WATER & AIR POLLUTION

Course name: Environmental Chemistry
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What is water pollution?

- **Water pollution** is the contamination of water bodies (e.g. lakes, rivers, oceans and groundwater), very often by human activities.
- Any change or modification in the physical, chemical and biological properties of water that will have a detrimental consequence on living things is water pollution.
- It occurs when pollutants are discharged directly or indirectly into water bodies without enough treatment to get rid of harmful compounds.
- Pollutants get into water mainly by human causes or factors.
- Water pollution is the second most imperative environmental concern along with air pollution.

Sources of Water Pollution

- There are various classifications of water pollution.
- The two chief sources of water pollution can be seen as
- Point source
- Non-Point source

Point source

Those sources which discharge water pollutants directly into the water are known as point sources of water pollution.

Oil wells situated near water bodies, factories, power plants, underground coal mines, etc. are point sources of water pollution.

Non-Point source

Those sources which do not have any specific location for discharging pollutants, in the water body are known as non-point sources of water pollution.

Run-offs from agricultural fields, lawns, gardens, construction sites, roads and streets are some non-point sources of water pollution.

What are the types of water pollution

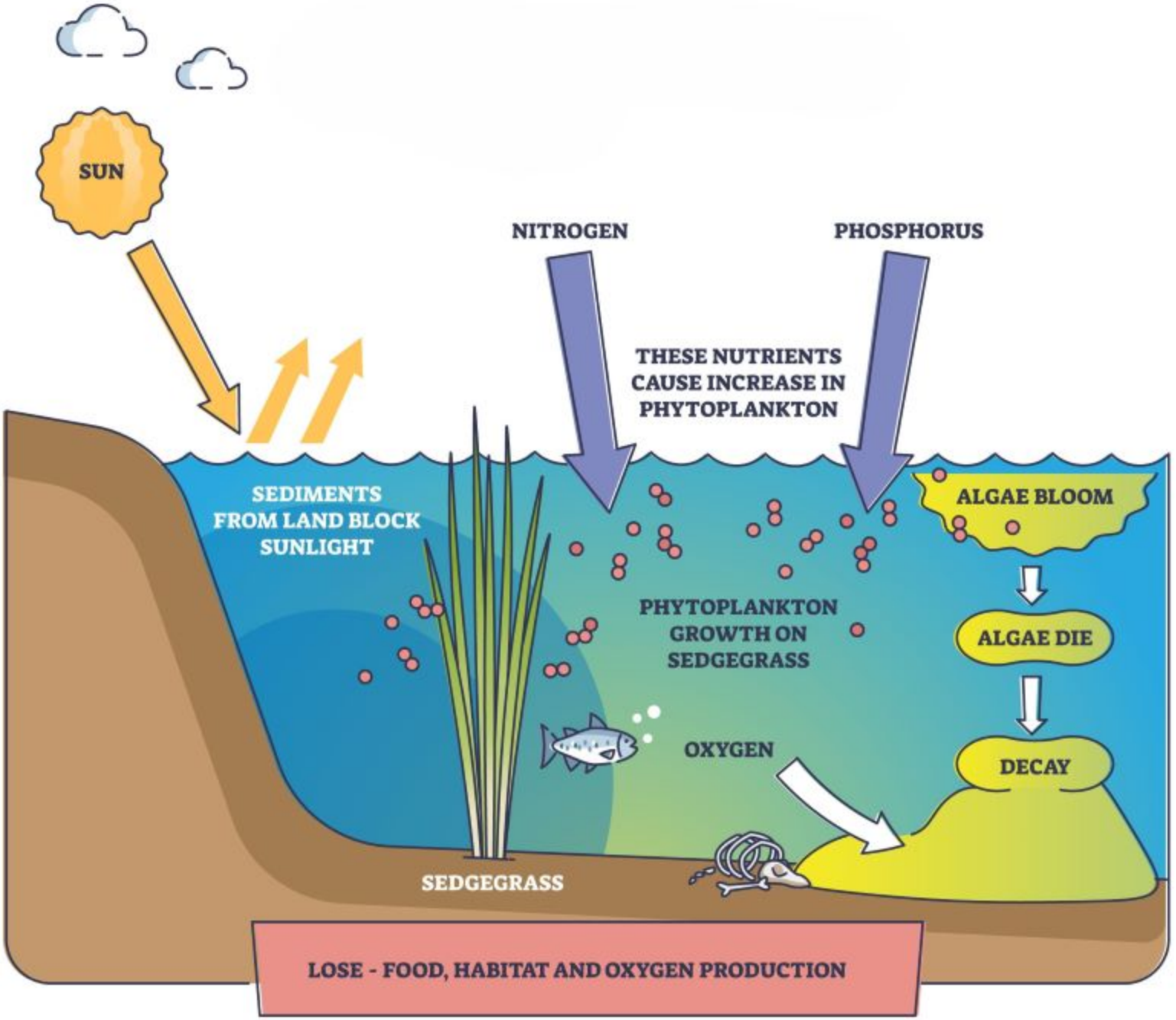
1. **Nutrients Pollution**

•Some wastewater, fertilizers and sewage contain high levels of nutrients.

