Anthropogenic Interference on Age-Old Khoai Region (Badland Topography) Near Bolpur-Santiniketan in Birbhum District of West Bengal, India and its Impact on the Natural Environment: A Geospatial Overview

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Abstract
Every type of relief has its own beauty and natural significance to the living organisms in this world. Since the past centuries, Mankind has altered the small and neglected relief features only for commercial profits. Very few people understand their natural functioning and importance in our day-to-day lives generation after generation. Many relief features have been abolished silently only due to anthropogenic activities in the name of human welfare. Natural reliefs have always been misunderstood due to the lack of our simple thoughts. Khoai, a unique example of the remnant of vast badland topography of the district of Birbhum in West Bengal in India, can be regarded as the best example depicting nature's struggle for existence to restore its wealth under the tremendous commercial pressure from all sides. This article has emphasized how this unique and noted relief feature has been destroyed in the last two decades. Several measures have been taken to restore this unique natural asset for its scenic beauty but reality shows different results. The author has tried to focus on the probable remedies to restore this relief through geospatial techniques and applications.

Keywords: Badland Topography, Khoai, temporary market, environmental potentiality, artisan, Wild Life Sanctuary

Introduction: Topography determines the physical, social, economic, and cultural aspects of any region of this world. Every country plans its socio-economic strategies based upon the diversity of relief features and tries to harness maximum economic benefit from them. Developed nations not only assess the economic outcome of each type of topography but restore them to continue the economic progress also for the next generations. Those who fail to understand the natural diversity and significance of the topography soon lose the economic and environmental potentialities of even the badlands. Badlands are generally defined as a type of dry terrain where soft unconsolidated sedimentary rocks or poorly consolidated clay material which is prone to extensive erosion. They are characterized by steep slopes, minimal vegetation, lack of a substantial regolith, and high drainage density (Torri *et.al,* 2000). Khoai near Bolpur-Santiniketan in Birbhum district of West Bengal is one of the most tourist attractions in the tourism Map of West Bengal. The term 'Khoai' was coined by Rabindranath a century ago when he noticed its scenic beauty and natural significance. It was once the homeland of some tribes who were accustomed to its topographic character and used to behave accordingly. Nowadays, this age-old badland topography near the R. Kopai to its northwest is struggling for its existence. Modernization and urbanization in and around Bolpur-Santiniketan have commercially left their footprints. Overlooking its natural character and scenic beauty, people nearby are settling by capturing the badland areas

and trying to convert them from infertile land to commercial land. As a result, its identity is now at risk and anthropogenic interference has been altering its natural behavior. The socio-economic environment of Khoai changing tremendously and eco-friendly development is ultimately been neglected.

Objectives: For the delineation of this case study, some major objectives have been put forth to understand the major issues and their remedies. The objectives of this study are-

1. To know the physical properties of Khoai (Badland Topography) which is noted as one of the most important international tourist sites near the Bolpur-Santiniketan area in the Birbhum district of West Bengal in India.
2. To understand the spatio-temporal changes and reasons behind the degradation of this relief feature.
3. To measure the impact of anthropogenic interference through empirical methods and recommend some remedial measures.

Materials and Methods: To know the physical history along with existing geographical attributes, a detailed literature review of some notable works on the badland topography of Birbhum has been carried out. Some of the noted work like- 'Badland development in a lateritic terrain at Santiniketan, West Bengal.' by Das and Bandyopadhyay (1996), 'Assessment of Factors Affecting Ephemeral Gully Development in Badland Topography: A Case Study at Garbheta Badland (Pashchim Medinipur)' by Shit, Bhunia, Maiti (2013)**,** Final report Revised LUDCP-2025 (May 2016) by SSDA of Government of West Bengal, 'A Strategic Plan for Environment Stewardship of Khoai landscape of Santiniketan and its surroundings, West Bengal' by Mukhopadhyay (2018), 'Micro-level Morphological Analysis of Khoyai Region (Part) in Birbhum District of West Bengal' by Bhoumick and Gour (2019), 'Understanding the Morphology and Development of a Rill-Gully: An Empirical Study of Khoai Badland, West Bengal, India' by Saha, Ghosh and Pal (2020). To obtain a detailed geological background, data has been obtained from the GSI Portal of the Government of India. To delineate the physical boundary of Khoai badland topography, SOI Toposheet No. 73M/10 (open series downloaded from NRSC Portal) and LISS-III satellite images of the same along with Google Earth have been consulted thoroughly. Both Arc GIS, QGIS, and Surfer software have been applied to get the output of the tabulated and analyzed data. Microsoft Excel has been used for statistical analysis of the data obtained from primary and secondary sources. Census Reports and Government Reports have been consulted with a detailed survey along with local interviews have been carried out to obtain the historical records with special reference to social and cultural attributes of the study area.

