

Read the question carefully and address exactly what is asked, avoiding unnecessary deviation.

Start with a clear and relevant introduction that shows understanding of the topic.

Structure the answer logically (introduction, explanation/analysis, and a brief conclusion).

Use correct scientific terminology (e.g., biodiversity, sustainability, carbon cycle, eutrophication).

Explain concepts clearly and accurately, avoiding vague or generalized statements.

Support answers with relevant examples, preferably from Pakistan or global case studies where appropriate.

Include data, statistics, or facts (e.g., temperature rise, deforestation rates) when relevant to strengthen arguments.

Incorporate environmental laws, agreements, or protocols (e.g., Paris Agreement, Kyoto Protocol, SDGs) where applicable.

Show cause-and-effect relationships in environmental processes.

Focus on analysis and application rather than rote definitions.

Present balanced views by mentioning impacts,

ENVIRONMENTAL SCIENCE

Eutrophication

Eutrophication refers to the phenomenon in which due to the enrichment of water bodies and nutrients like Nitrogen and Phosphorus, abnormal growth of algae and aquatic plants takes place. It is an ecological imbalance.

Major Causes:

5) Agricultural Runoff: Soil erosion

4) Sewage and Industrial Effluents

4) Soil erosion:

Soil erosion carries nutrients like Nitrogen and Phosphorus. When it enters the water, it fuels the growth of algae and water life.

2. Detergent containing phosphate:

House hold detergents for washing contains nutrients like phosphate. When this water mix with rivers or seas, abnormal growth of aquatic life takes place.

3. Industrial Effluents:

Industrial waste from textile, food processing, paper, chemical industries, contains excessive amount of nutrients.

4. Sewage and Domestic waste water:

Untreated sewage and domestic waste water contains high amount of nutrients that foster the growth of algae in water.

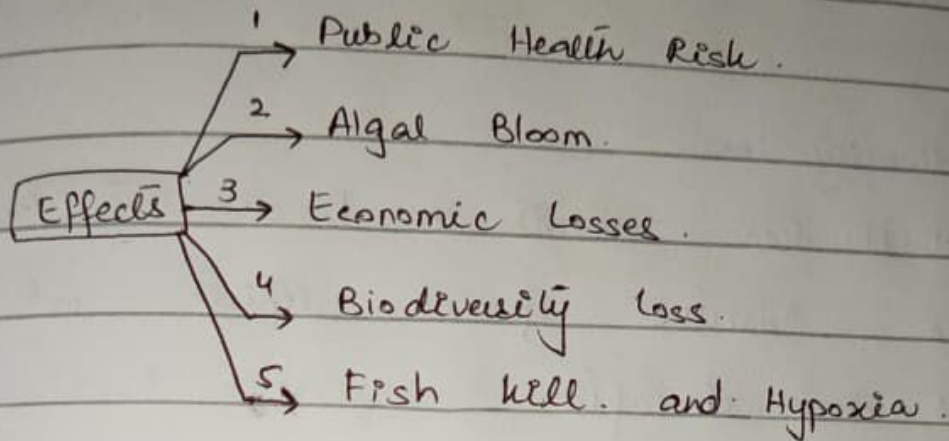
5. Agricultural Run off:

Agricultural waste contains excessive amount of nutrients extracted from fertilizer use, mixes with river, sea or lakes, thus polluting them and result in algae formation.

In this way, human activities causes abnormal growth of algae and water/aquatic life.

Effects of Eutrophication:

Eutrophication has multiple consequences on ecosystem and biodiversity. Such as:



1) Algal Bloom

With excessive growth of algae on the top of water, traps sunlight to penetrate deep down in the sea or river. This ~~causes~~ ^{leads to} imbalance in aquatic diversity.

2) Public Health Risk

Such water when consumed by humans or animals results into various fatal diseases like diarrhea, skin diseases, infections etc. It also upset animals stomach.

3. Economic Loss

Eutrophication brings economic losses with itself. loss of Tourism, fisheries and also increase in water treatment cost.

4. Biodiversity Loss.

Eutrophication results in bio-diversity loss. also. sensitive species deplete and food chain disruption.

