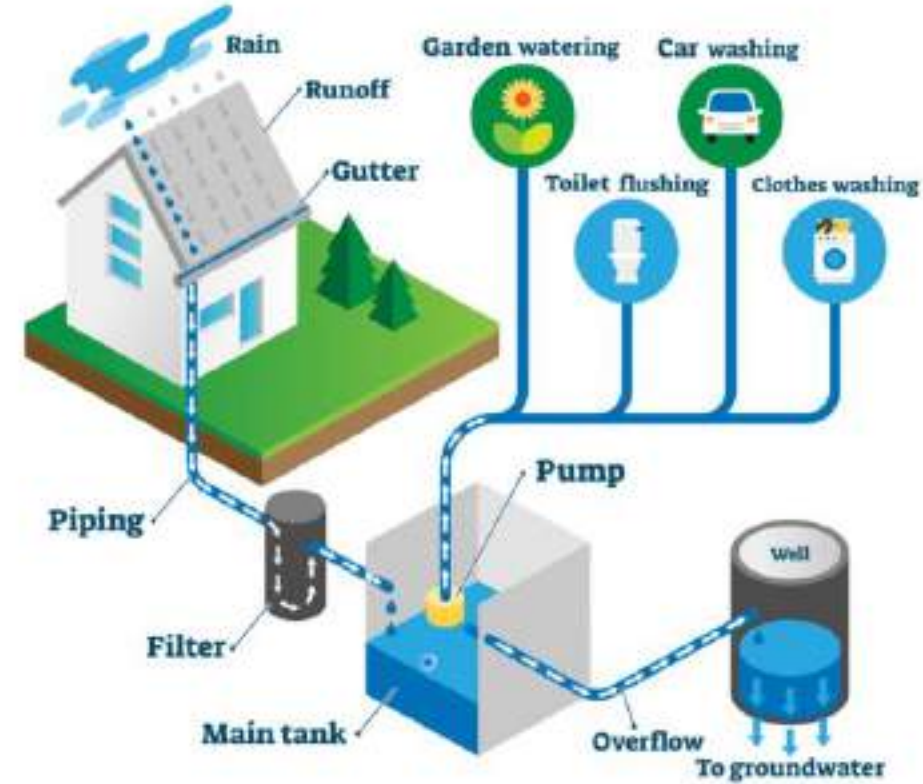


Natural Resources:
Rainwater Harvesting
Eutrophication
Restoration Of Lake

Rainwater Harvesting

- Rainwater harvesting is the simple process or technology used to conserve rainwater by collecting, storing, conveying and purifying of rainwater that runs off from rooftops, parks, roads, open grounds, etc. for later use.
- Traditionally, this involves harvesting the rain from a roof.
- The rain will collect in gutters that channel the water into downspouts and then into some sort of storage vessel.
- Rainwater collection systems can be as simple as collecting rain in a rain barrel or as elaborate as harvesting rainwater into large cisterns to supply your entire household demand.



Rainwater Harvesting System

Why is Rainwater Harvesting Important?

- The rainwater harvesting system is one of the best methods practised and followed to support the conservation of water.
- Today, scarcity of good quality water has become a significant cause of concern.
- However, rainwater, which is pure and of good quality, can be used for irrigation, washing, cleaning, bathing, cooking and also for other livestock requirements.

How To Harvest Rainwater?

Rainwater harvesting systems consists of the following components:

- Catchment- Used to collect and store the captured rainwater.
- Conveyance system – It is used to transport the harvested water from the catchment to the recharge zone.
- Flush- It is used to flush out the first spell of rain.
- Filter – Used for filtering the collected rainwater and removing pollutants.
- Tanks and the recharge structures: Used to store the filtered water which is ready to use.

The process of rainwater harvesting involves the collection and the storage of rainwater with the help of artificially designed systems that run off naturally or man-made catchment areas like- the rooftop, compounds, rock surface, hill slopes, artificially repaired impervious or semi-pervious land surface.

Several factors play a vital role in the amount of water harvested. Some of these factors are:

- The quantum of runoff
- Features of the catchments
- Impact on the environment
- Availability of the technology
- The capacity of the storage tanks
- Types of the roof, its slope and its materials
- The frequency, quantity and the quality of the rainfall
- The speed and ease with which the rainwater penetrates through the subsoil to recharge the groundwater.

What Are The Different Methods To Collect Rainwater?

RAIN BARRELS:

This method is the most common and one that many people are familiar with. This involves installing a barrel at a gutter downspout to collect rainwater. The actual barrel may be a recycled barrel or a new commercially available rain barrel.