Geographic Environment of the study area: Geologically this insitu site is a raised Pleistocene terrain with hollow
lateric nodules and allochthonous petrified woods of genera Cynometroxylon, Mylletrixylon, and Palmoxylon (Das& Bandyopadhyay, 1996). Very few parts of this badland topography have active gully erosion at present. Geospatially stretching from 23.66°N to 23.66°N, 87.64°'E to 87.64°'E, the study area covers a total area of 1110.1 hectares of typical badland topography locally known as Khoai (a term introduced by Rabindranath Tagore) is

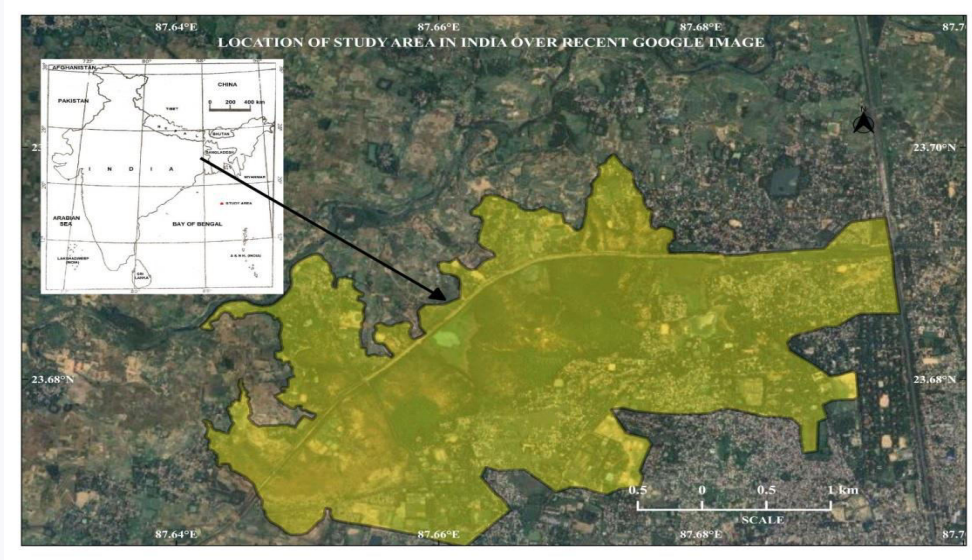

Fig. 1: Location of Study Area in India

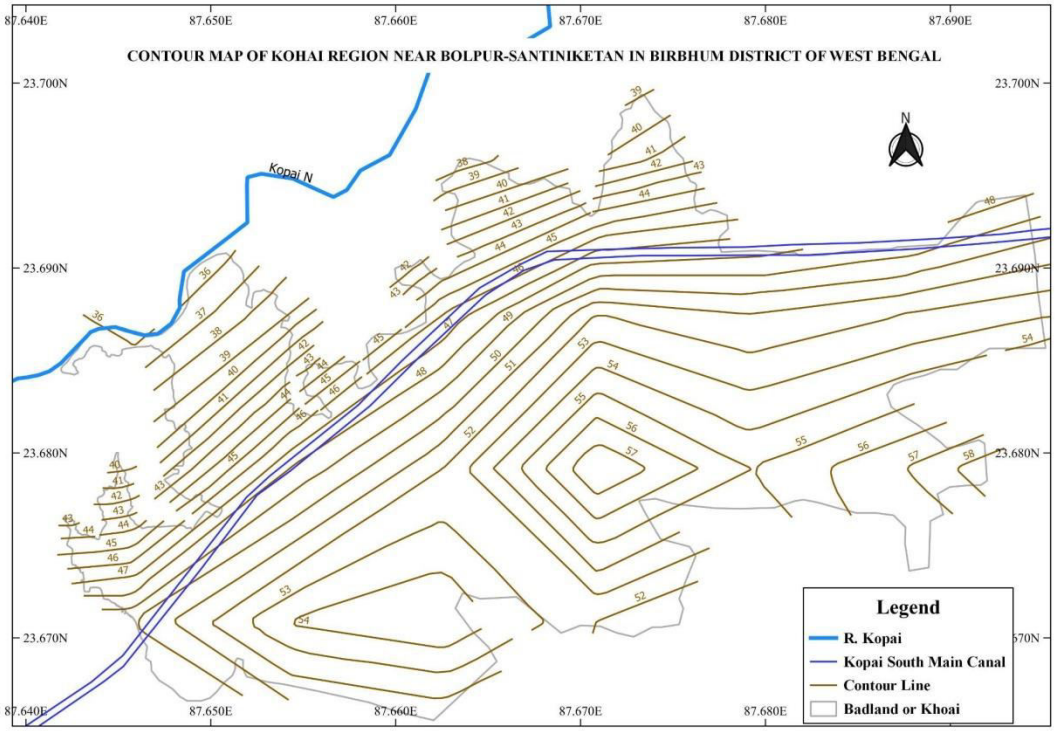

Fig. 2: Contour Lines showing the relief feature of Khoai near Bolpur-Santniketan

administratively falling under 10 villages and 1 town i.e. Sarip Bazar, Ballabhpur (to the west), Kabi Mohanpur, Goalpara, Bayradihi, Shyambati, and Madusudanpur (to the north), Taltor, Bolpur-Santiniketan to the east and Bolpur-Santiniketan, Surul, Benuria to the south. Khoai can be found up to the Prantik Township along the west of the Bolpur-Sahibganj loop railway. The perimeter of the study area is about

