BHARATI INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH & DEVELOPMENT (BIJMRD)

(Open Access Peer-Reviewed International Journal)

DOI Link : https://doi.org/10.70798/Bijmrd/03080026

Available Online: www.bijmrd.com|BIJMRD Volume: 3| Issue: 08| August 2025| e-ISSN: 2584-1890

Anthropogenic Pressure and Their Effects on Coastal Plant Diversity: A Study of Purba Medinipur and Balasore Coastal Areas

Swapan Kumar Sahoo[1] & Dr. Vijay Kumar Gonekar[2]

1. Research Scholar, Department of Geography, Faculty of social Science and Humanities, Mansarovar Global University, Bilkisganj, Sehore, Madhya Pradesh
2. Associate professor, Department of Geography, Mansarovar Global University, Bilkisganj, Sehore, Madhya Pradesh

Abstract:

Coastal ecosystems of Purba Medinipur and Balasore exhibit high ecological sensitivity, yet increasing anthropogenic pressure has accelerated the degradation of native plant communities. The present study analyses the extent to which activities such as tourism expansion, fishing and aquaculture intensification, settlement growth, and land-use modification contribute to shifts in coastal vegetation structure and species composition. Results indicate a marked decline in dune-stabilizing and salt-tolerant flora, accompanied by habitat fragmentation and reduced regenerative capacity. The study underscores the need for integrated coastal zone management and conservation-oriented interventions to safeguard plant diversity in these ecologically fragile coastal environments.

Keywords: *Floristic Diversity, Coastal Vegetation, Anthropogenic Impact, Land-Use Change.*

Introduction:

Coastal ecosystems are globally recognized as biodiversity hotspots and ecological buffers, playing a vital role in shoreline protection, carbon sequestration, and supporting livelihoods through fisheries, agriculture, and tourism (Alongi, 2002). India's eastern coastline along the Bay of Bengal is particularly rich in coastal biodiversity but faces escalating threats from both natural and anthropogenic disturbances. Among these, the coastal districts of Purba Medinipur in West Bengal and Balasore in Odisha are ecologically sensitive yet socio-economically significant regions, known for their estuarine landscapes, mangroves, sand dunes, and agricultural belts (Ghosh et al., 2015; Chakraborty &Mukhopadhyay, 2019).

Over the past few decades, rapid urbanization, unsustainable tourism, conversion of mangrove forests to monoculture plantations (especially *Casuarinaequisetifolia*), and infrastructural expansion have led to significant habitat loss and a decline in native flora (Das & Bandyopadhyay, 2013; Kathiresan& Bingham, 2001). Furthermore, climate-induced phenomena such as sea-level rise, saline intrusion, and cyclonic storms have amplified the ecological stress on these habitats, impacting floristic composition and ecosystem stability (Dutta et al., 2013).

This present study aims to conduct a comparative analysis of native plant diversity and anthropogenic pressure in selected 10 coastal areas of Purba Medinipur and Balasore. By direct observation vegetation surveys with local ecological knowledge and GIS-based land-use assessment, the research seeks to identify key species under threat, understand human-induced transformations, and propose conservation strategies for maintaining coastal plant diversity and ecosystem resilience.

Materials and Methods:

The study was conducted in ten coastal sites across Purba Medinipur (West Bengal) and Balasore (Odisha), chosen for their ecological importance and exposure to anthropogenic influences. Vegetation data were collected through field surveys using stratified quadrat sampling method where : 10×10 m for trees, 5×5 m for shrubs, and 1×1 m for herbs (Misra, 1968; Kershaw & Looney, 1985). Species were identified, and their frequency, density, and seasonal abundance were calculated. Seasonal variation (pre-monsoon, monsoon, post-monsoon) was recorded. Ethno botanical insights were gathered via interviews with local residents and traditional healers to assess human interactions with vegetation (Kala, 2005). Additionally, GIS and remote sensing (Landsat 8, Sentinel-2) were applied using QGIS software to evaluate land-use changes between 2017 and 2024 (Jensen, 2007; Lillesand et al., 2015). Collected plant specimens were collected, preserved and authenticated using regional floras and stored in a reference herbarium (Jain & Rao, 1977).