Pros:

- Easily implemented by anyone at any residence
- Barrels are readily available in your community or at various stores & websites
- Barrels don't take up much space so they can fit into any situation

Cons:

- Capacity is generally only 50 to 100 gallons
- Easily overflows and wastes collection opportunities



“DRY” SYSTEM:

This method is a variation of a rain barrel set-up, but it involves a larger storage volume. Essentially, the collection pipe “Drys” after each rain event since it empties directly into the top of the tank.

Pros:

- Can store a large amount of rainwater
- Great for climates where rainfall happens with infrequent, larger storm events
- Can be inexpensive to implement
- Less complicated system so maintenance is easier

Cons:

- The storage tank must be located next to your house

“WET” SYSTEM:

This method involves locating the collection pipes underground in order to connect multiple downspouts from different gutters. The rainwater will fill the underground piping and the water will rise in the vertical pipes until it spills into the tank. The downspouts and underground collection piping must have water-tight connections. The elevation of the tank inlet must be below the lowest gutter on the house.

Pros:

- The ability to collect from your entire collection surface
- The ability to collect from multiple gutters and downspouts
- The tank can be located away from your house

Cons:

- More expensive to implement due to underground piping
- Sufficient difference between gutters and tank inlet must be available



Dry and Wet System

What Are The Uses Of Collected Rainwater?

Rainwater collection is a technique to green your home and to lessen your environmental footprint.

There are basically three areas where rainwater can be used:

- Irrigation use
- Indoor, non-potable use
- Whole house, potable use

Here are some ideas for specific uses of rainwater:

- Hand water your lawn and garden
- Connect rainwater collection system to irrigation/sprinkler system
- Wash your vehicles
- Wash your pets
- Refill your fountains and fish ponds
- Refill your swimming pool
- Replace the use of tap water with rainwater to wash your driveways and sidewalks (if you don't use a broom)
- Use it for all indoor non-potable fixtures (toilets and clothes washer)
- Use it for all potable needs when properly filtered and disinfected
- Use it for industrial processes instead of municipally treated water

Advantages of Rainwater Harvesting

The benefits of the rainwater harvesting system are listed below.

Less cost.

- Helps in reducing the water bill.
- Decreases the demand for water.
- Reduces the need for imported water.
- Promotes both water and energy conservation.
- Improves the quality and quantity of groundwater.
- Does not require a filtration system for landscape irrigation.
- This technology is relatively simple, easy to install and operate.
- It reduces soil erosion, stormwater runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
- It is an excellent source of water for landscape irrigation with no chemicals, dissolved salts and free from all minerals.

Disadvantages of Rainwater Harvesting

In addition to the great advantages, the rainwater harvesting system has a few disadvantages like unpredictable rainfall, unavailability of the proper storage system, etc.

Listed below are a few more disadvantages of the rainwater harvesting process.

- Regular maintenance is required.
- Requires some technical skills for installation.
- Limited and no rainfall can limit the supply of rainwater.
- If not installed correctly, it may attract mosquitoes and other waterborne diseases.
- One of the significant drawbacks of the rainwater harvesting system is storage limits.

What Is Eutrophication?

- ❖ Eutrophication is the process in which a water body becomes overly enriched with nutrients, leading to plentiful growth of simple plant life.
- ❖ The excessive growth (or bloom) of algae and plankton in a water body are indicators of this process.
- ❖ Eutrophication is considered to be a serious [environmental concern](#) since it often results in the deterioration of water quality and the depletion of dissolved oxygen in water bodies.
- ❖ Eutrophic waters can eventually become “dead zones” that are incapable of supporting life.

