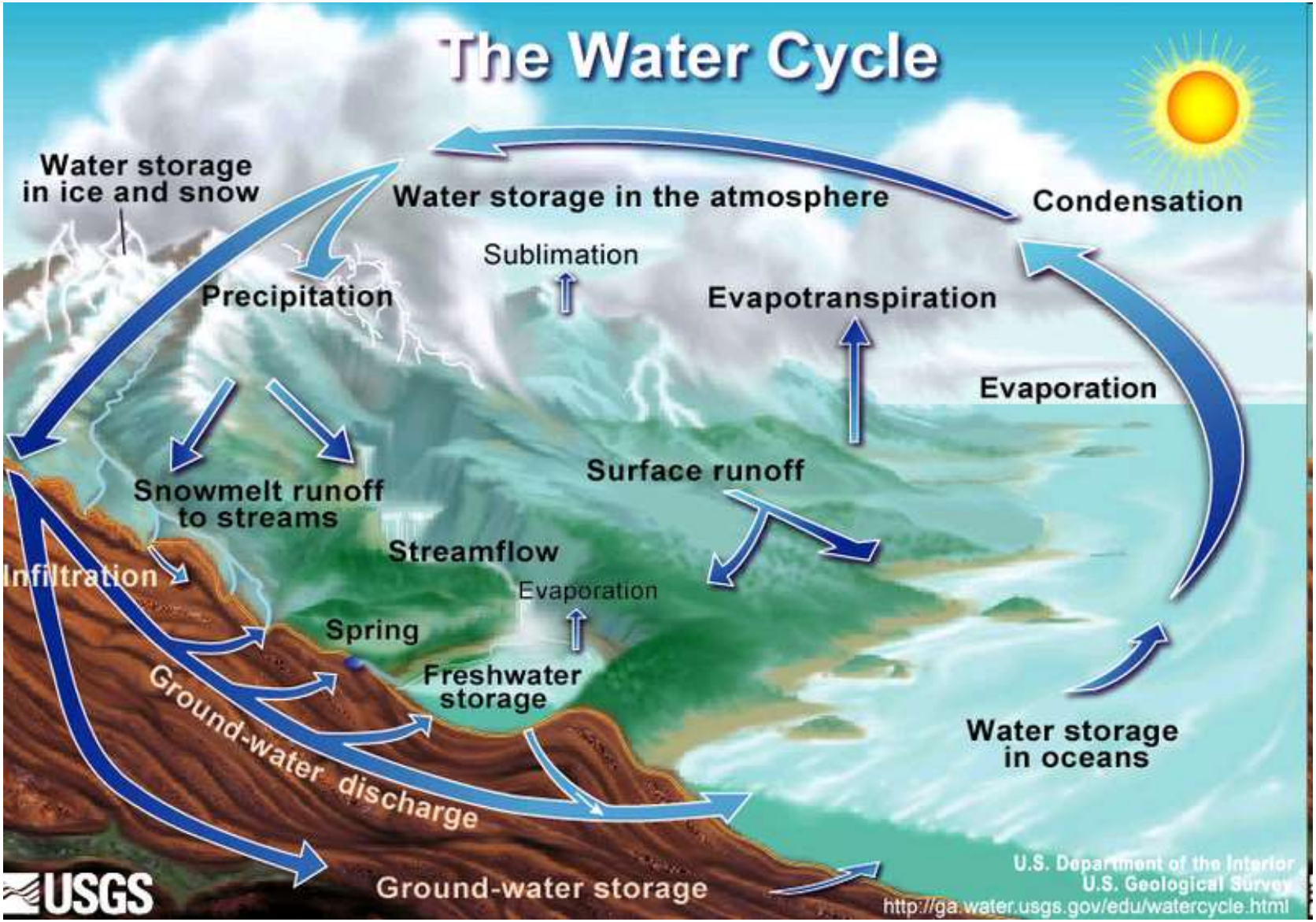
Surface WATER POLLUTION

Contents

WATER POLLUTION

- **Water pollution** is the contamination of water bodies (e.g. lakes, rivers, oceans, groundwater).
- Water pollution affects plants and organisms living in these bodies of water; and, in almost all cases the effect is damaging either to individual species and populations, but also to the natural biological communities.
- Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Surface runoff
Snowmelt runoff to streams
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
USGS
U.S. Department of the Interior
U.S. Geological Survey
http://ga.water.usgs.gov/edu/watercycle.html