29.08km (Fig.1). The area has a minimum elevation of 36m above MSL in the north-westernmost part in villages Sarip Bazar and Ballabhpur and a maximum elevation of 58m around Bolpur-Santiniketan. The study area slopes towards the north-northwest along the Kopai floodplain. The eastern and south-eastern parts are relatively steeper than the rest of Khoai (Fig. 2).

The eastward flowing R.Kopai has passed to the north-western part of this area and non-latiric regions border it from the rest parts. The Kopai South Main Canal (from West to East) has passed through this area where a majority of this badland topography lies to the right of it (Fig. 1). Khoai near Bolpur-Santiniketan is also noted for tourism nowadays. The daily art and handicrafts temporary market (locally known as Khoai/Shonjhurir Haat) is held here. This part has now been well connected by a metalled road connecting Suri (the Headquarter of Birbhum district which is about 33km away via Panrui), Illambazar (18km via Sriniketan), Labpur (27km via Kankalitala-Bipratikuri) and Kolkata (161km via Bolpur-Burdwan). Thus, thousands of visitors of Bolpur-Santiniketan gather in the market area on Khoai, particularly on short vacations and holidays.

Anthropogenic interference and its impact on Khoai: As per the record of the Survey of India Toposheet (updated in 2005-06), the forested area of Khoai near Bolpur-Santiniketan covered an area of 446.71 hectares of land area during the survey in 1991-92. According to the Report published by the Revised Land Use & Development Control Plan SSPA 2025, the forest cover in Khoai was 299 hectares in 2015. During the survey and geospatial analysis, it was noticed that the forested area shrank to 242.76 hectares in 2023. Almost this entire badland topography is uncovered by grass and mainly Sonajhuri trees (Acacia Auriculiformis) are found here with very few

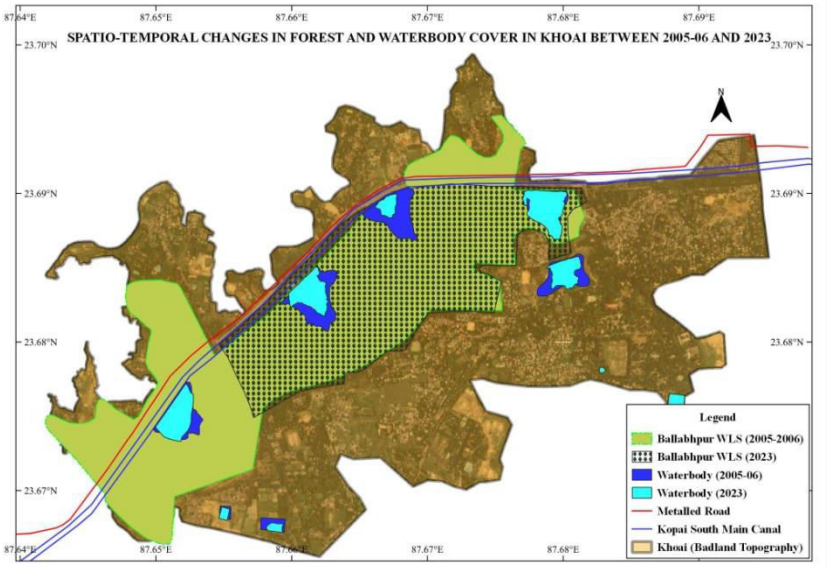

Fig. 3: Shrinking of Forest area in Khoai (from 1991-92 to 2023)

mud houses of the tribal people. The census records and district gazetteer reports reveal the facts that there was very little built-up cover in Khoai mainly dominated by the local Santhali tribes, particularly in the villages of Kabi Mohanpur and Goalpara.