•If they end up in water bodies, they encourage algae and weed growth in the water.

•This will make the water undrinkable, and even clog filters.

•Too much algae will also use up all the oxygen in the water, and other water organisms in the water will die out of oxygen starvation.


SUN
NITROGEN
PHOSPHORUS
THESE NUTRIENTS CAUSE INCREASE IN PHYTOPLANKTON
SEDIMENTS FROM LAND BLOCK SUNLIGHT
ALGAE BLOOM
PHYTOPLANKTON GROWTH ON SEDGEGRASS
ALGAE DIE
OXYGEN
DECAY
SEDGEGRASS
LOSE - FOOD, HABITAT AND OXYGEN PRODUCTION

2. **Surface water pollution**

•Surface water includes natural water found on the earth's surface, like rivers, lakes, lagoons and oceans.

•Hazardous substances coming into contact with this surface water, dissolving or mixing physically with the water can be called surface water pollution.

3. **Oxygen Depleting**

•Water bodies have micro-organisms including aerobic and anaerobic organisms.

•When to much biodegradable matter end up in water, it encourages more microorganism growth, and they use up more oxygen in the water.

•If oxygen is depleted, aerobic organisms die, and anaerobic organism grow more to produce harmful toxins such as ammonia and sulfides.

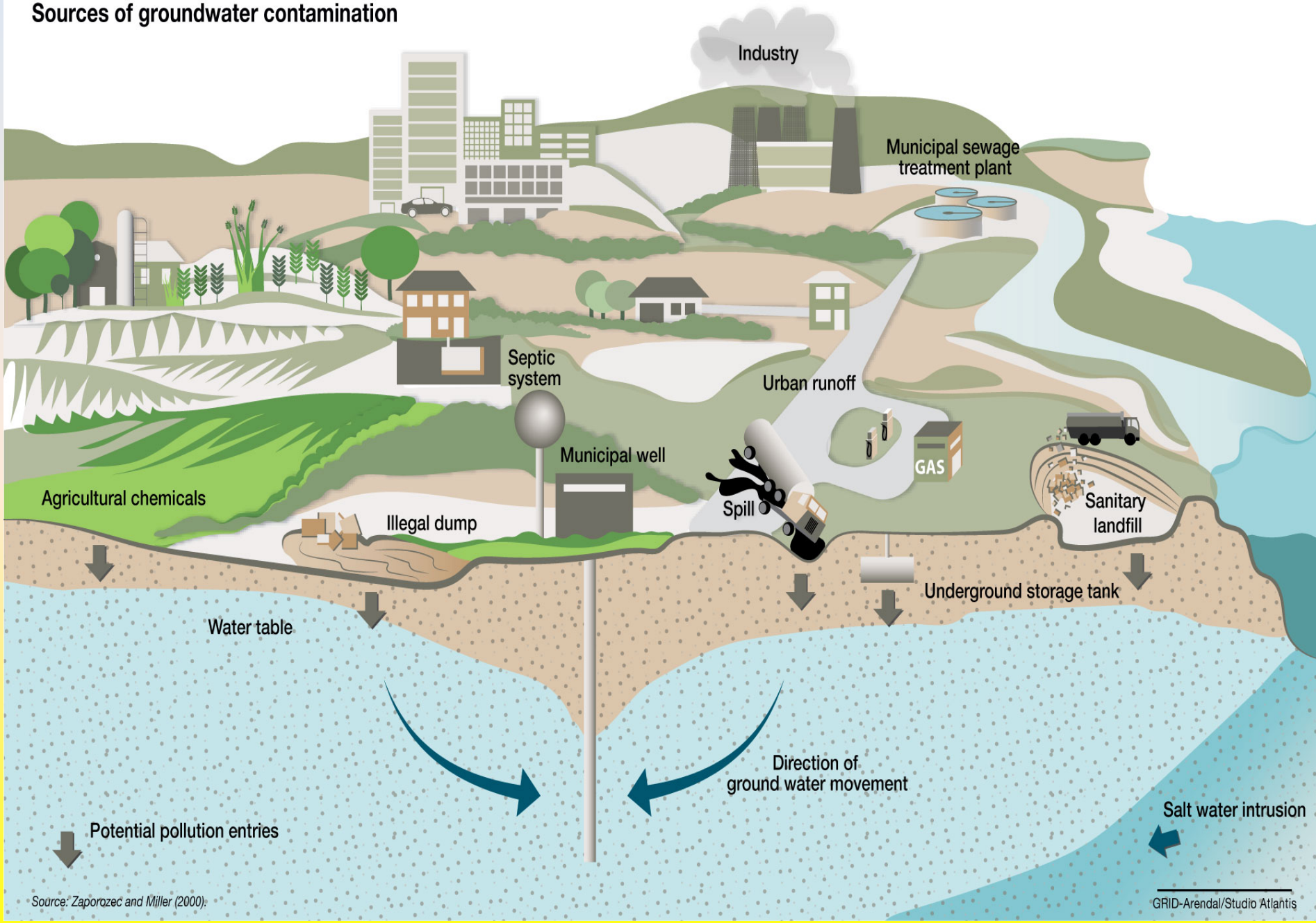
4**. Ground water pollution**

•When humans apply pesticides and chemicals to soils, they are washed deep into the ground by rain water.

•This gets to underground water, causing pollution underground.

•This means when we dig wells and bore holes to get water from underground, it needs to be checked for water pollution.

Sources of groundwater contamination



Source: Zaporozec and Miller (2000).

GRID-Arendal/Studio Atlantis

5. **Suspended Matter**

•Some pollutants (substances, particles and chemicals) do not easily dissolve in water.

•This kind of material is called particulate matter.

•Some suspended pollutants later settle under the water body.

•This can harm and even kill aquatic life that live at the floor of water bodies.

6. **Chemical Water Pollution**

•Many industries and farmers work with chemicals that end up in water.

•These include chemicals that are used to control weeds, insects and pests.

•Metals and solvents from industries can pollute water bodies.

•These are poisonous to many forms of aquatic life and may slow their development, make them infertile and kill them.