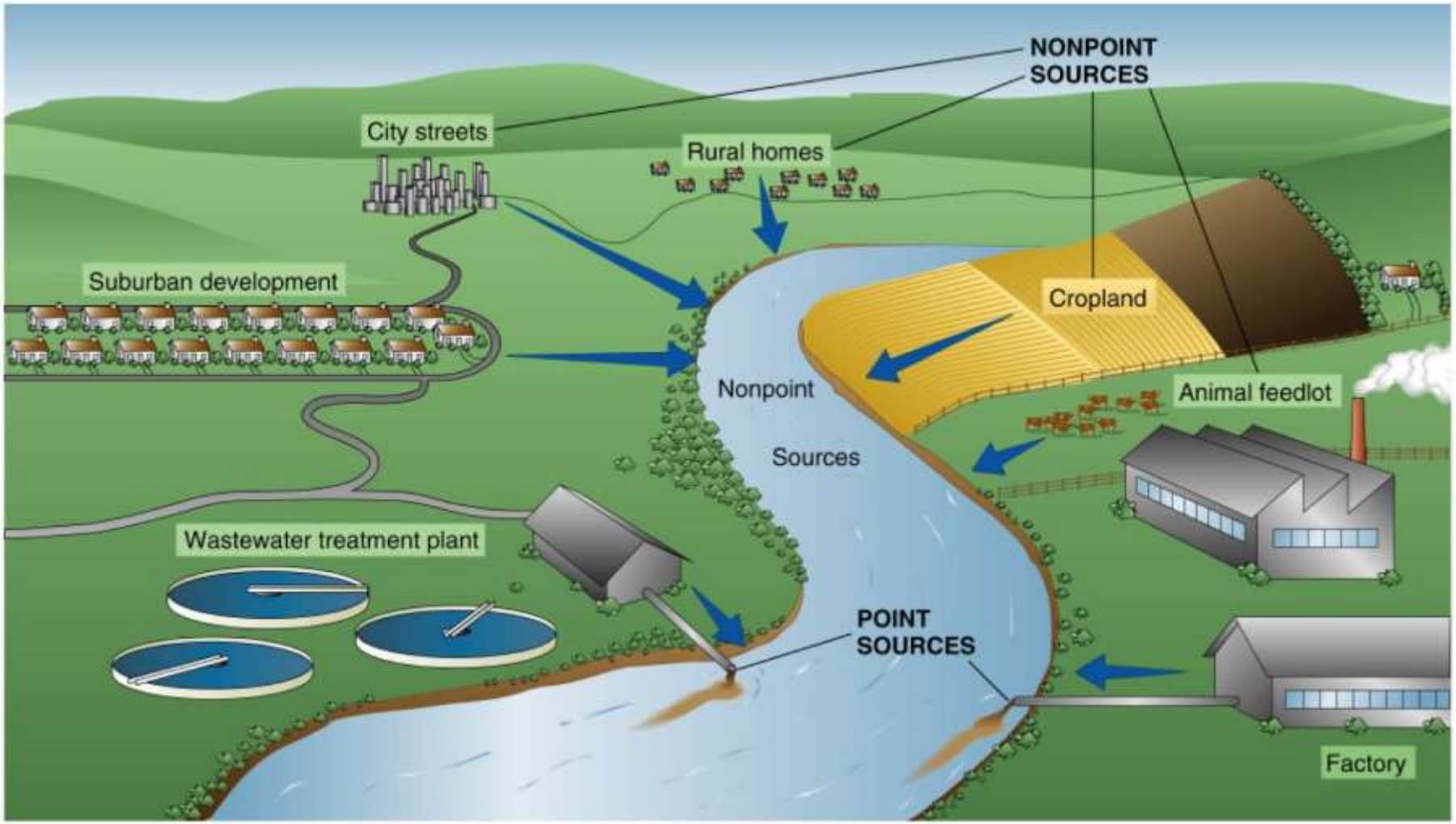
Water Pollution Sources

- **Water pollution**

- **Point sources**
  - Discharge at specific locations
  - Easier to identify, monitor, regulate

- **Nonpoint sources**
  - Runoff of chemicals and sediment
  - Agriculture
  - Control is difficult and expensive

Point Source and Non Point Source Pollutants



Major Sources of Water Pollution

Agriculture: by far the leader

- Sediment, fertilizers, bacteria from livestock, food processing, salt from soil irrigation

Industrial: factories and powerplants

Mining: surface mining toxics, acids, sediment

SOURCES OF WATER POLLUTION.

