Environment & Ecology · GS - III

Explain the process of eutrophication in freshwater ecosystems. How can nutrient pollution and climate variability intensify its ecological consequences?

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 28/11/2026	GS - III	Environment & Ecology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

Eutrophication, nitrogen, phosphorus, algal blooms, agricultural runoff, dissolved oxygen, hypoxia, aquatic biodiversity, nutrient management

Model Answer

Eutrophication refers to the enrichment of water bodies with nutrients, particularly nitrogen and phosphorus, resulting in excessive growth of algae and aquatic plants. Although it occurs naturally, human activities can accelerate the process and cause ecological degradation.

Process and ecological consequences:

1. **Nutrient loading:** Fertilisers, untreated sewage and agricultural runoff introduce excessive nutrients into lakes and rivers.

2. **Algal proliferation:** High nutrient availability promotes rapid algal growth, sometimes producing dense algal blooms.

3. **Oxygen depletion:** Decomposition of dead algal biomass increases microbial oxygen consumption, potentially causing hypoxic conditions.

4. **Biodiversity loss:** Oxygen depletion can cause fish mortality, disturb aquatic food chains and reduce ecosystem diversity.

Role of climate variability:

Rainfall can dilute nutrient concentrations and alter water chemistry, while runoff during heavy rainfall may transport additional nutrients into lakes. Temperature changes and water-column stratification can further influence algal growth and oxygen availability.

Management measures:

- Promote balanced fertiliser application and precision agriculture.
- Improve sewage treatment and wastewater management.
- Establish vegetative buffer zones around water bodies.
- Monitor nutrient concentrations, algal blooms and dissolved oxygen.
- Restore wetlands to reduce nutrient inflow.

Conclusion

Eutrophication threatens freshwater biodiversity, water quality and ecosystem stability. Integrated watershed management and continuous ecological monitoring are essential to prevent nutrient pollution and protect aquatic ecosystems.

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