

# Human Impact on the Environment: Part II



The late Alan Gregg pointed out that human population growth within the ecosystem was closely analogous to the growth of malignant tumor cells, that man was acting like a cancer on the biosphere. The growth of human numbers certainly seems wild and uncontrolled. Four million a month -- the equivalent of the population of Chicago. We seem to be doing all right at the moment; but if you could ask cancer cells, I suspect they would think they were doing fine. But when the organism dies, so do they; and for our own, selfish, practical, utilitarian reasons, I think we should be careful about how we influence the rest of the ecosystem.

Marston Bates



swathe of acid rain damaged coniferous forest in Karkonosze Mountains a Polish national park



Tampa Bay

## 4. ACID RAIN



Same statue before and after acid rain

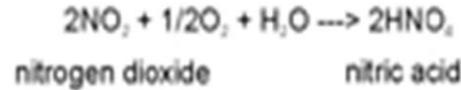
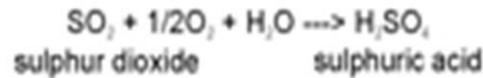
# Acid Rain



Sun's Energy

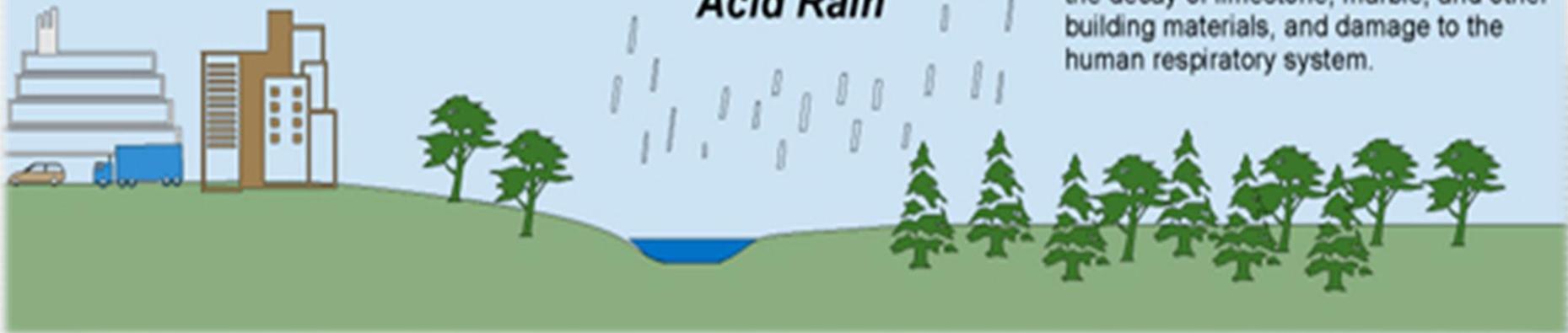
photochemical  
reactions are driven  
by the sun

## Oxidation



Acid-forming gases and particles have been linked to a variety of impacts, including forest decline, accelerated leaching of metals from rocks and soils, the decay of limestone, marble, and other building materials, and damage to the human respiratory system.

