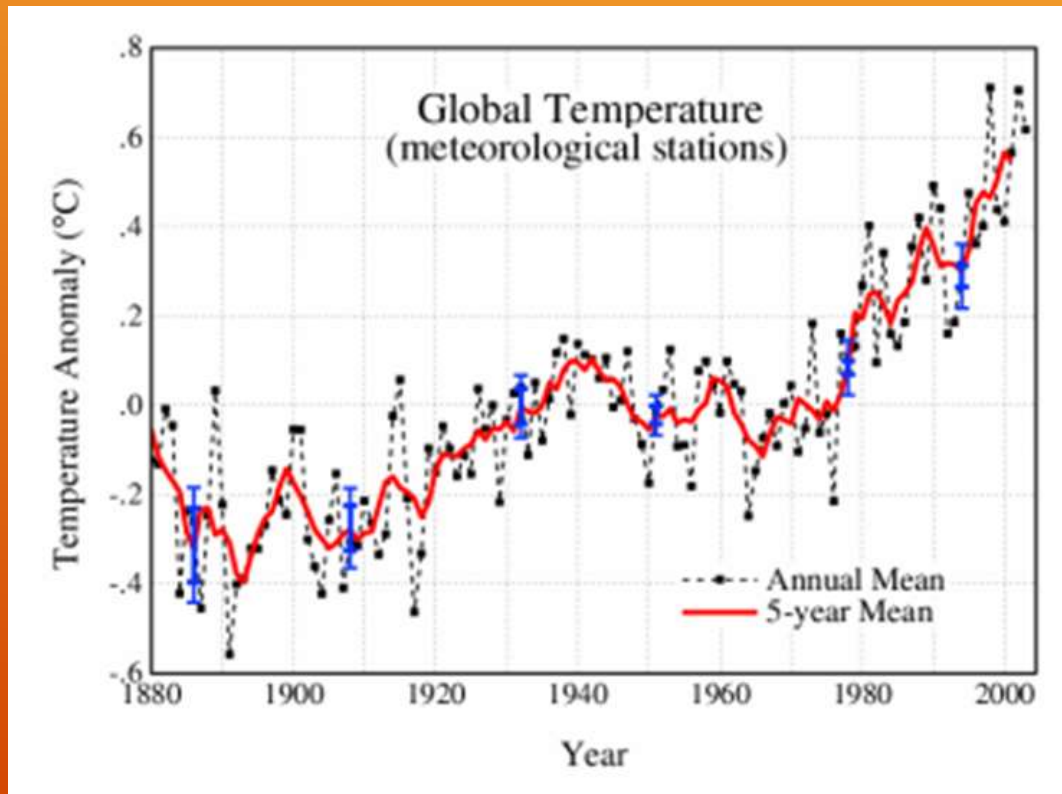
GLOBAL WARMING

- ▶ Although temperatures fluctuate naturally, over the past 50 years the average global temperature has increased at the fastest rate in recorded history.



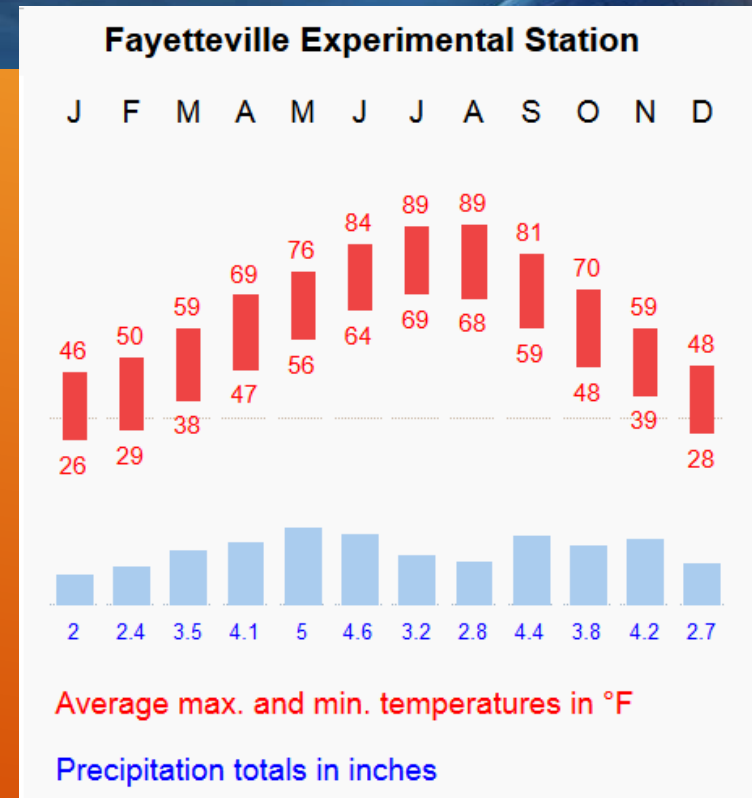
GLOBAL WARMING

- ▶ The 10 hottest years on record have all occurred since 1990.
- ▶ Scientists say that unless we curb global warming emissions, average U.S. temperatures could be 3 to 9 degrees higher by the end of the century.



CLIMATE

- ▶ Climate ≠ Weather
 - ▶ Weather is the current state of the atmosphere.
 - ▶ Short term - What it's like outside right now.
 - ▶ Climate is the average pattern of weather for a particular place over time.
 - ▶ Long term – what it's usually like during a certain time.





THE LOGIC OF CLIMATE CHANGE DENIERS WHEN APPLIED TO EVERYDAY WEATHER.

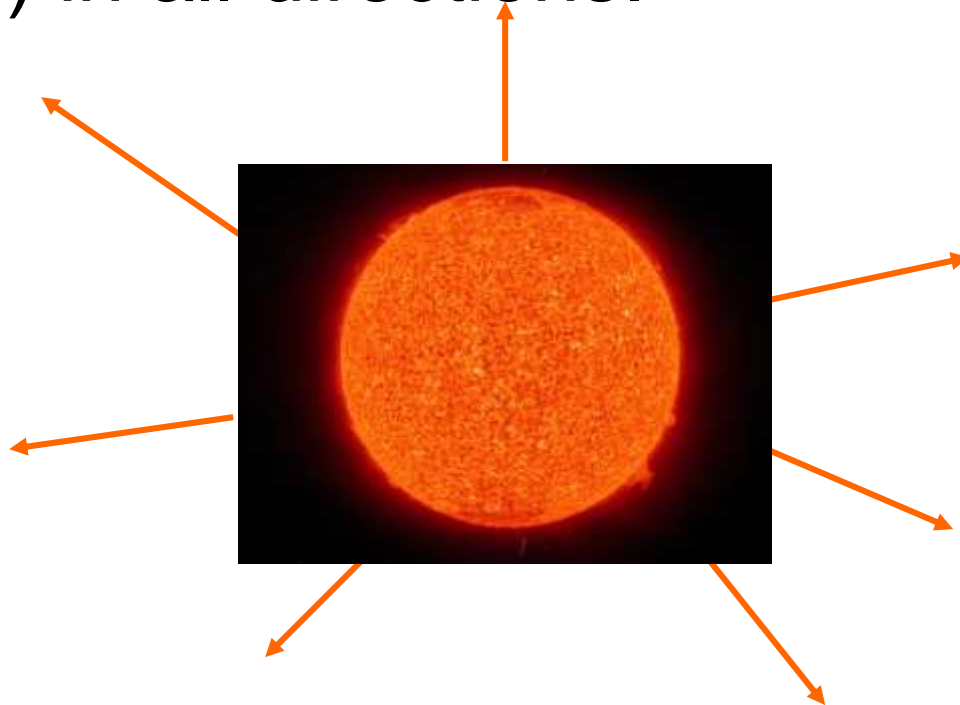
HOW DOES GLOBAL WARMING WORK?

- ▶ 1. About half of the solar radiation reaching the Earth is absorbed and heats the Earth's surface.
- ▶ 2. The Earth emits infra-red radiation and some of this is 'blocked' due to clouds and gases in the atmosphere – meaning it stays on Earth and doesn't reach space.



