



# Edaphic Profile and Benthic Nutrient Sequestration in Agrochemical-Impacted "Chaur" of Munger, Bihar

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**Abstract:** *The benthic zone of floodplain wetlands (Chaur) plays a critical role in nutrient cycling and the long-term sequestration of agricultural pollutants. This study analyzes the edaphic properties of Chaur sediments in the Haveli Kharagpur region of Munger, Bihar, between 2018 and 2020. Soil samples were evaluated for pH, organic carbon (OC), organic matter (OM), chloride, and phosphorus. Results indicate a slightly acidic soil environment (pH 6.10–6.85) with high organic carbon levels (mean 5.62%), signifying high biological productivity. However, enriched phosphorus levels suggest a significant influx of phosphate-based fertilizers from adjacent agricultural runoff. This article discusses the implications of these edaphic conditions for the health of bottom-dwelling fish species and the overall sustainability of the wetland ecosystem.*

**Keywords:** *Edaphic Profile, Benthic Nutrient Sequestration, Organic Carbon, Phosphorus Enrichment, Bihar Wetlands, Agrochemical Sink.*

## 1. INTRODUCTION

Floodplain wetlands, or "Chaur," act as natural filters and sinks for the surrounding landscape. In the agro-centric region of Haveli Kharagpur, Munger, these wetlands receive significant volumes of runoff containing fertilizers and pesticide residues. While much of the scientific focus remains on water quality, the benthic sediment—or the soil-sediment interface—often holds the long-term chemical "memory" of the ecosystem.

Recent research by Alexander (2026) demonstrates that tropical wetland sediments in India are increasingly becoming hotspots for nutrient over-loading, leading to benthic hypoxia. Furthermore, Li et al. (2021) have shown that pesticide residues in agricultural basins tend to bind to soil organic carbon, creating a persistent source of toxicity for bottom-dwelling organisms. As noted by Dr. Madhav Kumar, understanding the soil profile is essential for assessing the total environmental load of the Chaur, which support vital regional fisheries of species such as *Clarias batrachus*. This study evaluates whether the current soil status remains within the productive range or is transitioning toward a toxic "nutrient trap."

## 2. Materials and Methods

- Site Selection: Benthic soil samples were collected from five strategic locations across the Chaur of Haveli Kharagpur, Munger.
- Sampling Protocol: Samples were collected using a core sampler from the top 15cm of the sediment layer during the pre-monsoon and post-monsoon phases (2018–2020).
- Laboratory Analysis: \* Soil pH: Measured using a digital pH meter in a 1:2.5 soil-water suspension.
- Organic Carbon: Determined by the Walkley and Black method.
- Phosphorus: Estimated via the Bray and Kurtz method, relevant for acidic to neutral soils.

## 3. Results

The soil profile reveals a highly fertile but chemically sensitive benthic.



**Table 1: Physico-Chemical Status of Chaur Benthic Soil (Mean Values)**

| Soil Parameter       | Minimum | Maximum | Mean Value | Status            |
|----------------------|---------|---------|------------|-------------------|
| pH (Unit)            | 6.10    | 6.85    | 6.44       | Slightly Acidic   |
| Organic Carbon (%)   | 5.32    | 5.95    | 5.62       | Highly Productive |
| Organic Matter (%)   | 10.31   | 11.20   | 10.75      | Very High         |
| Chloride (mg/100g)   | 16.5    | 22.4    | 19.4       | Normal            |
| Phosphorus (mg/100g) | 14.5    | 18.2    | 16.3       | Enriched          |

**Table 2: Correlation between Soil Health and Aquaculture Potential**

| Ecological Implication                            | Suitability for Fish |
|---|----------------------|
| Optimal for nutrient release from organic matter  | Highly Suitable      |
| Supports dense benthic food web (insects/larvae). | Optimal for C. Batra |
| Risk of algal blooms if sediment is disturbed     | Caution Required     |

#### 4. Discussion

The edaphic analysis conducted by Dr. Madhav Kumar reveals that the Chaur soil is exceptionally rich in organic carbon (5.62%). In tropical wetlands, organic carbon above 2.5% is generally considered a sign of high productivity. However, the organic matter levels exceeding 10.7% suggest an accumulation of unused supplementary feeds and agricultural crop residues.

#### Recent Scientific Context:

- Frontiers in Environmental Science (2024) reports that phosphorus enrichment in the Gangetic floodplains is reaching a threshold where it may trigger internal eutrophication, even if external runoff is curtailed.
- Mishra et al. (2023) observed that slightly acidic soils (like the 6.44 pH found here) are common in Bihar's wetlands and help in the slow release of nutrients, though they can increase the solubility of certain heavy metals if agrochemical pollution increases.

The chloride levels (mean 19.4 mg/100g) remain within safe limits, indicating that the Chauras are not currently suffering from salinity issues, which is common in areas with over-pumped groundwater.

#### 5. Conclusion

The benthic soil of the Haveli Kharagpur Chauras is currently in a "highly productive" state. However, the high levels of phosphorus and organic matter are warning signs of potential ecological "browning" or hypoxia. To maintain the health of these wetlands, I recommend:

- Siltation Control: Periodic removal of excess benthic sludge to prevent anaerobic conditions.
- Crop Management: Implementing "precision farming" in the catchment areas to reduce the phosphorus footprint.

#### REFERENCES

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