INDUSTRY

- Industry is a huge source of water pollution, it produces pollutants that are extremely harmful to people and the environment.
- Many industrial facilities use freshwater to carry away waste from the plant and into rivers, lakes and oceans.
- Pollutants from industrial sources include:
  - Asbestos – This pollutant is a serious health hazard . Asbestos fibres can be inhaled and cause illnesses such as asbestosis, lung cancer, intestinal cancer and liver cancer.
  - Lead – This is a metallic element and can cause health and environmental problems. It is a non-biodegradable substance so is hard to clean up once the environment is contaminated. Lead is harmful to the health of many animals, including humans, as it can inhibit the action of bodily enzymes.

OIL POLLUTION IN WATER

- Oceans are polluted by oil on a daily basis from oil spills, routine shipping, run-offs and dumping.
- Oil spills make up about 12% of the oil that enters the ocean. The rest come from shipping travel, drains and dumping.
- An oil spill from a tanker is a severe problem because there is such a huge quantity of oil being spilt into one place.
- Oil spills cause a very localised problem but can be catastrophic to local marine wildlife such as fish, birds and sea otters.
- Oil cannot dissolve in water and forms a thick sludge in the water. This suffocates fish, gets caught in the feathers of marine birds stopping them from flying and blocks light from photosynthetic aquatic plants.

RADIO ACTIVE WASTE

- Nuclear waste is produced from industrial, medical and scientific processes that use radioactive material. Nuclear waste can have detrimental effects on marine habitats. Nuclear waste comes from a number of sources:
- Operations conducted by nuclear power stations produce radioactive waste. Nuclear-fuel reprocessing plants in northern Europe are the biggest sources of man-made nuclear waste in the surrounding ocean. Radioactive traces from these plants have been found as far away as Greenland.
- Mining and refining of uranium and thorium are also causes of marine nuclear waste.

Ocean Pollution

- Coastal areas – highly productive ecosystems
  - Occupied by 40% of population
  - Twice that population by 2050
  - About 80% marine pollution originates on land

- Deep ocean waters
  - Some capacity to dilute, disperse, degrade pollutants
  - Ocean dumping controversies
  - Assimilative capacity?