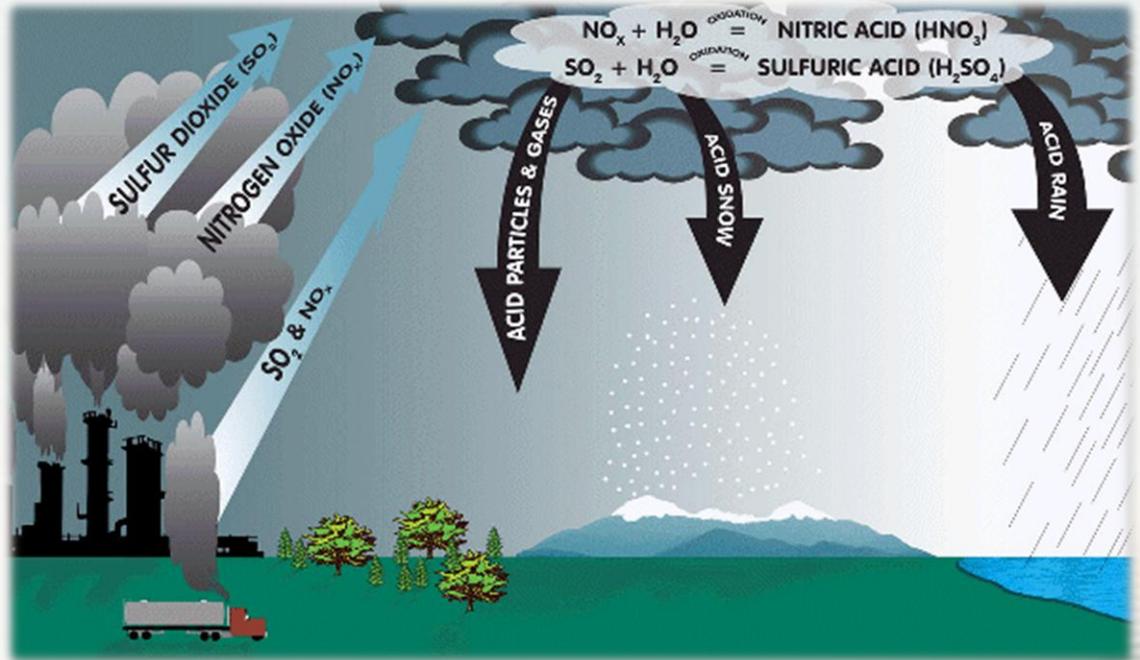
## Acid Rain



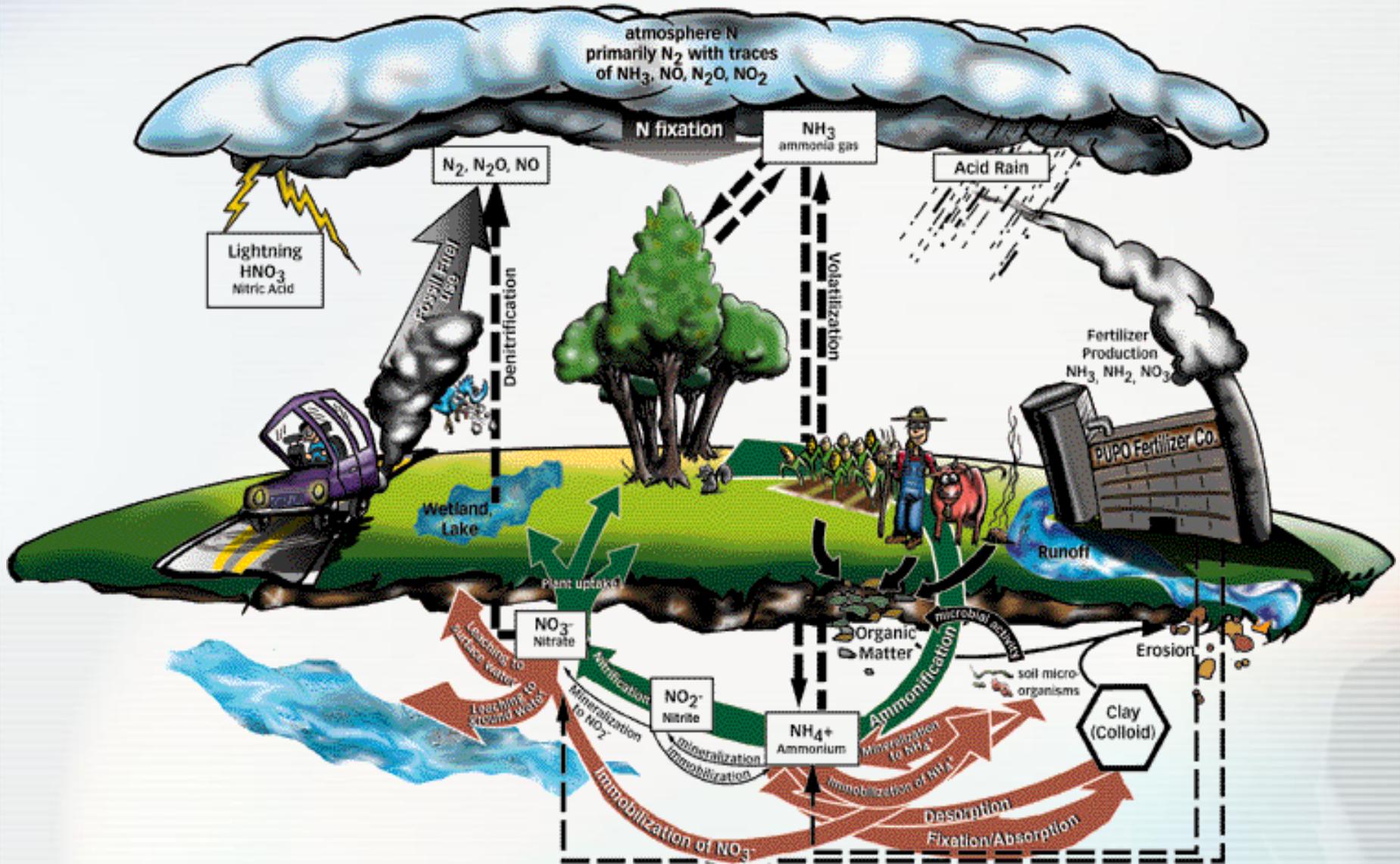
# Acid Rain



- The burning of **fossil fuels** (such as coal) and other industrial processes release into the air pollutants that contain sulfur dioxide and nitrogen dioxide.
- When these substances react with water vapor, they produce sulfuric acid and nitric acid.
- When these acids return to the surface of the earth (with rain or snow), they kill plants and animals in lakes and rivers and on land.