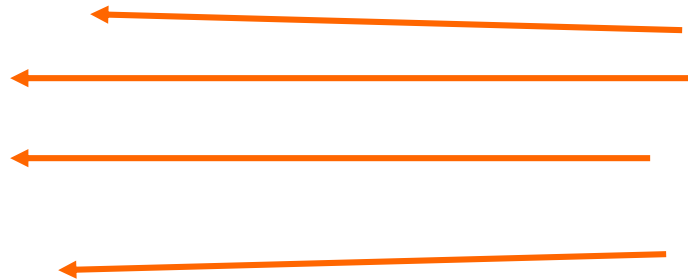
The Sun

The sun emits electromagnetic waves (gamma rays, X-rays, ultra-violet, visible light, infra-red, microwaves and radio waves) in all directions.



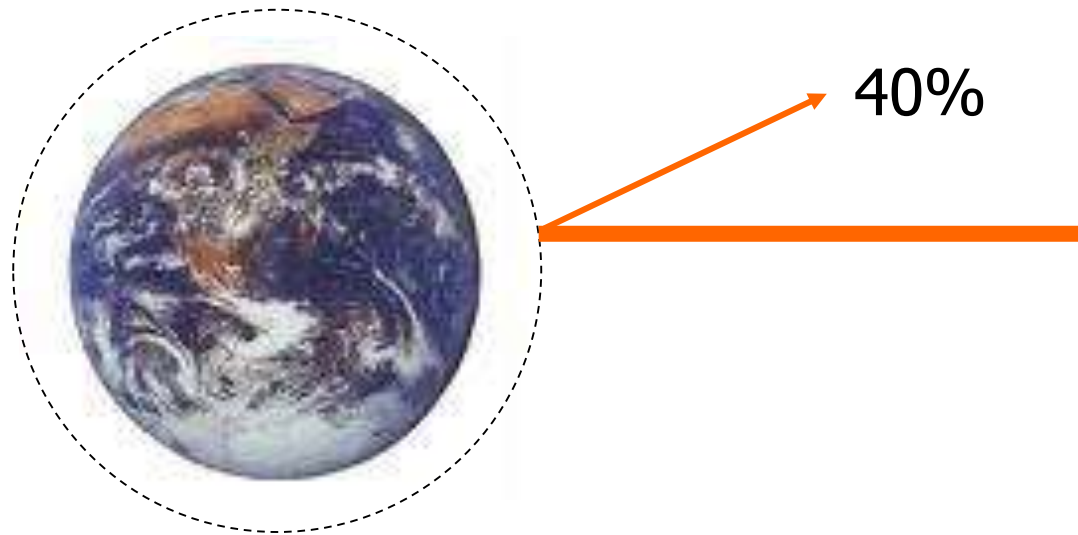
The earth

Some of these waves will reach the earth



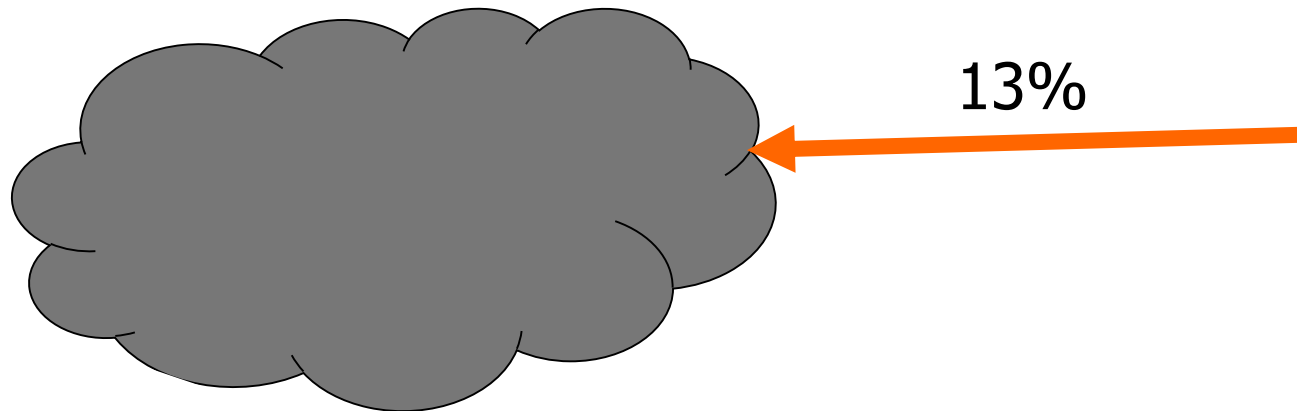
Reflected

40% will be reflected by the earth's atmosphere.