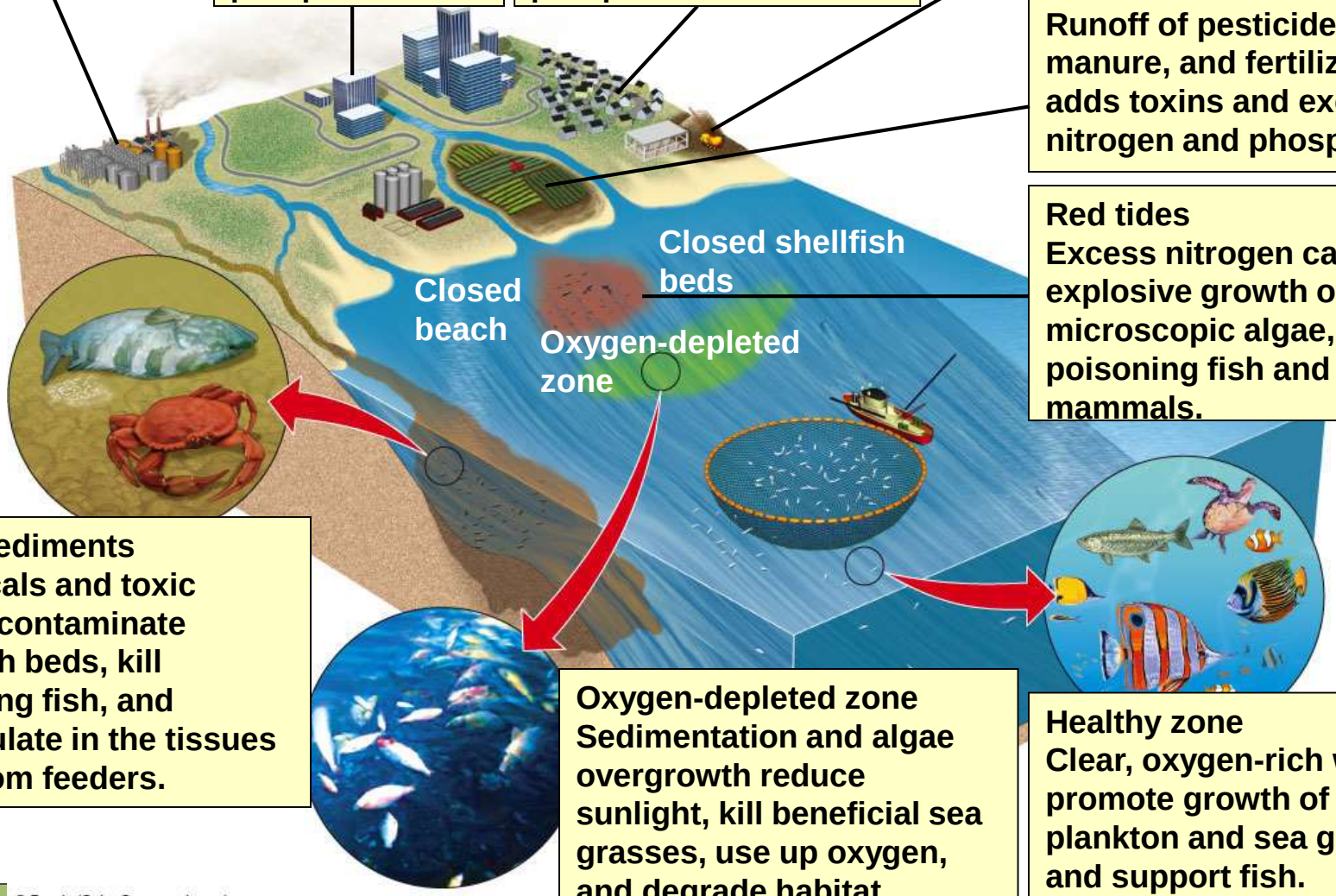
Industry Nitrogen oxides from autos and smokestacks, toxic chemicals, and heavy metals in effluents flow into bays and estuaries.

Cities Toxic metals and oil from streets and parking lots pollute waters; sewage adds nitrogen and phosphorus.

Urban sprawl
Bacteria and viruses from sewers and septic tanks contaminate shellfish beds and close beaches; runoff of fertilizer from lawns adds nitrogen and phosphorus.

Construction sites
Sediments are washed into waterways, choking fish and plants, clouding waters, and blocking sunlight.

Farms
Runoff of pesticides, manure, and fertilizers adds toxins and excess nitrogen and phosphorus.



Red tides
Excess nitrogen causes explosive growth of toxic microscopic algae, poisoning fish and marine mammals.

Toxic sediments
Chemicals and toxic metals contaminate shellfish beds, kill spawning fish, and accumulate in the tissues of bottom feeders.

Oxygen-depleted zone
Sedimentation and algae overgrowth reduce sunlight, kill beneficial sea grasses, use up oxygen, and degrade habitat.

Healthy zone
Clear, oxygen-rich waters promote growth of plankton and sea grasses, and support fish.

Fig. 20-15, p. 548

Types of Water Pollutants

- The water pollutants that we will discuss in this lecture include:
  - Pathogens
  - Organic Waste
  - Chemical Pollutants
  - Sediments
  - Nutrients

Pathogens

- “The most serious water pollutants are the infections agents that cause sickness and death” .
- Waterborne diseases kill thousands of people per year. The majority of these pathogens are a result of contaminated water – unsanitary water associate with poor hygiene.

Pathogens (continued)

- Pathogens are related to poor sanitary conditions. In a sense, they are often a result of organic pollution
- Human and animal excrement in water bodies creates a suitable environment for these pathogens
  - The fluid medium allows for quick transmitting
  - People bathing or drinking in contaminated streams are exposed to these pathogens
  - Improved sanitation and hygiene education have saved more lives than medicine. That is, the best way to mitigate the spread of infectious waterborne diseases is to improve sanitary conditions.

Organic Waste

- Human and animal waste creates “serious problems”
- Besides creating a pathogen-friendly environment, excess organic wastes reduce the availability of dissolved oxygen in water.
  - aerobic bacteria and other decomposers breakdown organic materials they consume oxygen through cellular respiration. More organic waste results in more aerobic decomposition, which ultimately lowers available oxygen.
- Biochemical Oxygen Demand (BOD) = measure of the amount of organic material in water in terms of how much oxygen will be required to break it down. The higher the BOD the greater is the likelihood that dissolved oxygen will be depleted.