# Acid Rain



# Acid Rain

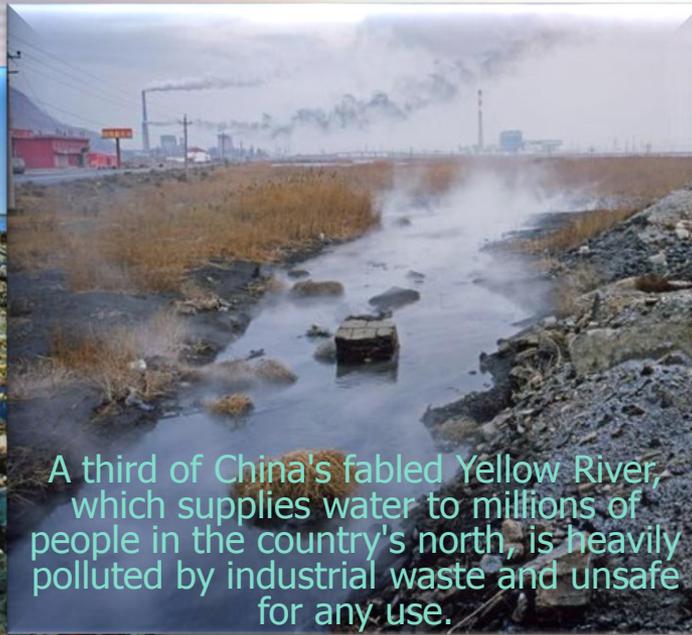


The effects of acid rain include:

- damage to buildings and statues
- decreased forest health and productivity
- fish kills
- reduction in biodiversity
- illnesses and premature death from heart and lung disorders such as asthma and bronchitis
- decreased crop yields



Barrow, Alaska garbage dump



A third of China's fabled Yellow River, which supplies water to millions of people in the country's north, is heavily polluted by industrial waste and unsafe for any use.



Chinese pollution (Did you know that 29% of San Francisco's air pollution comes from China?)

## 5. POLLUTION

# Pollution



Pollution is the presence of substances in the air, land or water that can degrade human health and environmental quality.

These substances may come from many sources, but some of the most serious pollution problems are the result of unwanted by-products -- commonly called wastes -- from human activities.



# Pollution



Most of the time it is not direct contact with pollutants by an organism but the indirect effects that are the most dangerous. For example, look at an ocean oil spill.

- Surface water oil slicks block out necessary light preventing the ability of phytoplankton to photosynthesize and provide energy for consumer organisms.
- Surface oil adheres to birds preventing their feathers from properly repelling water and insulating them from the cold.
- Any organism that ingests oil also has a greater chance of developing health problems, especially when it interferes with a fish's ability to exchange oxygen in the water through its gills.
- Oil spills often provide the nutrients for algal blooms which rob the water of required dissolved oxygen.
- Raw oil also often congeals to form **oil balls** that sink to the bottom and affect bottom feeding organisms, as well as shell fish, kelp and sea weed beds.

# Pollution



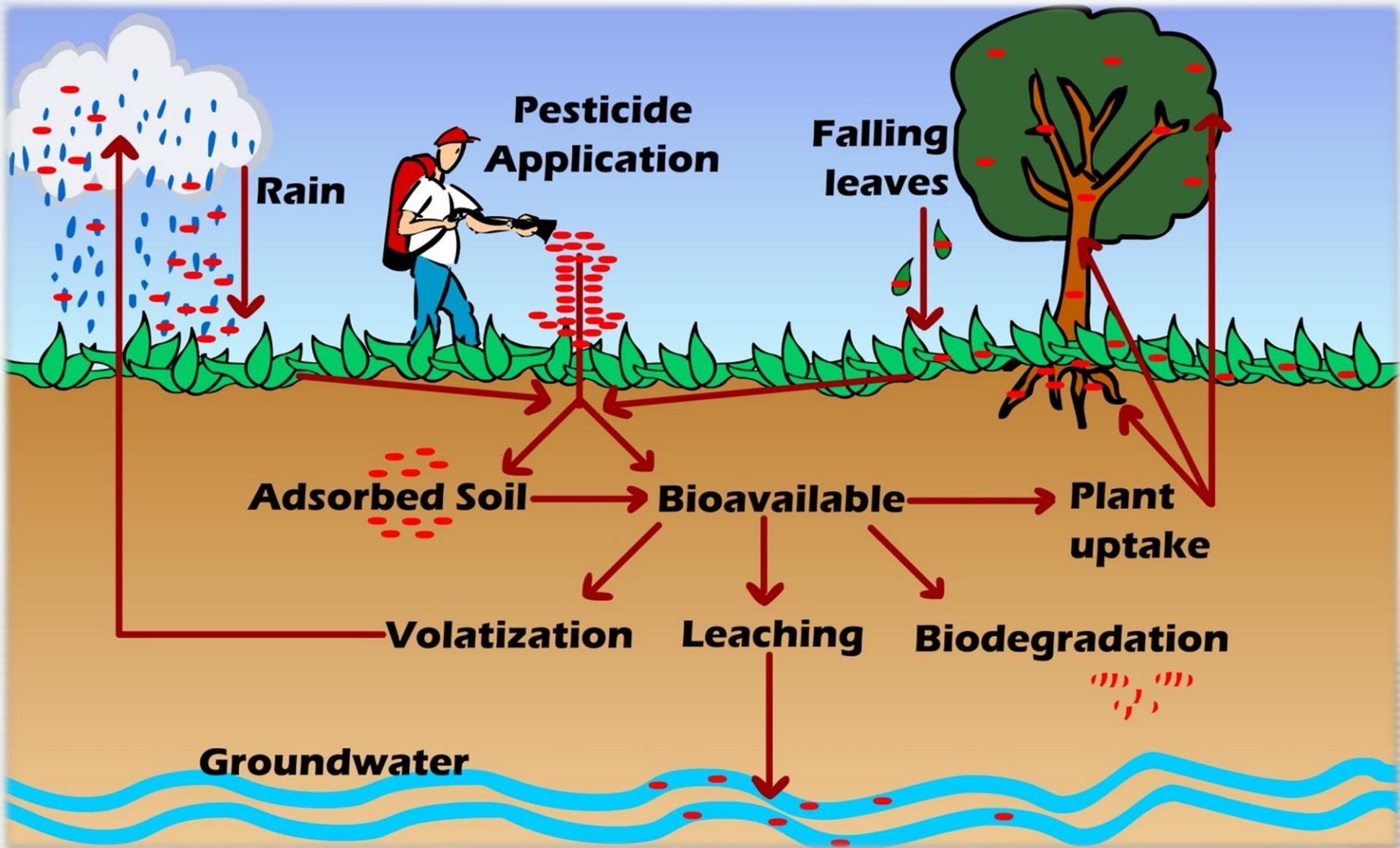
- Two types of pollutants exist -- point source and nonpoint source.
- **Point source pollution** is pollution that comes from a single, identifiable source such as a pipe or smokestack ... large, conspicuous sources of pollution such as factories and municipal sewage systems.
- The Exxon Valdez oil spill illustrates point source pollution.