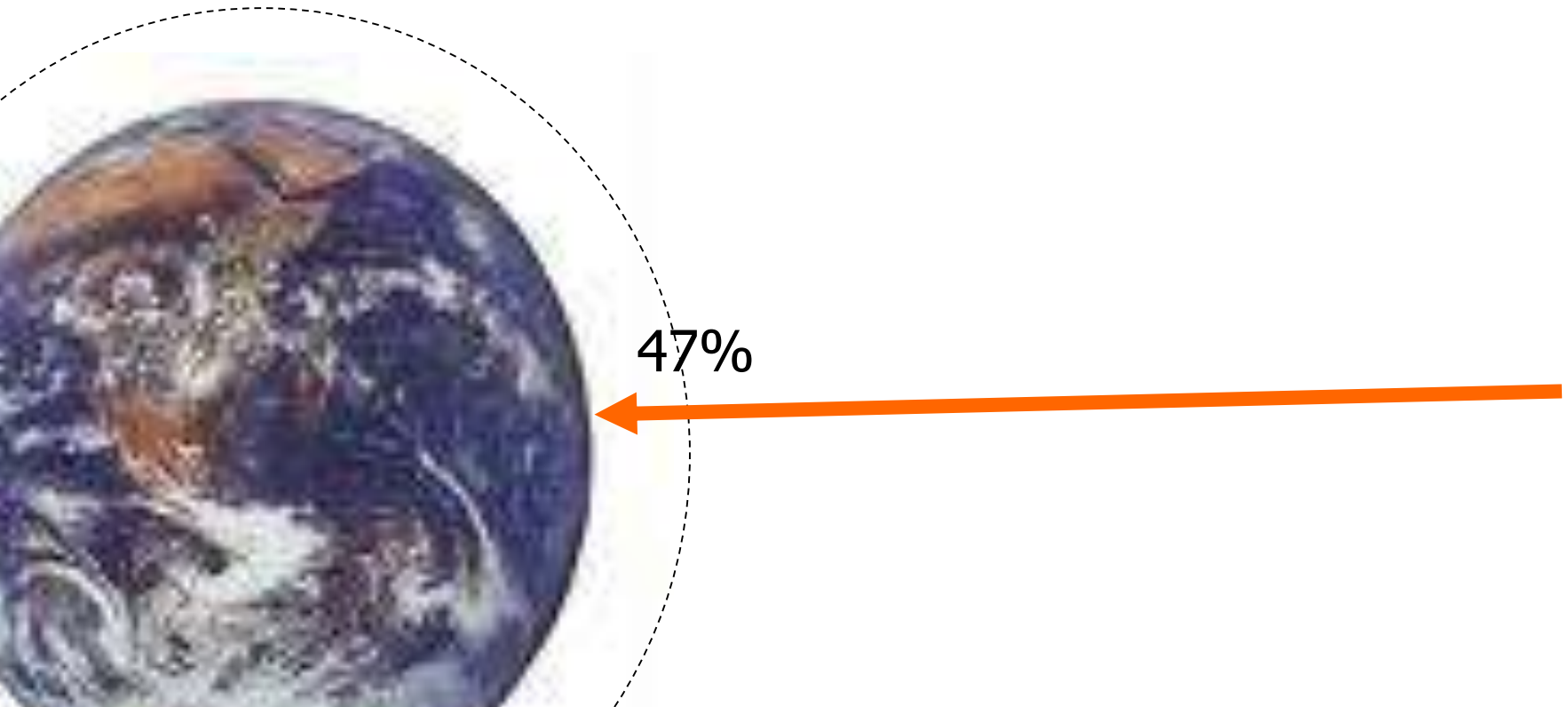
Absorbed

Some (13%) will be absorbed by clouds and the atmosphere



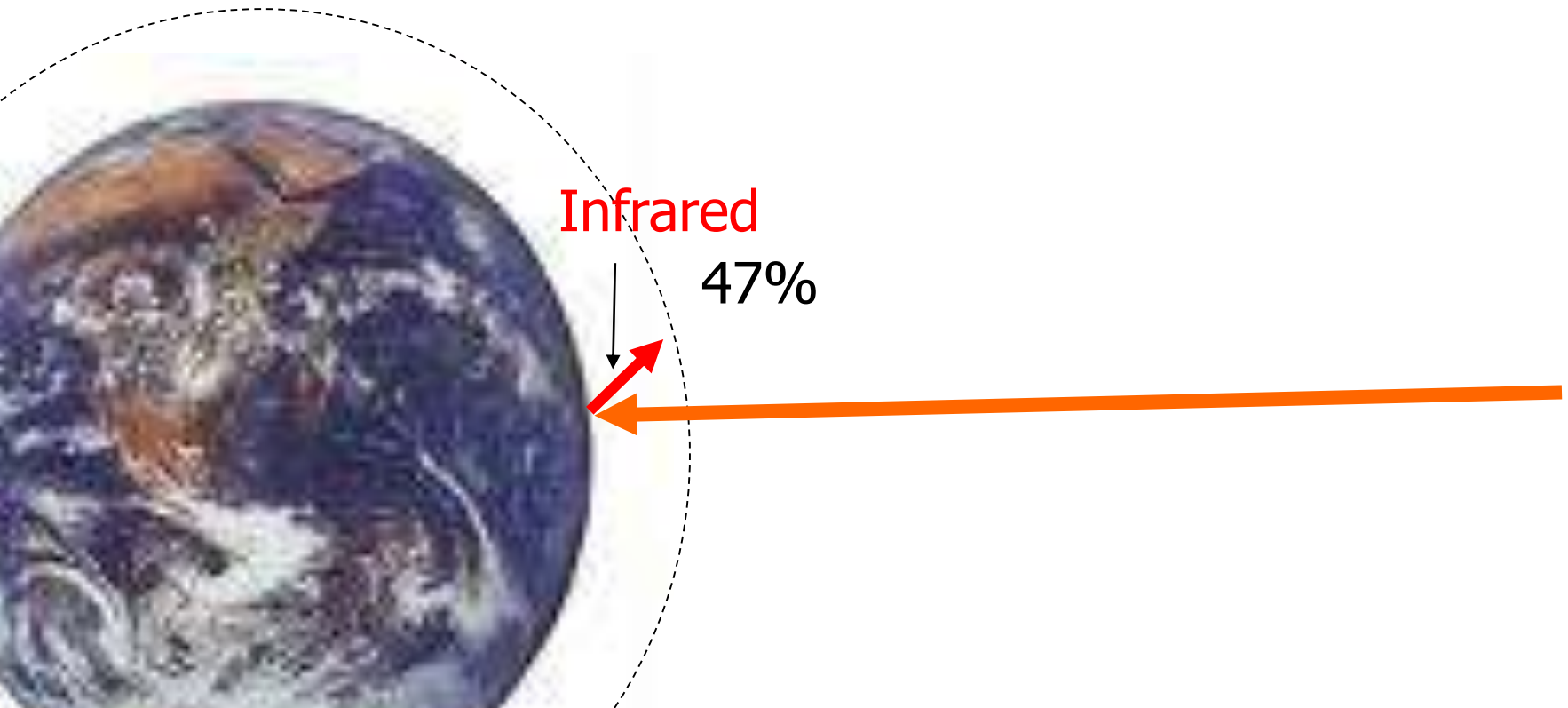
Absorbed by the earth

Around 47% reaches the ground and is absorbed by the earth's surface.



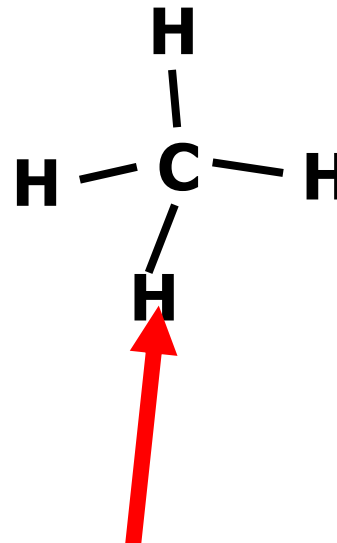
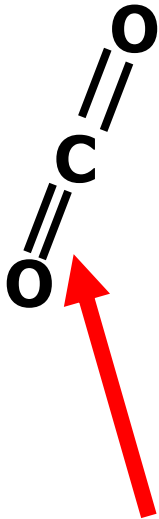
Absorbed by the earth

This absorbed solar energy is released as infrared radiation.



Absorbed

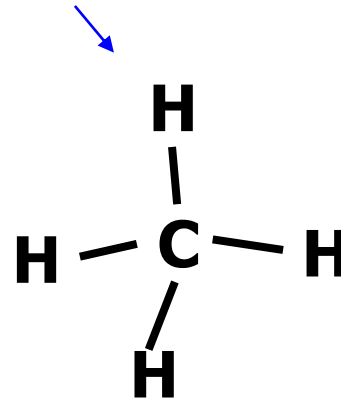
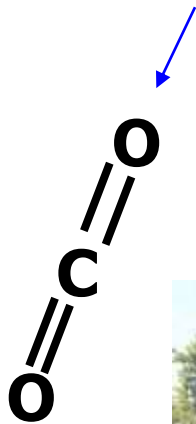
- Various gases in the atmosphere can absorb the infrared radiation.



They vibrate more (become **hotter**)

Greenhouse gases

- These gases are known as “Greenhouse” gases. They include carbon dioxide, methane and CFCs.



Balance

There exists a balance between the energy absorbed by the earth (and its atmosphere) and the energy emitted.



Balance

This means that normally the earth has a fairly constant average temperature (although there have been big changes over **thousands** of years)



Balance

Without the natural “greenhouse effect” the earth would be too cold to live on.



Greenhouse gases

- Most scientists believe that the greenhouse gasses we are producing are upsetting the balance and producing a higher temperature on earth.



THE GREENHOUSE EFFECT.

1) Heat and light energy reach us from the sun...



3) ...some of the heat escapes back into space...

4) ...while some of it is reflected back to the Earth - this is called The Greenhouse Effect

2) ...a lot of this heat is absorbed and later released from the Earth's surface...

CARBON DIOXIDE

- ▶ Carbon dioxide is the number one greenhouse gas produced through human activities.
- ▶ It is thought to be the main cause of global warming.
- ▶ Carbon dioxide makes up 82 % of all the greenhouse gas emissions from humans.



CO₂ SOURCES

- ▶ Fossil fuels

- ▶ Coal-burning power plants are the largest U.S. source of carbon dioxide pollution - they produce 2.5 billion tons every year.
- ▶ Automobiles, are the second largest source, and create nearly 1.5 billion tons of CO₂ annually.



FOSSIL FUELS

- ▶ Important in essentially all types of energy use in the world.
- ▶ Provide 85% of the world's energy.
- ▶ Formed from the remains of prehistoric plants and animals.