India's Ganges River

- Holy River (1 million take daily holy dip)
- 350 million (1/3rd of pop) live in watershed
- Little sewage treatment
- Used for bathing, drinking etc.
- Bodies (cremated or not) thrown in river
- Good news is the Indian government is beginning to work on problem

Organic Waste, Animals

- Animal Feeding Operations, colloquially referred to as “Factory Farms” contain large quantities of livestock.
- The high concentration of animals generates a lot of waste. Some animals, such as hogs, produce substantially more excrement per pound than humans.
- The animal waste poses serious threats to the environment. It is high in organic materials, nutrients, heavy metals, and pathogens

Examples of AFO's

- Stockyards
- Hog Houses
- Chicken Houses

www.ecohealth101.org/whats_left/eat3.html

http://www.goveg.com/photos_chicken11.asp

Waste Lagoons

- Waste from the AFO are hosed into waste lagoons.
- Ideally within the lagoons the solids become concentrated as the water evaporates. The manure can then be used as a fertilizer.
- These waste lagoons can leak into the environment contaminating surface and ground water with organic waste, nutrients, heavy metals, and pathogens

http://lwcd.org/images/MCR_earthen_Waste_lagoon.JPG

Photo Source: Dairy Waste Pictorial, EPA Region 10 and Washington State Dairy Federation

Chemical Waste

- “Water-soluble inorganic chemicals constitute an important class of pollutants that include”
  - Heavy metals (lead, mercury, cadmium, nickel, Def Leppard)
  - Acids from mine drainage
  - Road salts
  - Petroleum
  - Urban runoff
  - Pesticides, fungicides, herbicides

Chemical Pollutants

- Any noxious substance spilled on the landscape can contaminate the watershed. Toxic pollutants sometimes have very long residence time and can be very problematic to manage.
- The worst type of contamination is of the groundwater. Groundwater contamination is very difficult to manage.

Sediments

- All streams transport some degree of sediments.
- Development or construction within the watershed can increase the amount of sediment in streams.
- Excess sediment will “choke the stream”
- The environmental effect is loss of biodiversity, change in hydrology, and ruining the aesthetic beauty of the water body.
- Sediments also act as surface area for other pollutants, like heavy metals. So greater concentrations of sediments will directly result in higher concentration of other pollutants.

Nutrients

- Naturally, nutrients are limited within many aquatic ecosystems. Plants often have to compete for nutrients.
- Phosphorus and Nitrogen are two very important nutrients that are usually in high demand by aquatic vegetation. Both these elements are in the building blocks of biological molecules (DNA, Protein, Fatty Acids).
- When there are too many nutrients, however, it throws the entire aquatic ecosystem at of whack.
- Aquatic systems with too many nutrients become eutrophic.