# Pollution



- A **nonpoint source** delivers pollutants indirectly. An example is when fertilizer from a field is carried into a stream by rain in the form of run-off, which then effects aquatic life.
- Nearly half of US coastal waters continue to be degraded by rainwater and snowmelt that becomes contaminated as it moves over and through the ground. Pollutants include:
  - fertilizers and pest control chemicals from farms and home landscapes
  - oil, grease and toxic fluids from roads, parking areas, leaking underground storage tanks and improper disposal of used motor vehicle lubricants
  - sediments from poorly managed construction sites, forest lands and stream banks
  - acid drainage from abandoned mines
  - bacteria and nutrients from livestock, pet wastes and faulty septic tanks
- The diversity of sources and substances that result in nonpoint source pollution often make it difficult to know exactly what actions are needed to reduce or eliminate the problem.

# Pollution



# Pollution



- The technology exists for point sources of pollution to be monitored and regulated, although political factors may complicate matters.
- Nonpoint sources are much more difficult to control. Pollution arising from nonpoint sources accounts for a majority of the contaminants in streams and lakes.
- Because it is a serious and pervasive problem, nonpoint source pollution has been the focus of numerous state, local and national efforts. A key element of many initiatives is education and information, since nonpoint source pollution can come from such a wide variety of human activities that almost everyone contributes to the problem in some way, often without realizing it.