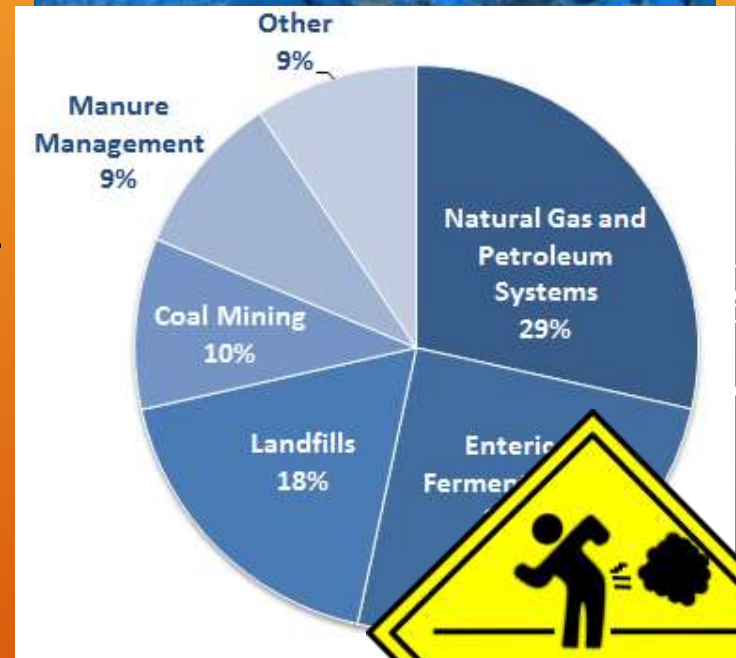
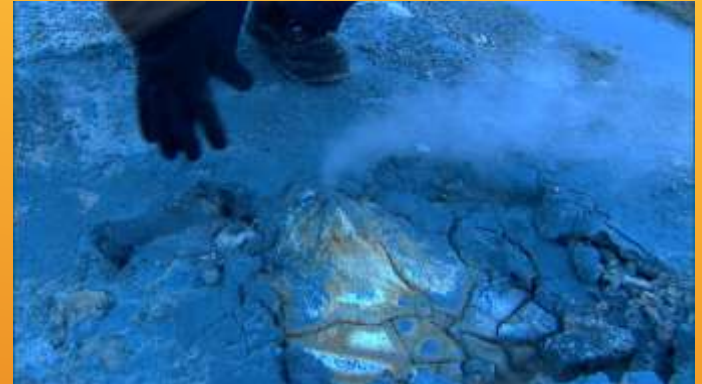
CO₂ SOURCES

- ▶ Deforestation
 - ▶ Trees naturally store carbon dioxide through photosynthesis.
 - ▶ Cutting them down and burning them releases the carbon stored in trees and also results in less carbon dioxide being removed from the atmosphere.



METHANE

- ▶ As a greenhouse gas, it is 20 times more powerful than carbon dioxide.
- ▶ Emitted naturally and in human related activities.
- ▶ Natural sources
 - ▶ Swamps, termites, bacteria, oceans, and wildfires.
- ▶ Human related
 - ▶ Fossil fuel production, animal farming, rice cultivation, biomass energy, and landfills.



WHAT MIGHT HAPPEN IF THE WORLD
GETS WARMER?



WHAT MIGHT HAPPEN?

- ▶ Polar ice caps melt

Shrinking cap

The Arctic polar ice cap is at its smallest size in 30 years of observations:



Source: NASA Goddard Space Flight Center

The Register

WHAT MIGHT HAPPEN?

- ▶ Higher sea levels
- ▶ Since 1900 global sea level has risen about eight inches. It's now rising at about an eighth of an inch a year –
and accelerating.



WHAT MIGHT HAPPEN?

- ▶ Flooding to low lying areas



WHAT MIGHT HAPPEN?

- ▶ More extreme weather (heatwaves, droughts, hurricanes, heavy rain)



WHAT MIGHT HAPPEN?

- ▶ Long term climate change
 - ▶ Desert → swamp
 - ▶ Great plains → desert



WHAT MIGHT HAPPEN?

- ▶ Associated social problems?
 - ▶ Food scarcity
 - ▶ People forced to move
 - ▶ Extreme weather destroying property
 - ▶ Public unrest



ACID RAIN



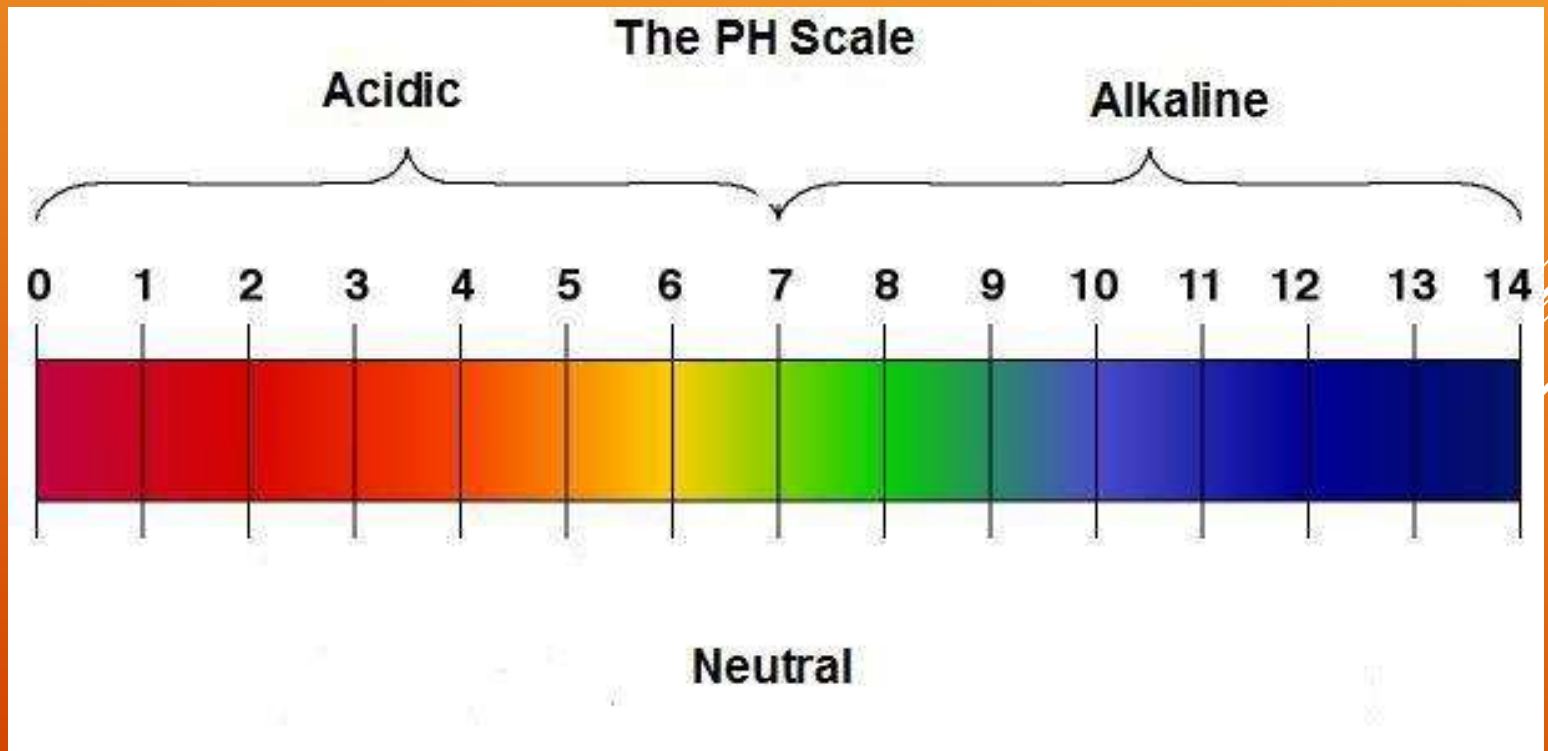
ACID RAIN

- ▶ Acid rain is rain, or any other form of precipitation (snow, mist, fog, dew) that is unusually acidic.