7. **Oil Spillage**

•Oil spills usually have only a localized effect on wildlife but can spread for miles.

•The oil can cause the death to many fish and get stuck to the feathers of seabirds causing them to lose their ability to fly

Water pollutants

River, lake and sea water may be polluted in many ways:

- Domestic sewage discharged into rivers from areas located on its banks.
- Industrial wastes effluents from urban areas containing high concentration of oil, heavy metals and detergents.
- Chemical fertilizers, pesticides, insecticides, herbicides and plant remains.
- Radioactive waste from nuclear reactor.
- Excretory wastes of humans and animals in water bodies.

Effects of Water Pollution

- The effects of water pollution are varied and depend on what chemicals are dumped and in which locations.
- Many water bodies near urban areas are highly polluted.
- This is the result of both garbage dumped by individuals and dangerous chemicals legally or illegally dumped by manufacturing industries, health centers, schools and market places.

Health Effects

- Consumption of polluted water is a major cause of ill health in India.
- Polluted water causes some of the deadly diseases like cholera, dysentery, diarrhea, tuberculosis, jaundice, etc.
- About 80 per cent of stomach diseases in India are caused by polluted water.

Effect of Nutrients- Eutrophication

- Water supports aquatic life because of the presence of nutrients in it.
- Excess fertilizers from agricultural fields may mix with surface water and may get drained into water bodies (surface runoff).
- The enrichment of water with nutrients such as nitrates and phosphates that triggers the growth of green algae is called **eutrophication.**
- This fast growth of algae followed by decomposition depletes the water body of its dissolved oxygen.
- As a result aquatic animals die of oxygen shortage.

Sewage and/or fertilizer run off from fields

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Enriched nutrient content in lakes (Eutrophication)

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Algae multiply to produce an ‘algal bloom’

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Algae use up oxygen and begin to die

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Decomposers (bacteria) multiply and use more oxygen