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# Pollution

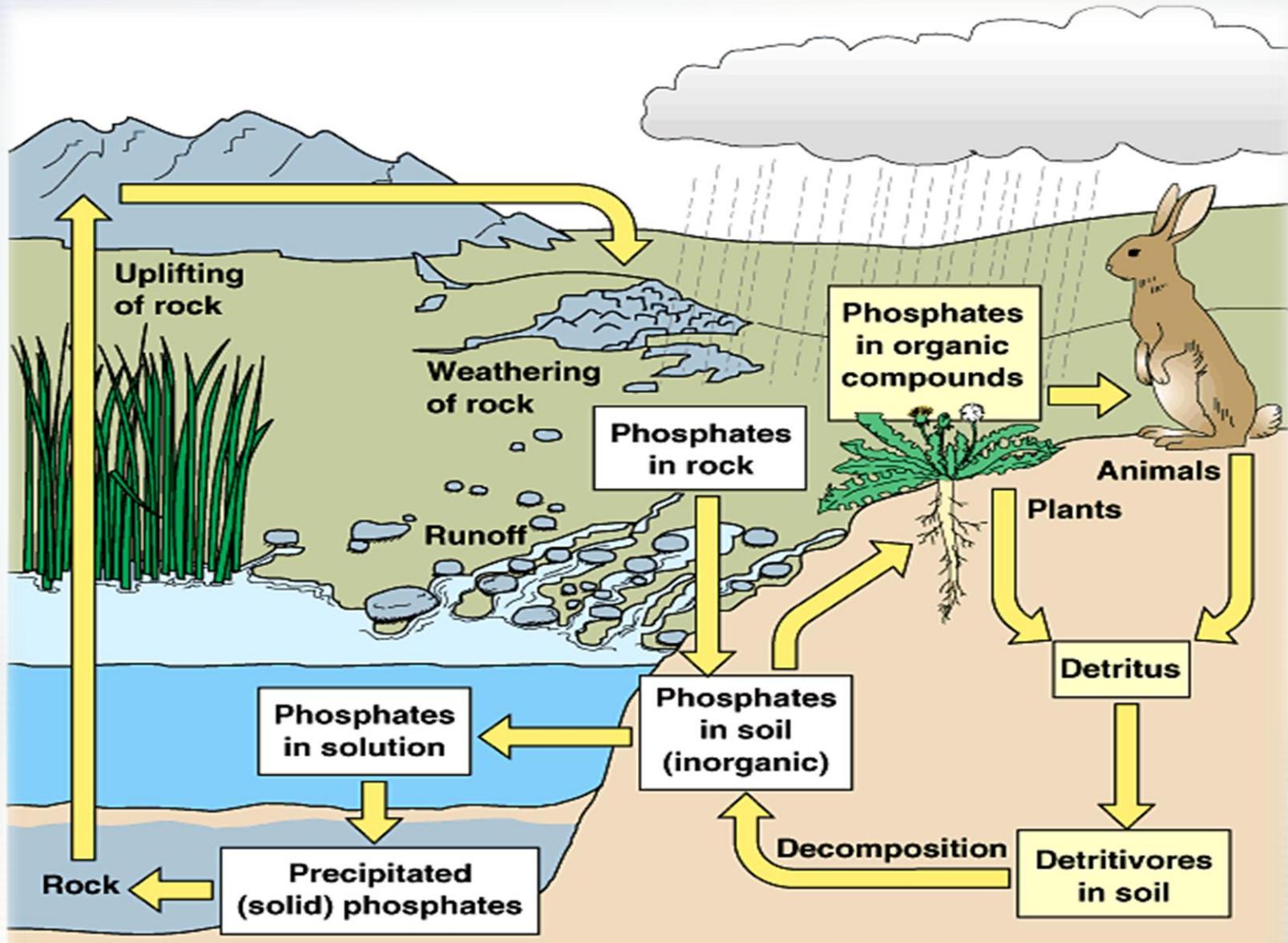
- The process of nutrient enrichment in lakes and the subsequent increase in biomass is called **eutrophication**.
- Phosphate pollution, stimulates **algal blooms**, or massive growths of algae and other phytoplankton.
- The phytoplankton reduce oxygen supplies at night when they respire.
- When the algae die, their bodies are consumed by bacteria, whose growth further depletes the oxygen.
- The result is massive oxygen starvation for many animals, including fish and invertebrates.
- In the end, the lake fills with the carcasses of dead animals and plants.
- When the process occurs naturally, growth rates are slow and balanced.
- With the influence of humans, the accelerated process often leads to the death of fish and the growth of **anaerobic bacteria** that produce foul-smelling gases.



Algal bloom in Orielton Lagoon, Australia, 1994



# Pollution



# Pollution



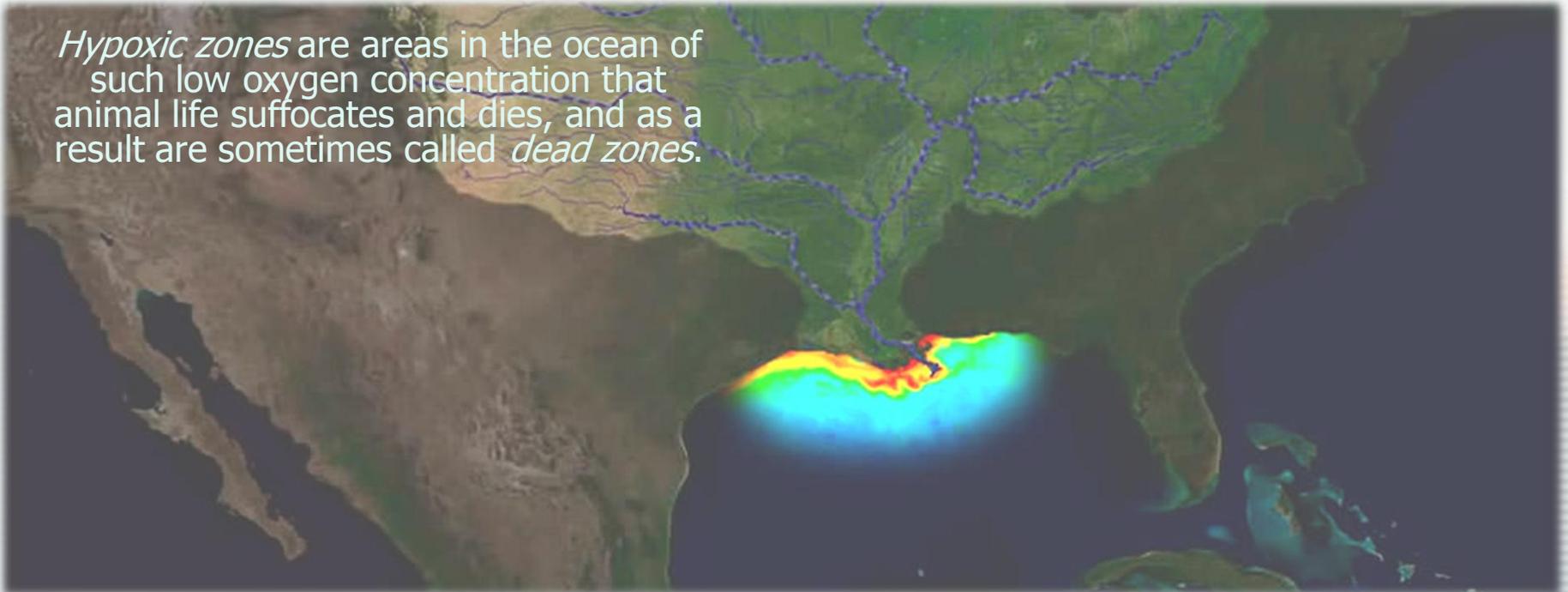
- **Dead zone** is a common term for **hypoxia**, which refers to a reduced level of oxygen in water.
- Hypoxic zones are areas in the ocean of such low oxygen concentration that animal life suffocates and dies or, if they are mobile such as fish, leave the area. Habitats that would normally be teeming with life become, essentially, biological deserts.
- Hypoxic zones can occur naturally, but scientists are concerned about the areas created or enhanced by human activity.
- Nutrient pollution is the primary cause of those zones created by humans. Excess nutrients that run off land or are piped as wastewater into rivers and coasts can stimulate an overgrowth of algae, which then sinks and decomposes in the water. The decomposition process consumes oxygen and depletes the supply available to healthy marine life.