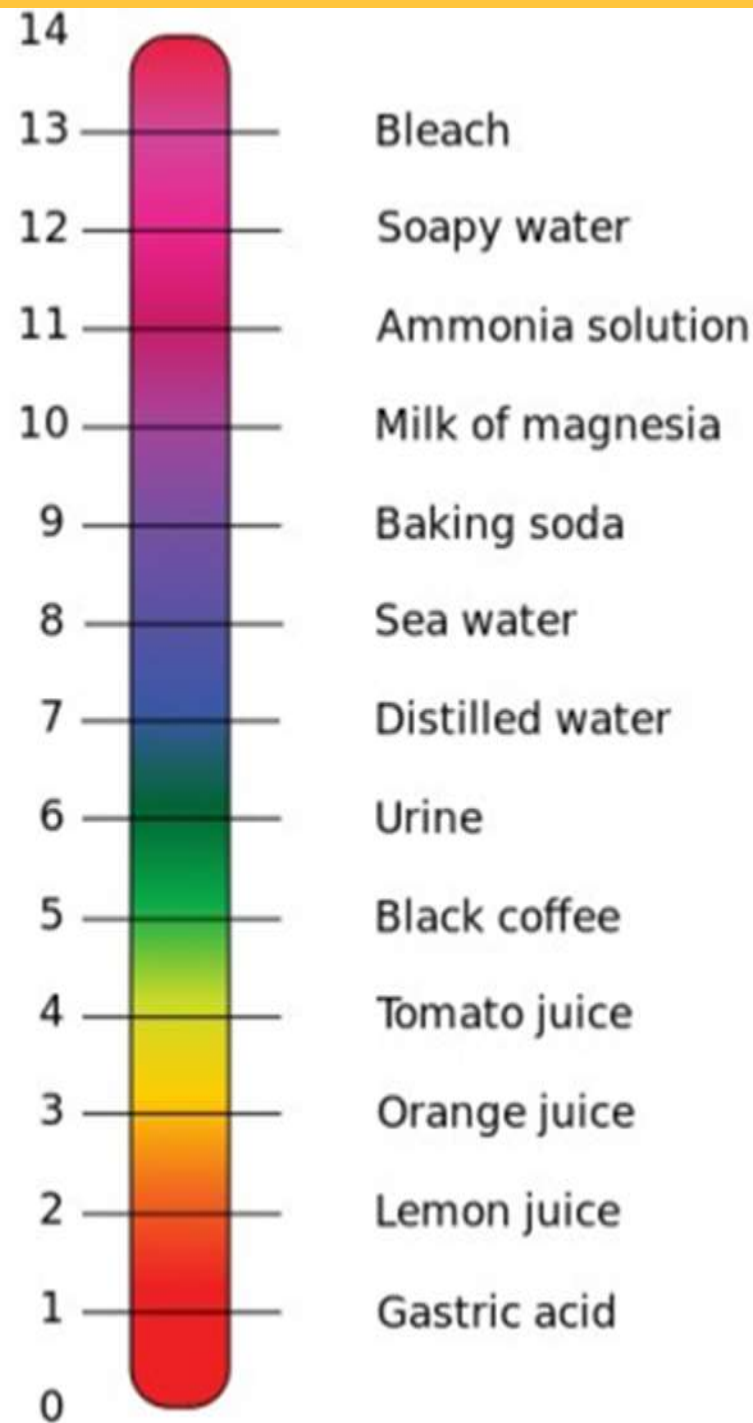
ACIDS

- ▶ Measured on the pH scale.
- ▶ Above pH 7 = Alkaline
- ▶ Exactly pH 7 = neutral
- ▶ Below pH 7 = Acidic



ACIDS

- ▶ The lower the number is the more acidic the liquid is.
 - ▶ The higher the number the more alkaline the liquid is.
- ▶ The further you get toward either end the more damaging the substance is.



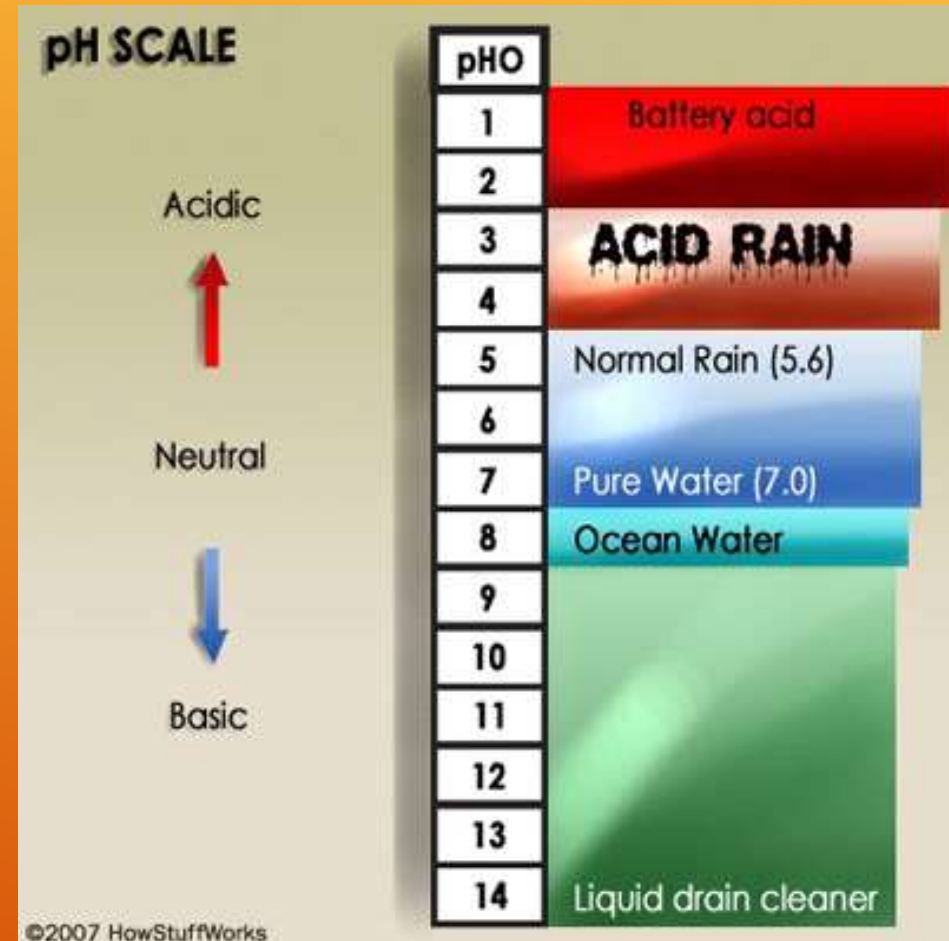
pH of Rain

- ▶ Pure water has a pH of 7.
- ▶ Normal rain has a pH of, on average, 5.6
- ▶ This is naturally caused by carbon dioxide in the air.
 - ▶ Water and carbon dioxide react to form carbonic acid which lowers the pH.