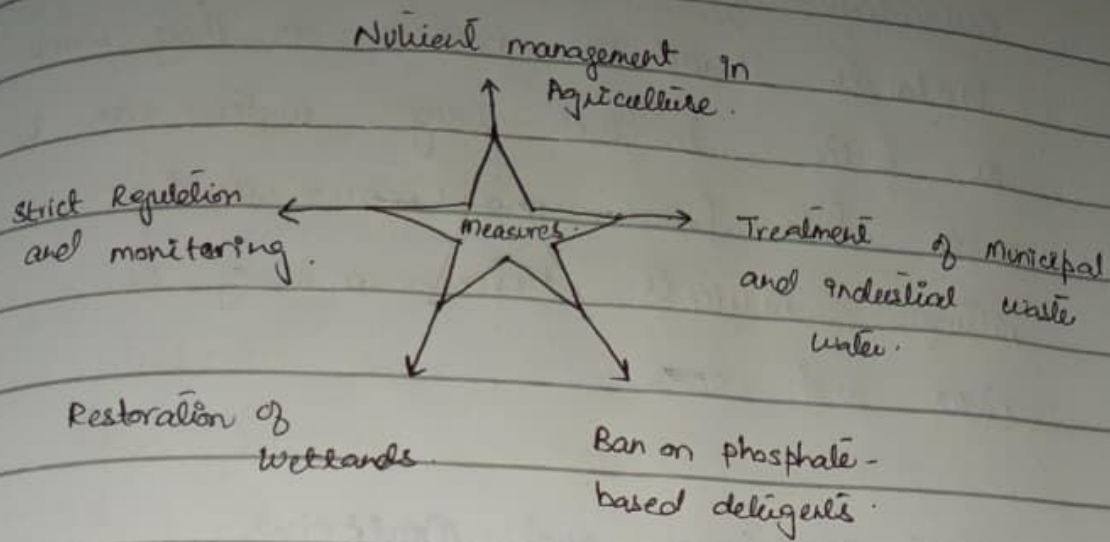
5. Fish kill and Hypoxia.

As algae die, oxygen level drops down excessively which leads to 'dead zone'.

This deoxygenation of water results in the death of fishes and other aquatic life thus disruption the ecosystem overall.

Appropriate Measures:

However this phenomenon can be tackled down by taking preventive measures. Such as,



1) Nutrient Management in Agriculture.

Precision farming should be promoted. Control and calculated use of fertilizer, deep irrigation, sprinkler irrigation system can be used. Use of technology eg mobile use in agriculture can be highly useful.

2) Treatment of Municipal and Industrial waste water.

Waste water from leakages in pipes of industries should be treated before they mix with water. STPs should be established.

3) Ban on phosphate based detergents.

Industries should manufacture detergents that are phosphate-free.

4. Restoration of wetlands.

Wetlands should be restored as they work as filters. In this way, water can be made free from phosphorous and nitrogen nutrients before mixing in rivers and seas.

5. Strict Regulations and Monitoring:

Regulations should be made and monitoring should be done of all such activities that result in Eutrophication. Environmental Impact Assessment (EIA) should be done and standards should be set for check and balance.

(b) Ramsar Convention (1971)

Ramsar Convention took place in Ramsar, Iran in 1971. The agenda of this international treaty was the conservation and sustainable use of wetlands. Wetlands are part of ecosystem meant for biodiversity, water purification, flood control and climate resilience.

Objective

- 1 → Conserve Wetlands.
- 2 → Promote wise use of wetlands
- 3 → Encourage International Cooperation

Major Features:

- 1) Countries should cooperate in:
 - a) protecting
 - b) Managing and
 - c) Restoring wetlands.
- 2) Emphasize 'Sustainable development'; ensuring that wetlands support ecosystem.
- 3) Provide framework for National legislation and policies on wetland conservation.

Pakistan and Ramsar Convention

Pakistan was one of the earliest signatories of Ramsar Convention. It became part of it in 1976. Owing to this convention Pakistan has 23 Ramsar sites (wetlands) covering an area of more than 1.6 million hectares. including Keenjharo Lake, Indus Delta, and Haleji Lake.

Significance:

- 1) Wetlands also called Ramsar sites helps to protect biodiversity.
- 2) They promote climate resilience as they act as carbon sink and natural flood buffers.
- 3) This convention supports global cooperation and efforts against wetland preservation.