Results and Discussion

Plant Composition and Diversity

Vegetation surveys across ten coastal sites in Purba Medinipur and Balasore revealed a total of 68 plant species which from 29 botanical families. The Fabaceae family emerged as the most dominant (16 species), followed by Moraceae and Arecaceae(Table 1). The dominance of Fabaceae aligns with their established ecological roles in nitrogen fixation, salinity tolerance, and soil stabilization, making them key players in disturbed and marginal ecosystems (Singh et al., 2010; Alongi, 2002).

Table 1. Dominant Plant Families in the Study Area

Family	No. of Species	Notable Features
Fabaceae	16	Nitrogen-fixing, coastal stabilizers
Moraceae	5	Large-canopy trees, shade providers
Arecaceae	4	Coconut palms, ornamental, salt-tolerant
Meliaceae	3	Timber species, shade
Rhizophoraceae	3	Core mangrove halophytes

Frequency and Habitat Preferences

Species distribution varied across three primary coastal habitats: mangrove, plantation, and transitional zones. In Balasore, mangrove-associated halophytes such as *Rhizophoramucronata* and *Avicennia marina* were dominant. In contrast, Purba Medinipur featured high frequencies of *Casuarinaequisetifolia*, a fast-growing exotic plantation species widely used in afforestation programs but known to suppress native biodiversity (Kathiresan& Bingham, 2001; Das & Bandyopadhyay, 2013). Transitional areas such as dunes

and disturbed zones were occupied by herbaceous colonizers like *Ipomoea biloba* and *Pandanusodorifer* (table 2).

Table 2. Frequency (%) of Dominant Species across Habitats

Species	Mangrove Zone	Plantation Zone	Transitional Zone	Overall Dominance
Rhizophoramucronata	84	10	0	Mangrove
Avicennia marina	80	12	6	Mangrove
Casuarinaequisetifolia	0	93	42	Plantation
Ipomoea biloba	0	20	88	Transitional
Pandanusodorifer	0	14	62	Transitional

Seasonal Variation in Species Abundance

With reference to table 3, post-monsoon surveys recorded the highest abundance of herbaceous species like *Ipomoea biloba*, favored by moist, sandy substrates typical of coastal dunes. In contrast, halophytes like *Avicennia marina* and planted species like *Casuarinaequisetifolia* remained relatively stable across seasons, suggesting tolerance to environmental fluctuations or management through replantation (Ghosh, et al., 2015; Magurran, 1988).

Table 3. Mean Seasonal Abundance (Individuals per Quadrat)

Species	Pre-Monsoon	Monsoon	Post-Monsoon
Ipomoea biloba	4.8	7.1	3.2
Casuarinaequisetifolia	5.5	6.8	6.0
Avicennia marina	4.6	4.9	5.0

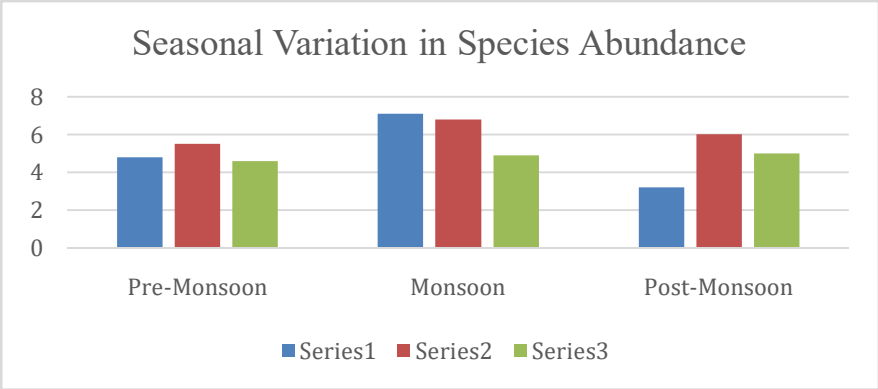

Figure 1. Seasonal Abundance Trends of Dominant Species(Line graph showing increasing trend for *Ipomoea biloba*, stability for *Casuarina* and *Avicennia*across seasons.)