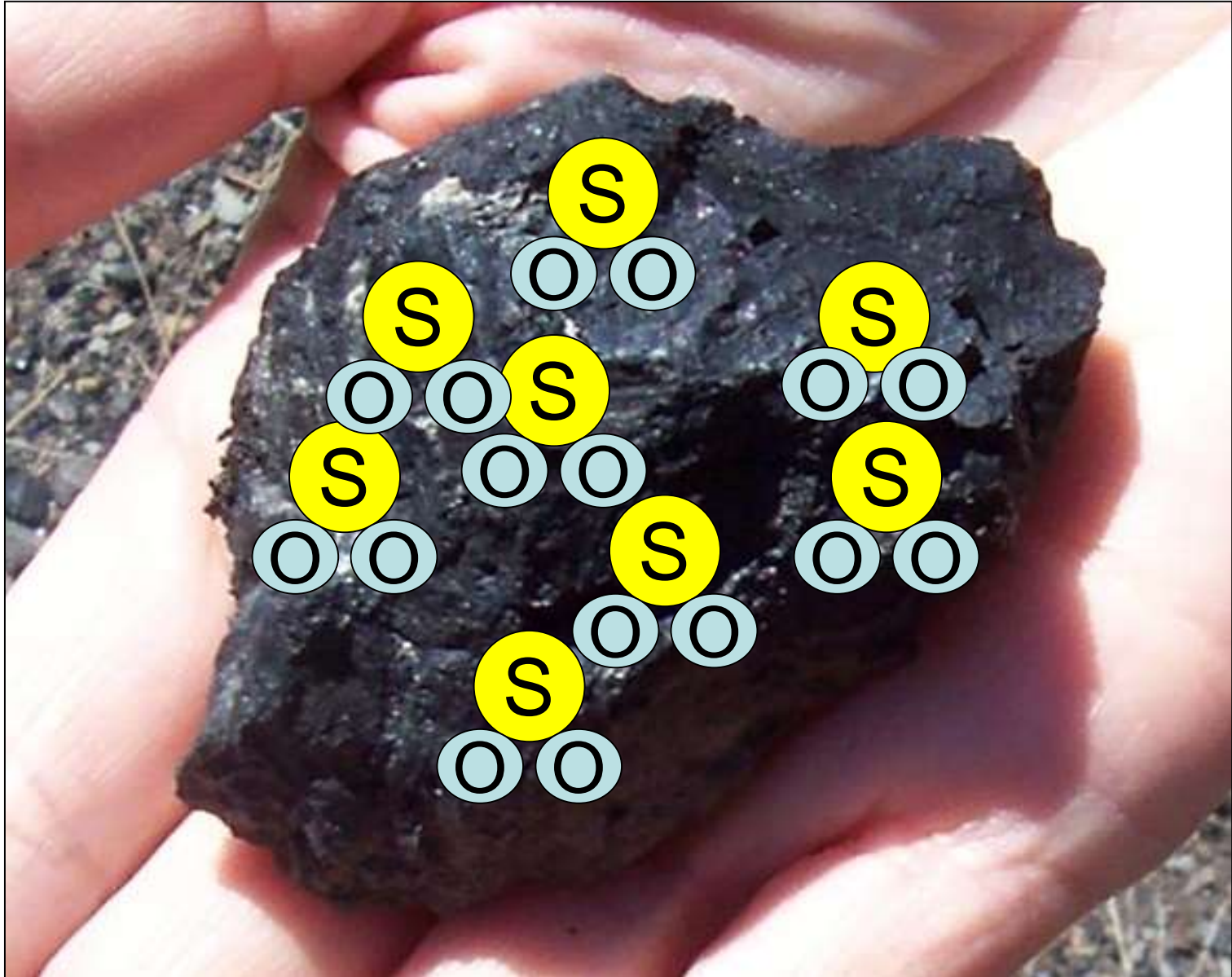


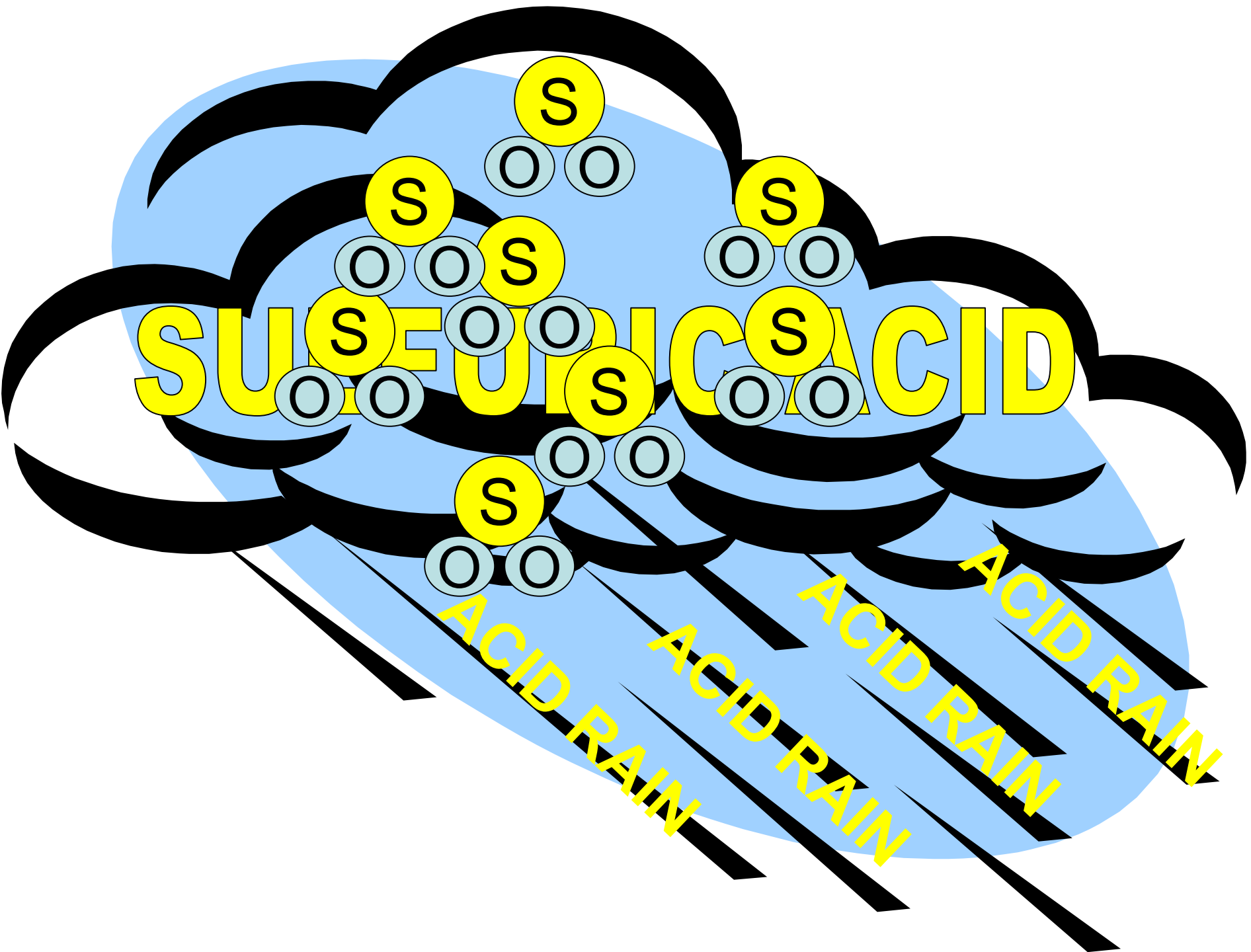
ACID RAIN

- ▶ Rain with a pH lower than 5
- ▶ Caused by man made pollutants.
 - ▶ Carbon dioxide
 - ▶ Sulfur dioxide
 - ▶ Nitrogen oxides



Fossil fuels contain sulphur



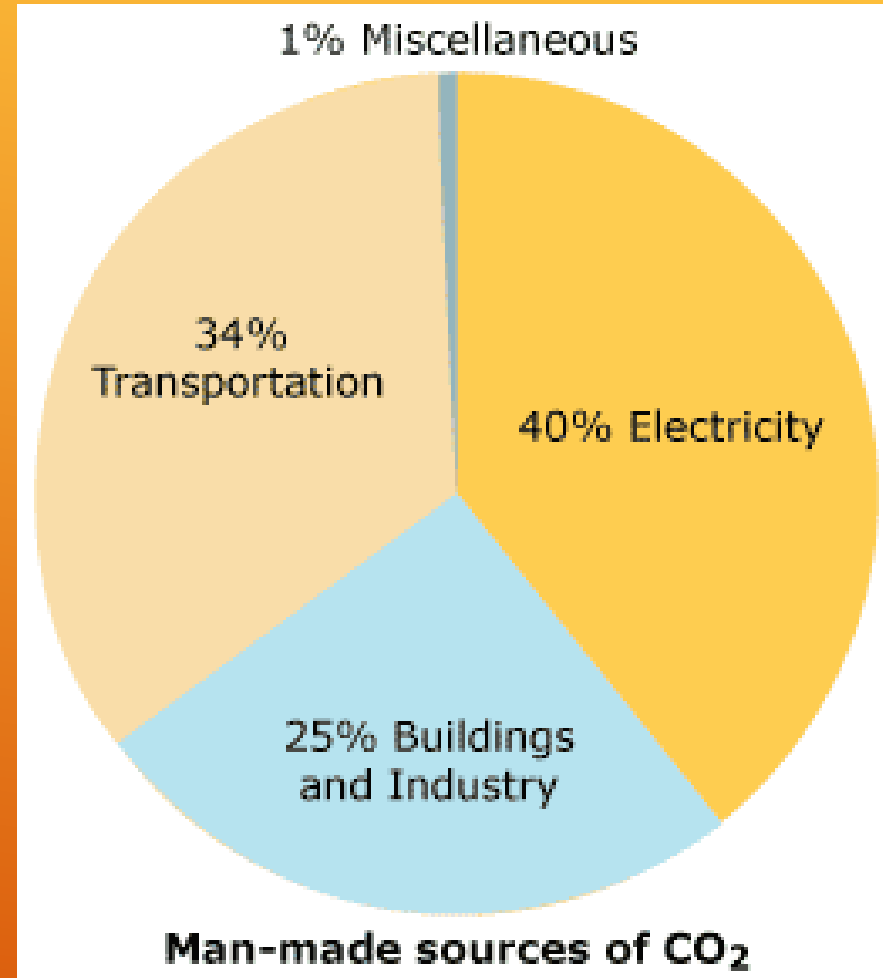


SULFURIC ACID

ACID RAIN
ACID RAIN
ACID RAIN
ACID RAIN

CARBON DIOXIDE

- ▶ Released by burning fossil fuels. (and almost everything else we normally burn)
- ▶ Makes rain acidic in the same way as natural carbon dioxide.