# Pollution



One of the largest hypoxic zones (5,000–8,000+ miles<sup>2</sup>) forms in the Gulf of Mexico every spring. Each spring as farmers fertilize their lands preparing for crop season, rain washes fertilizer off the land and into streams and rivers, and eventually into the Gulf.

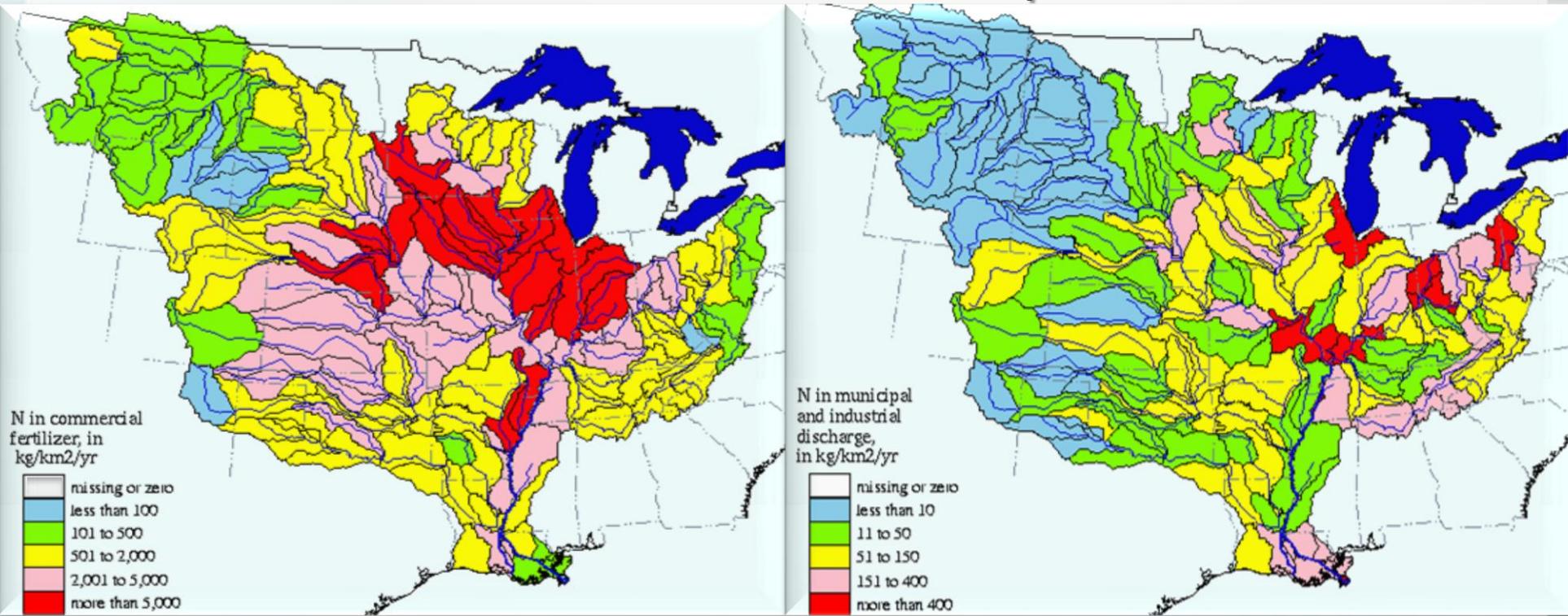
*Hypoxic zones* are areas in the ocean of such low oxygen concentration that animal life suffocates and dies, and as a result are sometimes called *dead zones*.