Anthropogenic Influence and Land-Use Change

GIS-based land-use analysis using Sentinel-2 imagery and QGIS revealed a 50% reduction in vegetation cover in Purba Medinipur between 2017 and 2024(Figure 2). In contrast, Balasore, particularly near Talsari and Udaipur, retained more native vegetation due to less tourism and development pressure. These patterns corroborate prior findings on coastal degradation from unregulated tourism and plantation expansion (Chakraborty&Mukhopadhyay, 2019; Jensen, 2007).

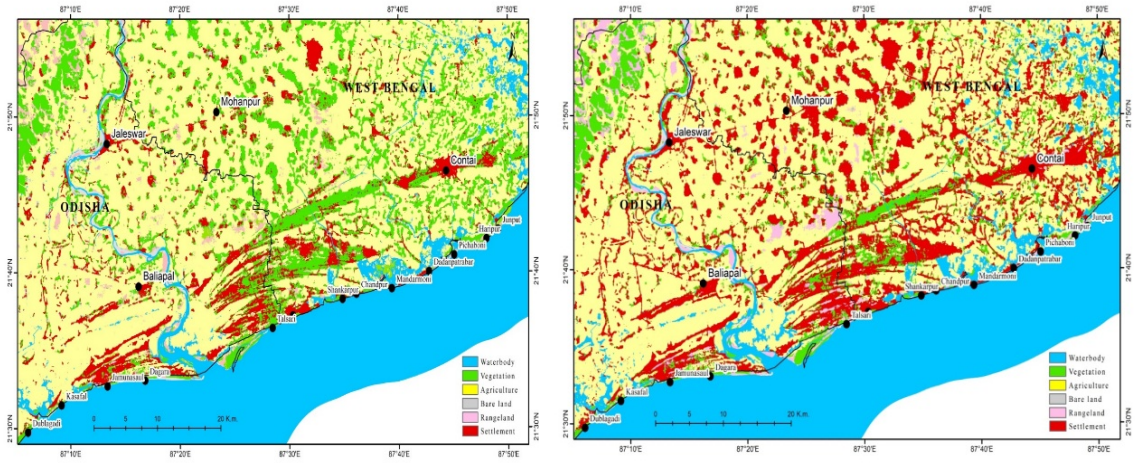

Figure 2. Land Use Change from 2017 to 2024 (left & right respectively in Study Sites;LULC Maps of Coastal Region comparing vegetative cover and built-up areas using Sentinel-2 imagery and QGIS analysis.

Table 4. Land Use Comparison Between Districts (2017–2024)

District	Vegetative Cover		Built-Up Area Increase (%)
	In 2017 (km²)	In 2024 (km²)	
Purba Medinipur	613	309	102%
Balasore	498	388	53%

Ecological Implications

The study underscores the ecological significance of Fabaceae, not only as dominant taxa but also as potential agents for coastal restoration due to their nitrogen-fixing ability and adaptability (Singh et al., 2010). However, monoculture plantations such as *Casuarinaequisetifolia* risk displacing native dune and mangrove flora, leading to habitat homogenization and lower resilience (Kathiresan& Bingham, 2001). Declining trends in native species like *Bruguieragymnorhiza*, *Ipomoea pes-caprae*, and *Pandanusodorifer* further highlight the need for ecologically sensitive land-use policies (Alongi, 2002).

Conclusions:

This c study of the coastal zones in Purba Medinipur and Balasore reveals significant variation in floristic diversity, habitat structure, and anthropogenic impact. While Balasore retains relatively intact native vegetation, Purba Medinipur faces rapid degradation due to urbanization and monoculture plantations. The dominance of Fabaceae and halophytes like *Avicennia marina* reflects ecological resilience, while the decline of native dune and mangrove species signals habitat stress. GIS-based land-use analysis underscores

the urgent need for sustainable coastal management. Restoration using native species, controlled tourism, and community-led conservation can help maintain biodiversity and ecosystem stability in these fragile regions.