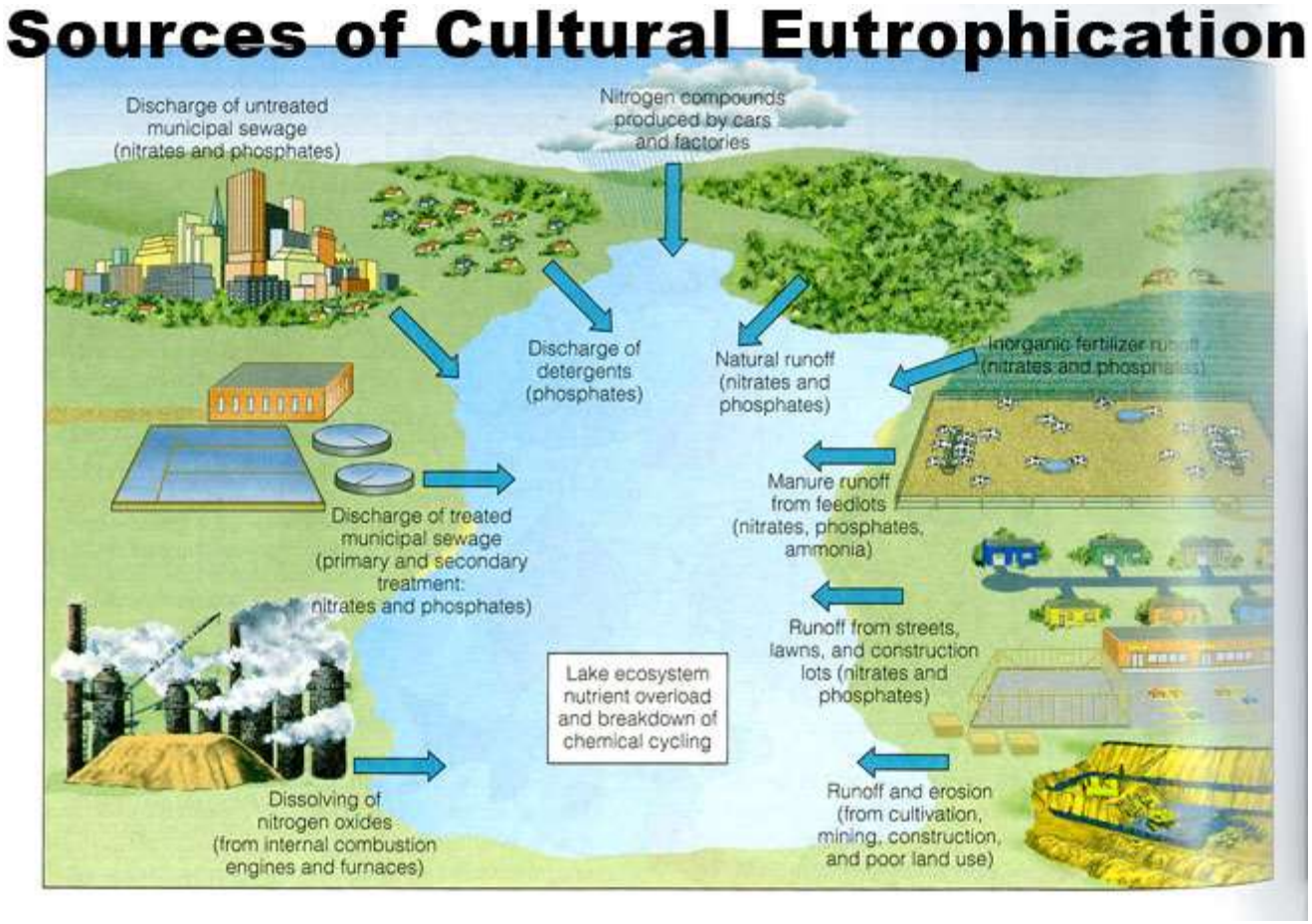
Eutrophication

The breakdown of excess organic matter not only consumes oxygen, but it also releases a variety of compounds into the water, such as nitrates, phosphates and sulfates

The nitrates and phosphates are plant nutrients that encourages the rapid and excessive growth of aquatic plants, especially algae

When this occurs, it is described as the eutrophication of the water (or the body of water is described as eutrophic)