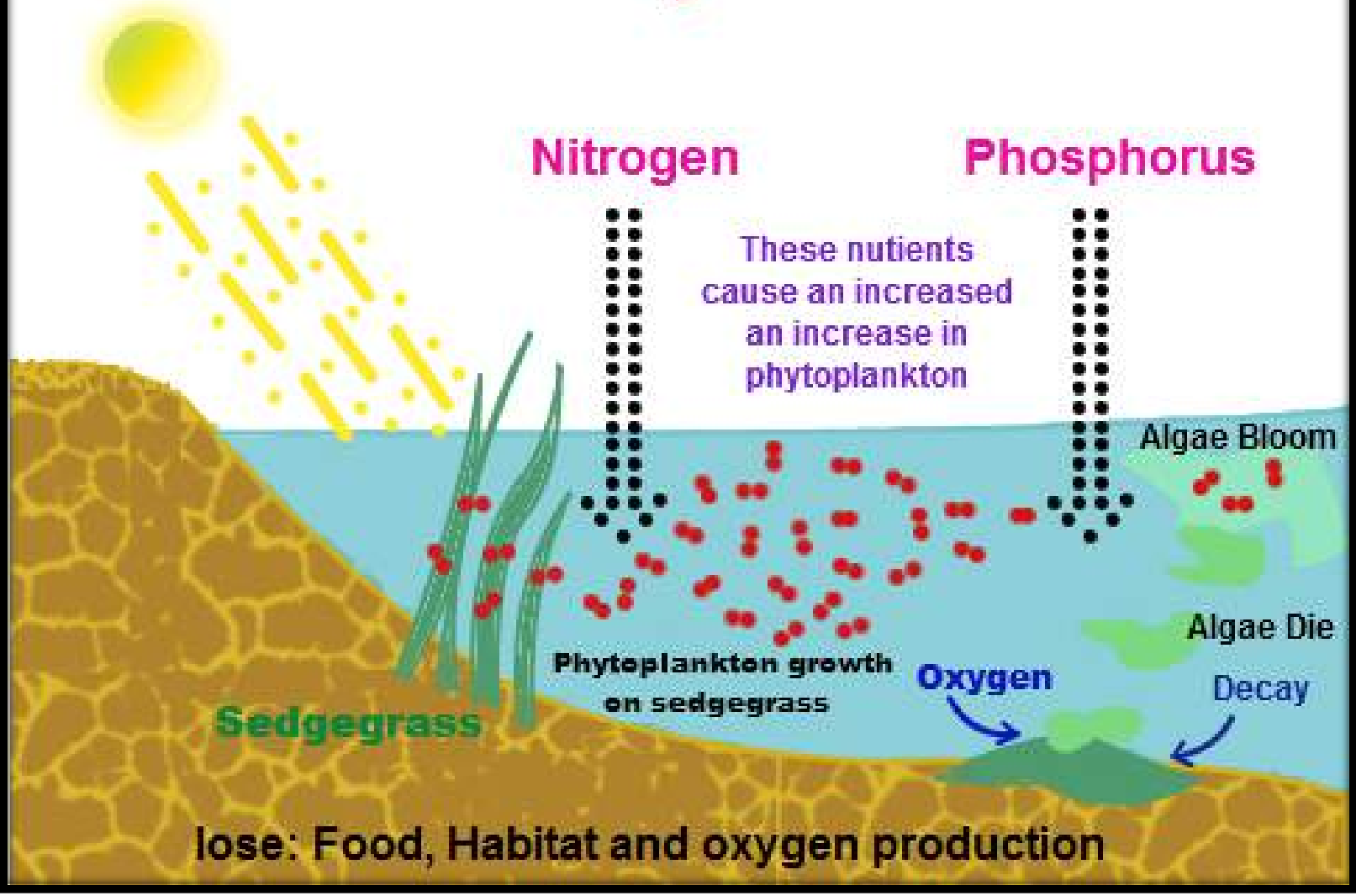
Definition Of Eutrophication

- Eutrophication may be defined as the inorganic nutrient enrichment of natural waters, leading to an increased production of algae and macrophytes.
- The term Eutrophication is more widely known in relation to human activities where the artificial introduction of plant nutrients has led to community changes and a deterioration of water quality in many freshwater systems.
- This aspect has become increasingly important with increases in human population and more extensive development of agriculture and eutrophication now ranks with other major anthropogenic effects such as deforestation, [global warming](#) depletion of the ozone layer and large scale environmental disturbance in relation to its potentially harmful effect on natural ecosystems.

Causes of Eutrophication

- 1. Phosphate and nitrate fertilizers** - Because they rely on nitrate and phosphate fertilizers, humans are the major source of Eutrophication. Nitrate and phosphate nutrient build up are aided by agricultural methods and fertilizer usage on lawns, golf courses, and other areas.
- 2. Discharge of sewage and industrial waste in oceans, lakes, and other water bodies**- it Introduces large amounts of chemical fertilizers, causing algal blooms and other aquatic plants to grow densely, and endangering aquatic life in a variety of ways.
- 3. Aquaculture** - Aquaculture is the practice of producing fish, shellfish, and even aquatic plants in water that contains dissolved nutrients without the need for soil. It counts as a major contributor to Eutrophication since it has become a widely accepted practice in recent years.
- 4. Natural events** - Floods and the flow of streams and rivers can also sweep surplus nutrients from the land into the water systems, causing algal blooms to flourish excessively.