SULFUR DIOXIDE

- ▶ Sulfur dioxide is mainly produced from burning coal.
- ▶ Sulfur dioxide rises into the air and reacts with water to form sulfuric acid.



NITROGEN OXIDES

- ▶ Created when normal nitrogen in the atmosphere is heated to high temperatures.
 - ▶ Lightning, burning coal, or burning gasoline in a car.
- ▶ Nitrogen oxides in the air combine with water to form nitric acid.



EFFECTS OF ACID RAIN – WATER

- ▶ Acid rain lowers the pH of lakes and streams.
- ▶ The low pH is harmful to animals living in the water.
 - ▶ It also causes toxic levels of aluminum to be released from the soil.



	pH 6.5	pH 6.0	pH 5.5	pH 5.0	pH 4.5	pH 4.0
TROUT	Survives	Survives	Survives	Survives	Survives	Survives
BASS	Survives	Survives	Survives	Survives	Survives	Survives
PERCH	Survives	Survives	Survives	Survives	Survives	Survives
FROGS	Survives	Survives	Survives	Survives	Survives	Survives
SALAMANDERS	Survives	Survives	Survives	Survives	Survives	Survives
CLAMS	Survives	Survives	Survives	Survives	Survives	Survives
CRAYFISH	Survives	Survives	Survives	Survives	Survives	Survives
SNAILS	Survives	Survives	Survives	Survives	Survives	Survives
MAYFLY	Survives	Survives	Survives	Survives	Survives	Survives

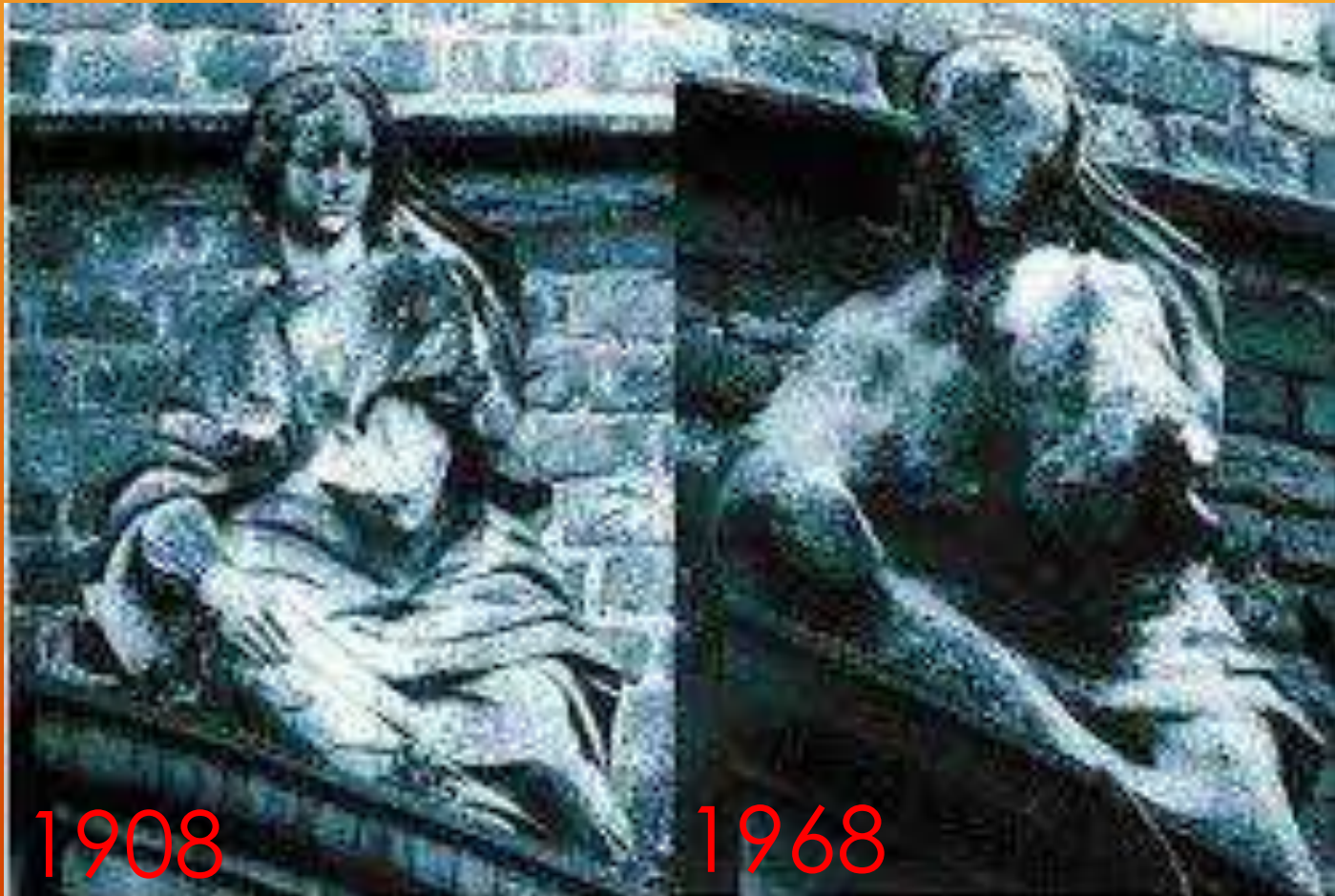
EFFECTS OF ACID RAIN – FORESTS

- ▶ Damages the leaves of trees.
- ▶ Releases toxic chemicals from the soil.
- ▶ Removes nutrients from the soil.



EFFECTS OF ACID RAIN – MATERIALS

- ▶ Destroys bronze, paint, and stone statues



EFFECTS OF ACID RAIN – HEALTH

- ▶ Acidic rain does not harm people directly.
 - ▶ It is not acidic enough to damage us.
- ▶ Sulfur dioxide and nitrogen oxides do damage us.
 - ▶ Leads to increased illnesses and death from heart and lung disorders such as asthma and bronchitis.