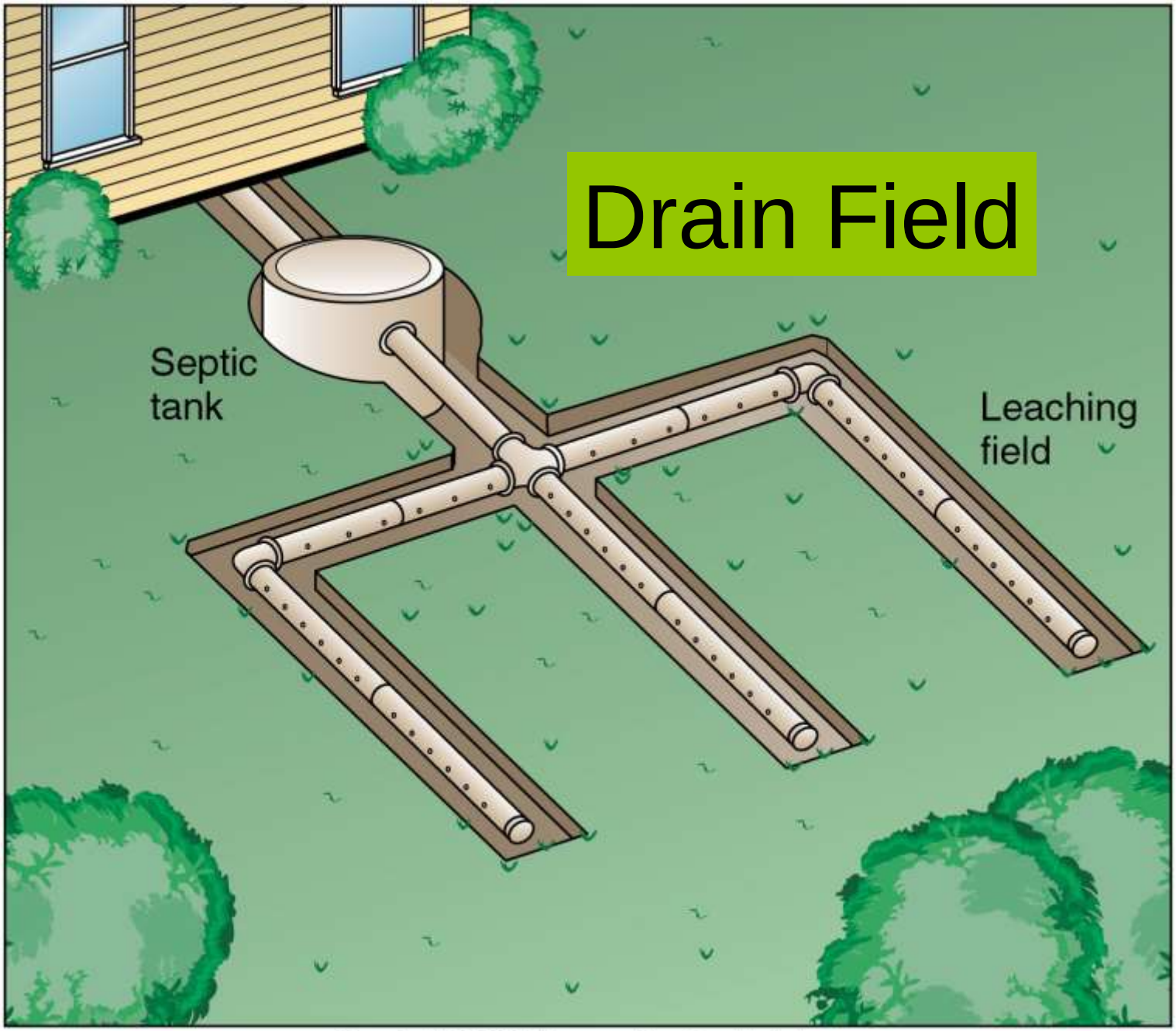
Sources of Eutrophication



Septic System

- Waste leaving the home flows through a septic tank. In the tank the solids settle towards the bottom. Here the organics breakdown through aerobic and anaerobic decomposition. The colloidal and dissolved inorganics flow out into the yard via a drain field. The effluent is supposedly filtered naturally by the lawns, gardens, and soil microbes.

Drain Field



PREVENTIONS

- If you want to help keep our waters clean, there are many things you can do to help. You can prevent water pollution of nearby rivers and lakes as well as groundwater and drinking water by following some simple guidelines in your everyday life.
- Conserve water by turning off the tap when running water is not necessary. This helps prevent water shortages and reduces the amount f contaminated water that needs treatment.
- Be careful about what you throw down your sink or toilet. Don't throw paints, oils or other forms of litter down the drain.
- Use environmentally household products, such as washing powder, household cleaning agents and toiletries.

PREVENTIONS

- Take great care not to overuse pesticides and fertilizers. This will prevent runoffs of the material into nearby water sources.
- By having more plants in your garden you are preventing fertilizer, pesticides and contaminated water from running off into nearby water sources.
- Don't throw litter into rivers, lakes or oceans. Help clean up any litter you see on beaches or in rivers and lakes, make sure it is safe to collect the litter and put it in a nearby dustbin.

CONCLUSION

The problems associated with water pollution have the capabilities to disrupt life on our planet to a great extent. We must become familiar with our local water resources and learn about ways for disposing harmful household wastes so they don't end up in sewage treatment plants that can't handle them or landfills not designed to receive hazardous materials. In our yards, we must determine whether additional nutrients are needed before fertilizers are applied, and look for alternatives where fertilizers might run off into surface waters. We have to preserve existing trees and plant new trees and shrubs to help prevent soil erosion and promote infiltration of water into the soil

References

- P K Goel (2000), **Water pollution: causes, effects and control,** new age international (p) ltd.
- en.wikipedia.org/wiki/water
- www.geology.ar.gov/water/properties.htm


Thank You