Eutrophication



lose: Food, Habitat and oxygen production

Classification of Eutrophication

Anthropogenic Eutrophication:

Anthropogenic eutrophication is caused by human activity – Agricultural farms, golf courses, lawns, etc. are supplied with nutrients by humans in the form of [fertilizers](#). These fertilizers are washed away by rains and eventually find their way into water bodies such as lakes and rivers.

Natural Eutrophication:

Natural eutrophication refers to the excessive enrichment of water bodies via natural events. For example, the nutrients from the land can be washed away in a flood and deposited into a lake or a river. These water bodies become overly enriched with nutrients, enabling the excessive growth of algae and other simple plant life.





Effects of Eutrophication

- Phytoplankton's grow much faster in such situations. These phytoplankton species are toxic and are inedible.
- Gelatinous zooplankton blooms fast in these waters.
- Increased biomass of epiphytic and benthic algae can be observed in eutrophic waters.
- Significant changes arise in the species composition of macrophytes and the biomass.
- The water loses its transparency and develops a bad smell and colour. The treatment of this water becomes difficult.
- Depletion of dissolved oxygen in the water body.
- Frequent fish kill incidents occur and many desirable fish species are removed from the water body.
- The populations of shellfish and harvestable fish are lowered.
- The aesthetic value of the water body diminishes significantly.
- Decrease in Biodiversity
- Increase in Water Toxicity
- Invasion of New Species

Solutions of Eutrophication:

1. Biological Control

Phosphorus is one of the important elements that induce the process of eutrophication. Thus, it is important to remove phosphorus from various sources.

2. Reduction of excessive fertilization

Fertilizers are one of the important sources of nutrients causing eutrophication thus reducing the use of fertilizers can be a good strategy to reduce nutrient inputs.

3. Public Awareness and legislations

Public awareness determines the ability of the public to understand the surrounding world, sensitivity to changing environment, and understanding the cause-effect relationship between environment and human behaviour.

Restoration Of Lake

Introduction:

Lake is a very general term used for any standing water, generally large enough in area and depth, but irrespective of its hydrology, ecology, and other characteristics.

These water bodies are used primarily for drinking water supplies, irrigation and/or recreation.

Functions of Lakes:

- Lakes are majorly for storage of water.
- Most riverine lakes (oxbows) play a very important role in flood mitigation and groundwater recharge.
- At the landscape level, large lakes significantly influence microclimate and therefore influence biotic diversity.
- Man-made lakes have been constructed mostly to store seasonally available water, usually for urban water supply and/or irrigation.
- Power generation is generally a collateral use.
- Groundwater recharge.

Degradation of Lakes

- Most lake pollution problems are caused by nutrients, contaminants, and sediments carried into the lakes. Soil particles carry more than 90 percent of the organic nitrogen and phosphorus originating from upland agricultural practices.
- In a typical watershed, nutrients may come from sewage, wastewater, agricultural and urban runoff, and atmospheric fallout. In recent years, heavy use of fertilizers and pesticides and high rates of soil erosion have increased the severity of the problem.
- High concentrations of nitrogen and phosphorus are the main causes of algal growth, which results in the deterioration of the lake water quality.



Lake Restoration Methods:

1. Diversion of wastewater has been extensively used, often to replace wastewater treatment.
2. Removal of superficial sediment can be used to support the recovery process of very [eutrophic lakes](#) and of areas contaminated by toxic substances (for instance, harbour's).
3. Uprooting and removal of macrophytes have been widely used in streams and also to a certain extent in reservoirs, where macrophytes have caused problems in the turbines.
4. Flocculation of phosphorus in a lake or reservoir is another alternative.
5. Circulation of water can be used to break down the thermocline.
6. Aeration of the lake sediment is a more direct method to prevent anaerobic conditions from occurring.
- 7.. Biological control methods are also used. Water hyacinths and other macrophytes are a pest in many tropic lakes and reservoirs.



Photo showing the contrast of the lake basin before and after restoration.

References:

[Rainwater Harvesting -Process, Advantages and Disadvantages \(byjus.com\)](#)

[Rainwater Harvesting 101 | Your How-To Collect Rainwater Guide \(watercache.com\)](#)

[Eutrophication- Definition, Causes, Classification, Effects and FAQs on Eutrophication. \(byjus.com\)](#)

[Lake Restoration - CivilDigital -](#)

[Lake Restoration Methods - Ecological Engineering - Ecology Center](#)