References:

- Alongi, D. M. (2002). Present state and future of the world's mangrove forests. Environmental Conservation, 29(3), 331–349.
- Bagchi, M., & Bairagya, S. (2021). Concept and context of teacher education. In Teacher education: Contemporary issues, practices & prospects (Vol. 1). Redshine Publication.
- Bairagya, S. (2021). Models of teaching: Bruner and Ausubel. In Educational technology: Essentials, approaches and trends. Redshine Publication.
- Bairagya, S., Maity, N., & Maity, A. (2022). Issues and challenges in women's access to higher education in Purba and Paschim Medinipur District, West Bengal. Vidyawarta: Peer-Reviewed International Multilingual Research Journal, 47(9).
- Chakraborty, S., & Mukhopadhyay, A. (2019). Vulnerability of coastal vegetation to changing climate and sea-level rise in eastern India. Regional Environmental Change, 19(6), 1551–1566.
- Das, S., & Bandyopadhyay, S. (2013). Coastal vegetation change and human interference: A case from West Bengal. International Journal of Environmental Studies, 70(3), 392–404.
- Dutta, S., Debnath, B., & Pal, D. K. (2013). Impact of soil salinity on coastal land use in West Bengal. Journal of the Indian Society of Coastal Agricultural Research, 31(2), 54–59.
- Ghosh, S., & Bairagya, S. (2010). Attitude of secondary school teachers towards teaching profession in relation to some demographic variables. Edusearch: Journal of Educational Research, 1(1), 55–59.
- Ghosh, T., Mukhopadhyay, A., & Dasgupta, R. (2015). Coastal erosion and changing human intervention along the eastern coast of India. Natural Hazards, 75(2), 1231–1245.
- Jain, S. K., & Rao, R. R. (1977). A handbook of field and herbarium methods. Today & Tomorrow's Printers and Publishers.
- Jensen, J. R. (2007). Remote sensing of the environment: An earth resource perspective (2nd ed.). Pearson Education.
- Kala, C. P. (2005). Indigenous knowledge and conservation practices in tribal areas of Central India. Indian Journal of Traditional Knowledge, 4(3), 305–308.
- Kershaw, K. A., & Looney, J. H. H. (1985). Quantitative and dynamic ecology (3rd ed.). Edward Arnold.
- Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). Remote sensing and image interpretation (7th ed.). Wiley.
- Magurran, A. E. (1988). Ecological diversity and its measurement. Princeton University Press.
- Maity, A. (2016). Higher education in India: A study on two states. Gurukul International

Multidisciplinary Research Journal (GIMRJ), 6(2), 156.

- Maity, A. (2024). Investigating the benefits of project-based learning in science education. In New trends of teaching, learning and technology (Vol. 1314). Redshine Publication.
- Maity, A., et al. (2022). Educational problems of the scheduled caste students in Paschim Medinipur, West Bengal. Shodh Navneet, 10(8).
- Majumder, R., & Bairagya, S. (2025). Exploring teachers' perceptions on the provisions of NEP 2020 for teachers. Bharati International Journal of Multidisciplinary Research and Development, 3(3).
- Misra, R. (1968). Ecology workbook. Oxford & IBH Publishing Co. Pvt. Ltd.
- Paria, M., & Maity, A. (2022). Gender disparity in teacher education: The experience in West Bengal. International Journal of Advanced Academic Research (IJAAR), 2(10).
- Roy, S., & Bairagya, S. (2019). Conceptualisation of pedagogical content knowledge (PCK) of science from Shulman's notion to refined consensus model (RCM): A journey. Education India Journal: A Quarterly Refereed Journal of Dialogues on Education, 8(2), 55–59.
- Sanuar, S. K., & Maity, A. (2023). Prospective female teachers' attitude towards teaching profession in Paschim Medinipur District of West Bengal. Vidhyayana: An International Multidisciplinary Peer-Reviewed E-Journal, 8(SI6), 602–612.
- Sanuar, S. K., & Maity, A. (2024). Educational problems of Muslim girls' students at secondary and higher secondary school education of Paschim Medinipur District in West Bengal. American Journal of Language, Literacy and Learning in STEM Education, 2(5).
- Singh, A., Mehta, R. K., & Chauhan, P. (2010). Role of Fabaceae in dune stabilization and nitrogen cycling. Indian Journal of Ecology, 37(1), 73–77.

Citation: **Sahoo. S. K. & Gonekar. Dr. V. K..,** (2025) "Anthropogenic Pressure and Their Effects on Coastal Plant Diversity: A Study of Purba Medinipur and Balasore Coastal Areas", *Bharati International Journal of Multidisciplinary Research & Development (BIJMRD)*, Vol-3, Issue-08, August-2025.