↓

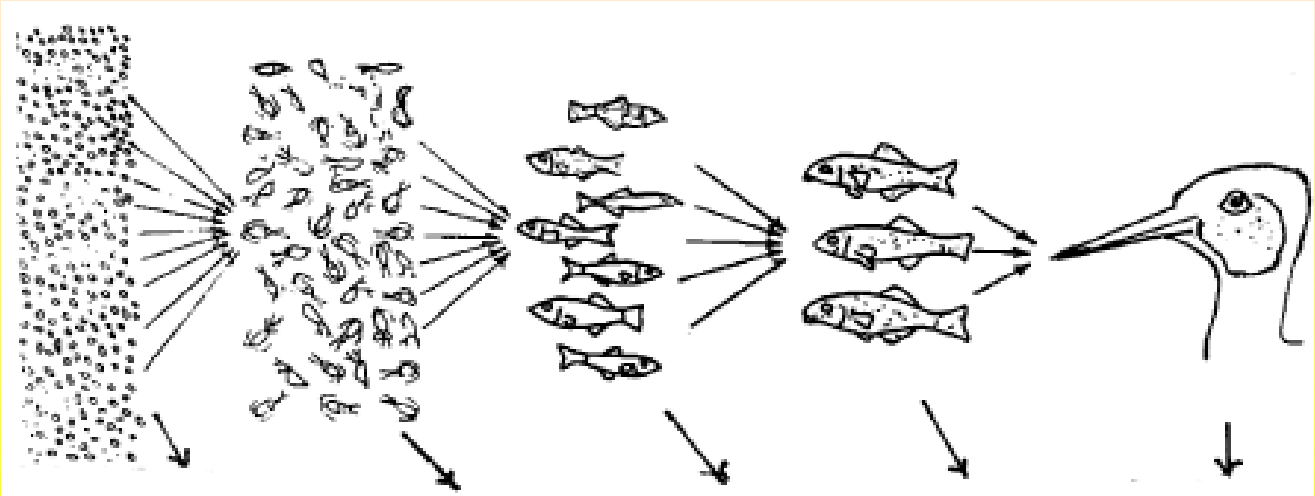
Organisms (such as fish) die due to lack of oxygen

Effect of Toxic Pollutants

- Toxic pollutants mainly consist of heavy metals, pesticides and other individual xenobiotic pollutants.
- Some metals e.g., Mn, Zn and Cu present in trace quantity are important for life as they help and regulate many physiological functions of the body.
- Some metals, however, cause severe toxicological effects on human health and the aquatic ecosystem.

- **Biomagnification**
- Non-biodegradable pesticides, such as DDT are widely used for crop protection.
- Once they enter the food chain, their concentration keeps on increasing with each trophic level (steps of a food chain).
- As a result, accumulation of these compounds takes place in the body of top consumers over a period of time.
- Entry of harmful non-biodegradable chemicals in small concentrations and their accumulation in greater concentrations in the various levels of food chain is called **biomagnification.**

- Water → Algae → Fish → Pelican bird (top consumer)
- DDT used in small quantities to kill mosquitoes can enter the food chain and may get concentrated in large concentration due to its non-biodegradable nature in the body of birds (top) consumer.
- This causes adverse effects, such as weak egg shells, resulting in decreased population.



0.2 ppm 77 ppm 500-600 ppm 1700 ppm

Control of water pollution

- Recycling and Reuse of water
- Treating industrial effluents before discharging into rivers, separate channels for river and sewage water
- Avoid contamination of rivers, lakes and ponds by washing clothes, bathing. etc.
- Not throwing waste, food materials, paper, biodegradable vegetables and plastic into open drains.

- Qualified and experienced people must be consulted from time to time for effective control of water pollution.
- Public awareness must be initiated regarding adverse effects of water pollution using the media.
- Laws, standards and practices should be established to prevent water pollution and these laws should be modified from time to time based on current requirements and technological advancements.

Air Pollution

Air Pollution

- Air Pollution can impact your
  - Health
  - Environment
  - Nation's Economy

Clean Air Act

- The original Clean Air Act was established in **1963**. It established funding for the study and the cleanup of air pollution.
- In **1970** Congress created the Environmental Protection Agency (EPA) and gave it the primary role in carrying out the law.
- In **1990**, Congress revised and expanded the Clean Air Act,
  - Provided the EPA even broader authority to implement and enforce regulations reducing air pollutant emissions.
  - Placed an increased emphasis on more cost-effective approaches to reduce air pollution.

Clean Air Act

- By reducing air pollution, the Clean Air Act has led to significant improvements in human health and the environment in the U.S.
- Since 1970, the six commonly found air pollutants have decreased by more than 50 percent.

Criteria Air Pollutants

- Ozone
- Particle Pollution
- Carbon Monoxide
- Lead
- Sulfur Dioxides
- Nitrous Dioxides

How You Can Help Reduce Air Pollution?

- Conserve Energy
- Drive Wisely / Ride Wisely