# Pollution



The Mississippi River Basin is one of the most productive farming regions in the world. The map on the left shows the nitrogen from fertilizer that eventually washes into the Gulf. The map on the right shows the nitrogen from municipal and industrial discharge. Both directly contribute to the Gulf dead zone seen on the previous slide.



# Pollution



Dead zones are not irreversible. The Black Sea dead zone, previously the largest dead zone in the world, largely disappeared between 1991 and 2001 after fertilizers became too costly to use following the collapse of the Soviet Union.



**MORE THAN JUST A DROP IN THE OCEAN**  
● Already dead  
● Areas of concern



**Dead zones are rapidly increasing as oceans warm**

- They are caused by excess nutrients and warming waters.
- The zones can suffocate fish, squid and other marine life.
- There are more than 400 ocean dead zones in the world's seas.
- Waters around Tasmania and near Perth were recently included on the list.



# Pollution



**Suspended Particles** – Made up of soot, smoke, dust and liquid droplets.

*Associated health hazard:* Particles and soot exposure over a long period of time are related to a wide range of chronic respiratory illnesses such as asthma and chronic obstructive pulmonary diseases, as well as worsening heart conditions and other conditions.

**Nitrogen Dioxide** – Caused by fuel combustion, aerobic decomposition and nitrogenous fertilizers.

**Sulfur Dioxide** – Produced by the combustion of fossil fuels, with motor vehicles and small and varied sources (such as boilers and stoves) contributing the most.

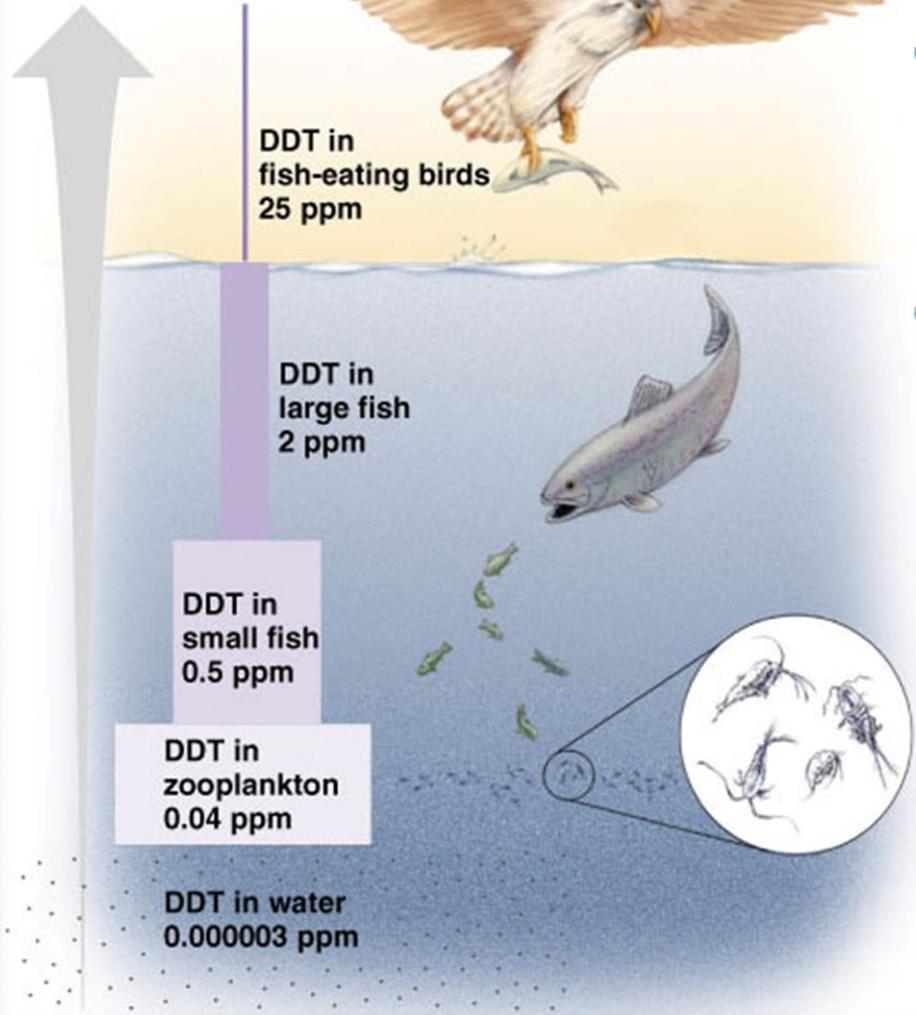
*Associated health hazard:* Causes acid rain and can be extremely detrimental to the health of the young and elderly.



