



Mains Practice Question

Q. "Soil pollution is intrinsically linked to water pollution and biodiversity loss." Discuss how an integrated approach to environmental protection can help address the challenges of soil contamination in India. **(250 words)**

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Approach

- Introduce the answer by briefing the linkage of Soil pollution, water contamination, and biodiversity loss
- Give key arguments supporting Interlinkages Between Soil Pollution, Water Pollution, and Biodiversity Loss
- Suggest Integrated Approach to Address Soil Contamination
- Conclude suitably.

Introduction

Soil pollution, water contamination, and biodiversity loss are interlinked challenges undermining India's environmental and agricultural sustainability. Excessive fertilizer use, urbanization, and deforestation degrade ecosystems, pollute water bodies, and threaten biodiversity hotspots like the **Western Ghats and Himalayas**.

Example:

Agricultural Runoff → Nutrient Pollution (Eutrophication) → Algal Bloom → Blocked Sunlight & Disrupted Coral-Zooxanthellae Symbiosis → Coral Bleaching

Body

Interlinkages Between Soil Pollution, Water Pollution, and Biodiversity Loss:

- **Soil Pollution and Water Contamination:** Overuse of chemical fertilizers and pesticides leads to nutrient runoff, polluting surface and groundwater resources.
 - **Example:** In Punjab, **excessive nitrogen use causes nitrate leaching** into aquifers, making water unsafe for consumption.
 - Industrial effluents **with heavy metals seep into soils and water**, affecting both ecosystems.
- **Soil Pollution and Biodiversity Loss:** Degraded soils result in reduced fertility, impacting vegetation and wildlife habitats.
 - **Example: Jhum cultivation in Northeast India** leads to the loss of forest cover, harming native species such as the hoolock gibbon.
 - **Persistent organic pollutants (e.g., DDT) accumulate in soil and water**, disrupting food chains and ecosystems (like **DDT-induced egg shell thinning in raptor birds**)
- **Water Pollution and Biodiversity Loss:** Polluted water bodies harm aquatic biodiversity through oxygen **depletion (eutrophication) and bioaccumulation of toxins**.

- **Example:** The **Yamuna River suffers from industrial effluents** and agricultural runoff, causing the **collapse of aquatic ecosystems**.

Integrated Approach to Address Soil Contamination

▪ Sustainable Agricultural Practices

- **Organic Farming and Biofertilizers:** Reduce dependency on synthetic chemicals and restore soil health.
 - **Example:** The **Paramparagat Krishi Vikas Yojana (PKVY)** promotes organic farming practices.
- **Integrated Nutrient Management (INM):** Balancing chemical fertilizers with organic inputs and biofertilizers.
 - Revise the **Nutrient-Based Subsidy (NBS)** to include incentives for **biofertilizers and promote fortified fertilizers**.
- **Agroforestry and Crop Rotation:** Enhance biodiversity, improve soil structure, and reduce erosion.
 - Promote traditional **Wadi systems (tree-based farming)** for better soil conservation and socio-economic benefits.

▪ Water Management for Soil Health

- **Micro-irrigation Techniques:** Promote drip and sprinkler irrigation to prevent waterlogging and salinization.
 - **Example:** **PM Krishi Sinchayee Yojana (PMKSY)** targets micro-irrigation but needs expansion (**currently only 19% coverage**).
- **Wetland Revival:** Use wetlands to naturally filter pollutants from agricultural and industrial runoff, protecting downstream water bodies and surrounding soils.

▪ Afforestation and Biodiversity Restoration

- **Afforestation Programs:** Rehabilitate degraded lands with native vegetation to restore soil fertility and wildlife habitats.
 - **Example:** The **National Afforestation Programme (NAP)** should integrate with **MGNREGA for community-led land restoration**.
- **Mangrove Restoration:** Protect coastal soils from salinity intrusion and support aquatic biodiversity.
 - **Example:** **Tamil Nadu's mangrove afforestation programs** can be scaled up nationwide.

▪ Climate-Resilient Soil Conservation

- **Conservation Agriculture:** Practices like **zero tillage, mulching, and cover cropping** reduce erosion and enhance soil carbon sequestration.
 - **Example:** The **Borlaug Institute for South Asia** promotes zero-tillage methods in Punjab with technologies like the Happy Seeder.
- **Adaptation Strategies:** Integrate **National Adaptation Fund for Climate Change (NAFCC)** projects with soil health initiatives to build resilience against floods, droughts, and erratic rainfall.

▪ Bioremediation and Pollution Control

- Use **bioremediation techniques** such as Phytoextraction to clean soils contaminated by heavy metals and industrial toxins.
 - **Example:** In Ankleshwar, Gujarat, bioremediation has been piloted to **detoxify industrially polluted soils**.
- **Microplastic Contamination Control:** Promote biodegradable alternatives such as starch based plastic to agricultural plastics and regulate waste disposal.
 - Using jute bags instead of plastics for sustainable packaging.
 - Cabinet Committee on Economic Affairs (CCEA) approved that **100% of the food grains and 20% of the sugar** shall be mandatorily packed in diversified jute bags is a step in the right direction.

▪ Integrated Policy Framework

- **Unified Environmental Policies:** Align soil health programs (e.g., Soil Health Card Scheme) with water management schemes (e.g., **Jal Shakti Abhiyan**) and biodiversity programs.
- **Digital Soil Mapping:** Use **ISRO's Earth Observation Satellites** to monitor soil degradation and recommend region-specific interventions.

▪ **Community and Technology-Driven Solutions**

- **Participatory Approaches:** Involve local communities in soil and water conservation, especially in vulnerable areas like **Rajasthan and the Northeast**.
- **Technology Integration:** Use AI and drones to monitor soil erosion, water pollution, and forest cover changes.

Conclusion

Soil pollution, water pollution, and biodiversity loss are interconnected challenges that require a coordinated and integrated approach to environmental protection. By promoting **sustainable agricultural practices, improving water management, and restoring biodiversity**, India can address soil contamination while safeguarding its ecological balance.

PDF Reference URL: <https://www.drishtiias.com/mains-practice-question/question-8632/pnt>