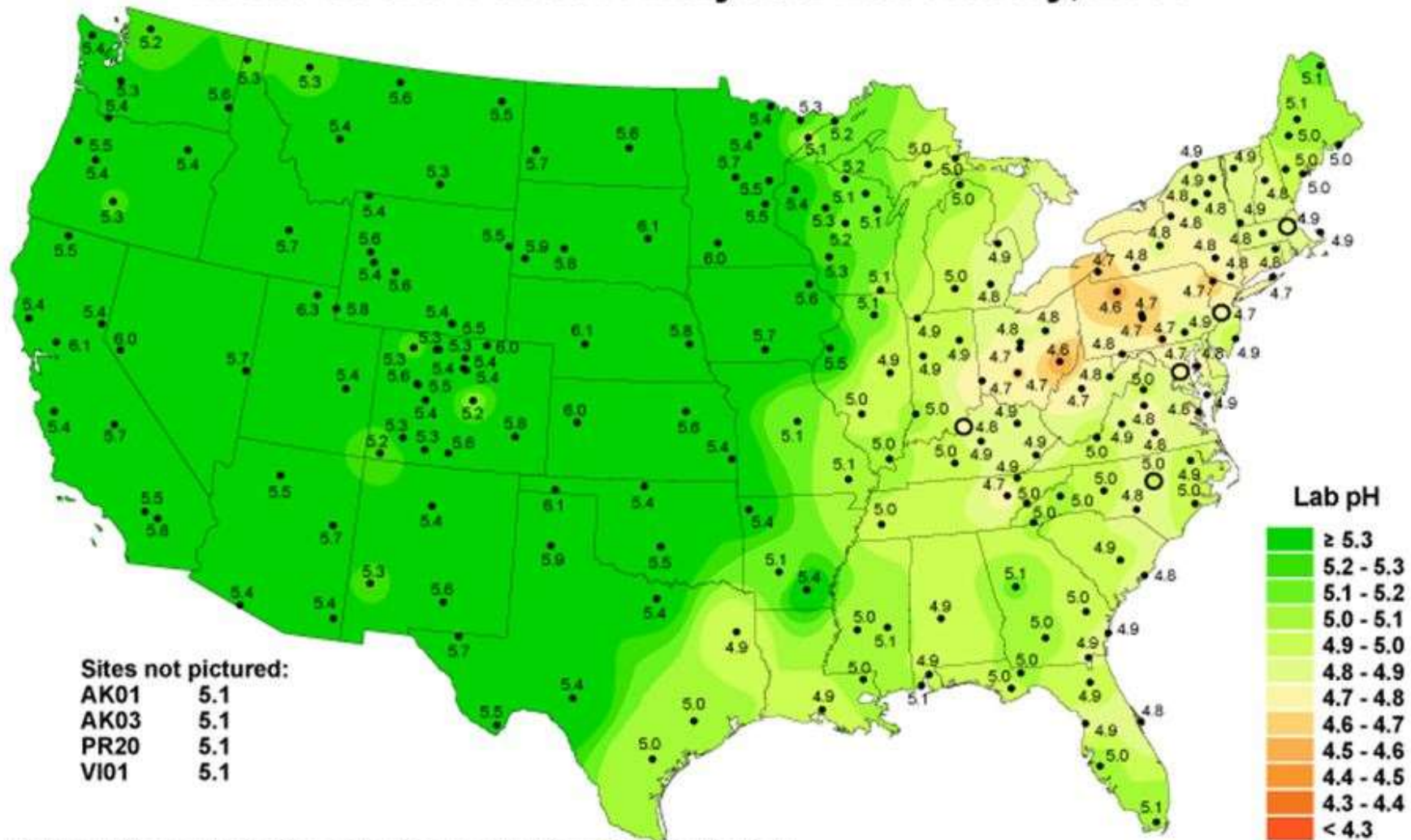


FIGHTING ACID RAIN

- ▶ Since 1990, the Environmental Protection Agency, or EPA for short, has been working to reduce acid rain by lowering the levels of pollutants produced.
 - ▶ Power plants now have a limit on the amount of pollution they can produce.
 - ▶ “Scrubbers” in power plants help to remove the pollutants from the smoke produced.

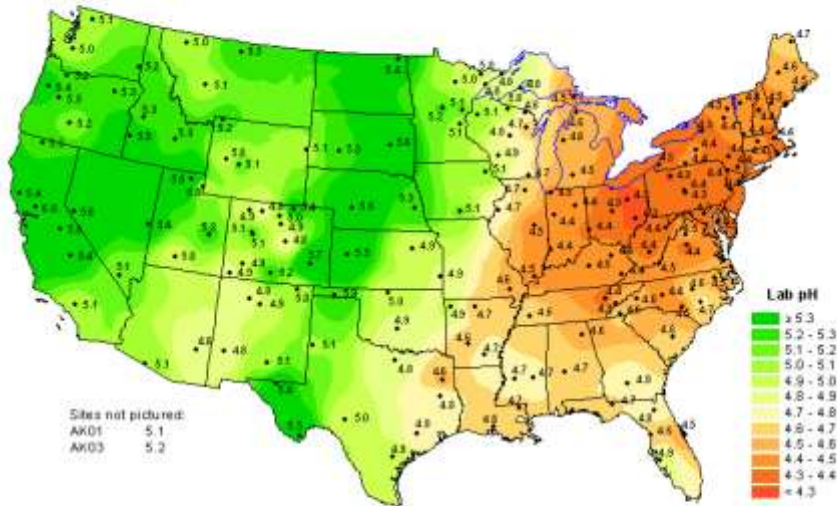


Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2009



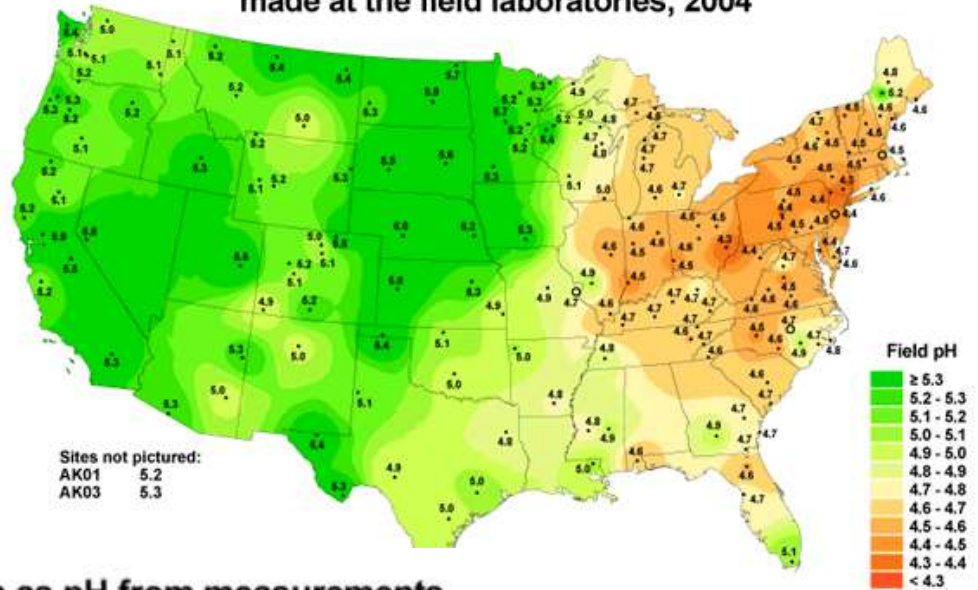
National Atmospheric Deposition Program/National Trends Network

Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 1997

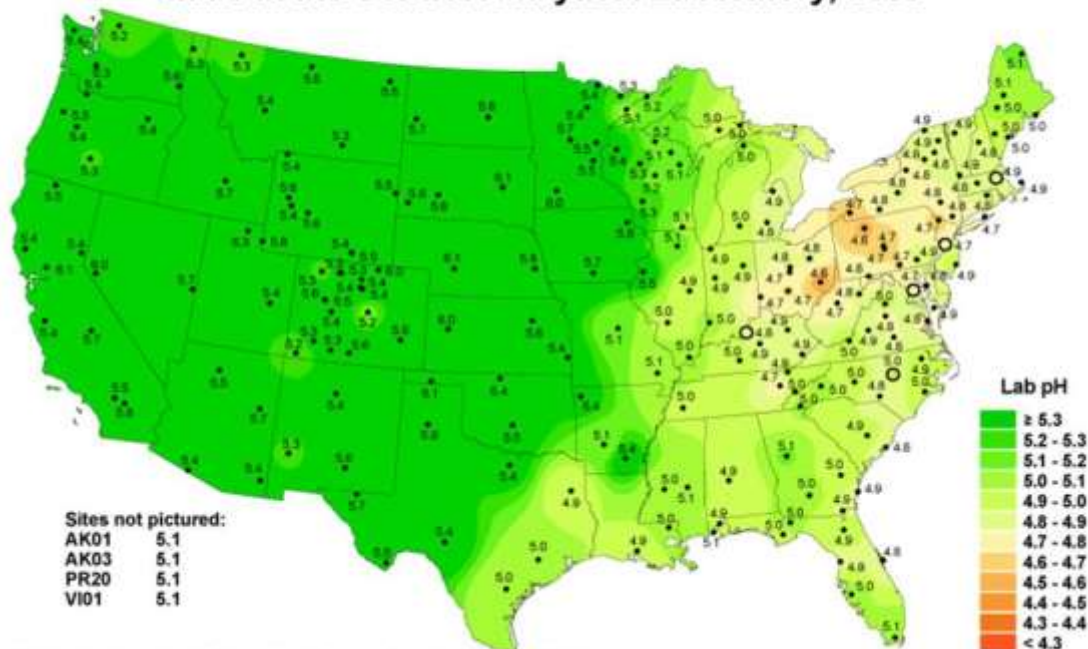


National Atmospheric Deposition Program/National Trends Network
<http://nadp.sws.uiuc.edu>

Hydrogen ion concentration as pH from measurements made at the field laboratories, 2004



Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2009



National Atmospheric Deposition Program/National Trends Network