# Pollution



DDT concentration:  
increase of  
10 million times

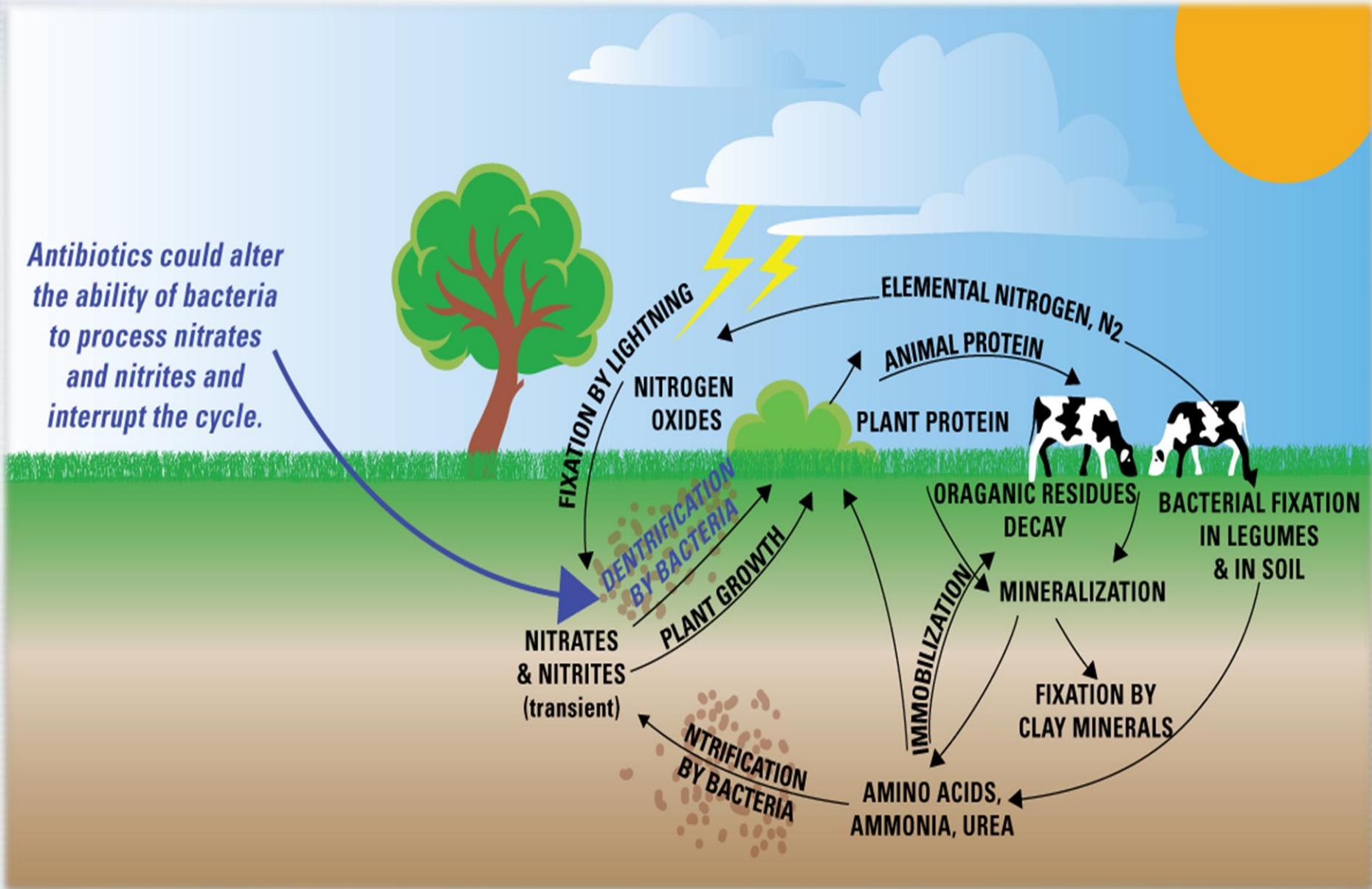


- Some toxins, such as the pesticide DDT, concentrate in plants and animals.
- As one organism eats another, the toxin becomes more and more concentrated, a process called **biological magnification**.

# Pollution



*Antibiotics could alter the ability of bacteria to process nitrates and nitrites and interrupt the cycle.*



# Pollution



- Soil pollution is mainly due to **chemicals** in herbicides (weed killers) and pesticides (insect and other invertebrate pest poisons ).
- **Litter** is waste material dumped in public places such as streets, parks, picnic areas, at bus stops and near shops.
- **Waste** disposal and accumulation threatens the health of people in residential areas. Waste decays, encourages household pests and turns urban areas into unsightly, dirty and unhealthy places to live in.

Land pollution is a big problem.



US Oil Field

# Pollution



The effects of pollution include:

- breakdown of food chains and/or biological magnification
- acid rain
- interference with fish's ability to exchange oxygen in the water through gills
- eutrophication and algal bloom
- hypoxia and dead zones
- oil balls
- the growth of anaerobic bacteria
- decreased forest health and productivity

# Pollution



The effects of pollution include (continued):

- breakdown in biosphere cycles
- plant and animal health problems and death
- human health problems, including a wide range of chronic respiratory illnesses such as asthma and chronic obstructive pulmonary diseases, as well as worsening heart conditions and other conditions
- household pests
- unsightly, dirty and unhealthy living conditions
- reduction in the amount of arable land
- decreased quality of fresh water
- increased competition for water



Continued in  
Human Impact on the Environment  
Part III