



**“Gheorghe Asachi” Technical University of Iasi, Romania**



---

## **SPATIAL VARIABILITY OF SOIL PROPERTIES OF BALLIA DISTRICT OF UTTAR PRADESH**

**Plabani Roy<sup>1\*</sup>, Nirmal De<sup>2</sup>, Hemant Jayant<sup>2</sup>, Chandrashekhar Sharma<sup>2</sup>, Arnab Kundu<sup>2</sup>**

<sup>1</sup>*ICAR-Indian Agricultural Research Institute, Pusa, New Delhi 110 012, India*  
<sup>2</sup>*Banaras Hindu University, Varanasi, Uttar Pradesh 221005 India*

---

### **Abstract**

Soil, being a natural resource, involves a complex interplay among its components and its surroundings. It is well-known that soil qualities vary geographically, emphasizing the need to account for this when conducting field sampling. It is equally vital to assess how this variability has evolved over time and space. For the investigation, mapping, and assessment of soil deterioration, it was discovered that remote sensing and Geographic Information System (GIS) techniques were useful tools when used in conjunction with fieldwork. The study was conducted at Ballia district of Uttar Pradesh Ortho-rectified Landsat satellite images were acquired from the USGS website. Additionally, topographic maps from the Survey of India (SOI) at a scale of 1:50,000 were utilized to take samples from the site. Soil samples were collected from 77 distinct locations from Ballia during 2018-2020 and mechanical analysis was conducted to determine particle size, physiochemical analysis was conducted in laboratory and mean data were presented. Laboratory testing allowed for the approval of the result of the processing of satellite imagery and the validation of the kriging interpolation tool. Sandy loam and sandy clay loam were found to be the dominant among the seven textural classes observed. In agriculture, higher amount of sandy component causes a decrease in water holding capacity (WHC) and poor nutrient retention. All the soils have medium to low organic carbon and medium to high K, medium to high soil pH, slight to strong in soil salinity and strong in alkalinity. Due to the impact of intensive agriculture, intermittent drought, and unpredictable rainfall, significant changes were observed across the entire region of Ballia. These factors contributed to a large degradation of soil quality.

*Key words:* digital image processing, geographic information system (GIS), land degradation, remote sensing, spatial variability

*Received: October, 2023; Revised final: June, 2024; Accepted: June, 2024; Published in final edited form: December, 2024*

---

---

\* Author to whom all correspondence should be addressed: e-mail: [plabaniroyiari@gmail.com](mailto:plabaniroyiari@gmail.com); Phone: 7797812028