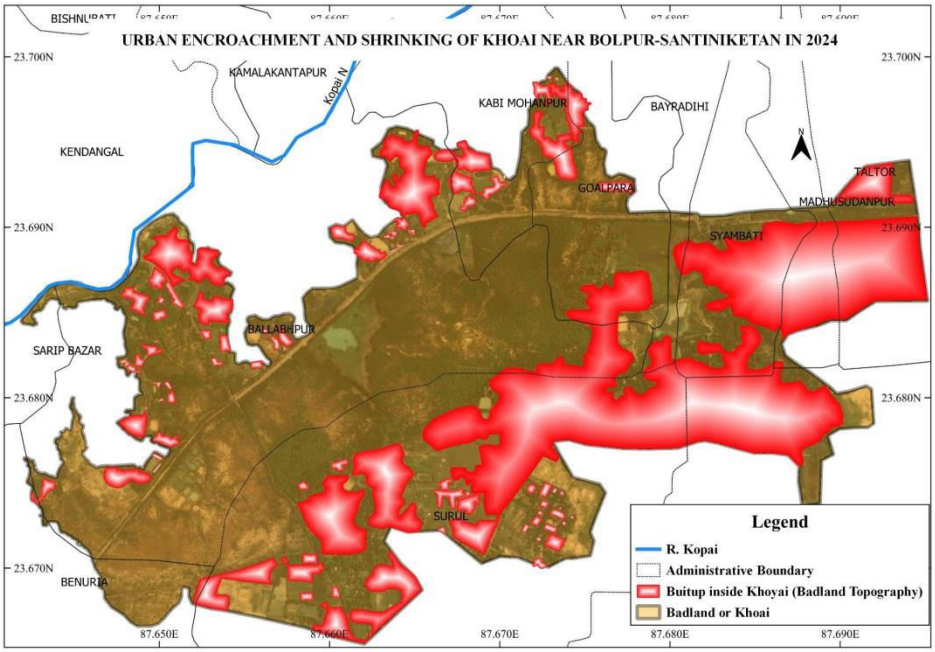

Fig. 4: Settlement Encroachment and shrinking waterbodies in Khoai from 1991-92 to 2023

However, a recent geospatial analysis of this study area found a built-up cover of about 386.31 hectares (Fig. 4). Side by side, it was also found that the area under water bodies also decreased significantly (Fig. 3). These incidents indicate that even after government rules and restrictions, settlements are being grown up steadily and acting as heat islands. The art and craft market was started through government initiation to promote tourism and develop the nearby poor artisans' (mainly related to Kantha stitch, woodwork, and leather) economic condition and it used to be held every Saturday (locally known as Shanibar er- Haat). But in due course of time, the rapid popularization of this market and demands from several artisan groups of nearby villages, the size and duration of the market increased during the last decade and are held regularly.

Nowadays, the market attracts thousands of tourists who visit this market in the scenically beautiful landscape through their private or rented cars which are ultimately becoming overburdened by the badland topography. To accommodate the tourists, heavy demands from local entrepreneurs led to the construction of several legal and illegal hotels during the last decade. Thus, modernization and the need for more and more tour comfort encouraged the administration for more and more economic return. Unfortunately, none of the hoteliers or homestay owners nor the local administration paid attention to the load capacity of Khoai which is characterized by

(1) a badland topography and very much prone to soil erosion here,

(2) gully erosion (a common phenomenon in this topography), and

(3) fragile region where continuous vehicle turnout weakens the cohesive nature of the topsoil of Khoai.

Several households are also facing drainage issues in this area. The metalled road which replaced the unmetalled tract also indirectly helps the movement of small to medium vehicles the vibration of which not only disturbs the nearby Deer Park under Ballabhpur Wild Life Sanctuary, just a few meters away to its south but produces more and more dust and pollutants in this age-old topography. So, the AQI level which is supposed to have remained below 50 two decades ago, has now exceeded the AQI level of 200 on average.

The age-old tribal and Baul cultural programs have also changed a lot during the last two decades in Khoai. In earlier times, the tribes of Kabi Mohanpur and Goalpara used to follow their traditional cultural festivals and

those were honored by the people of West Bengal. But new generation tribes, particularly female performers are now forced to sing or dance to modern songs on tour or public demand. So, not only the physical characteristics of the Khoai near is losing its prosperity, but the ground level or route of the tribal cultures are also being threatened.

Remedial measures and management issues: The Final Report Revised LUDCP-2025 indicates that more and more developmental approaches are needed to generate more and more income from Khoai-oriented eco-tourism. However, promoting more housing projects may bring economic prosperity to the villagers of Khoai-oriented badland but environmental sustainability and restoration of old landscapes must be restored immediately. Allowing housing areas over the infertile badland areas of Khoai may accelerate the high rate of soil erosion in Khoai which will ultimately shrink the limited forest cover. The continuous transportation of vehicles through the metalled road built over this badland may degrade this heritage topography to the environmentalists. Some management-level initiation can be taken in this regard, such as

(1) Only allowing housing apartments or lodges will not work in this regard. Rather, more restrictions are required for the entrance of private or public houses in the Khoai territory. The actual territory must be delineated scientifically with the assistance of geologists and other allied academicians or engineers.
(2) Non-electric vehicles must be prohibited from taking entry inside the Khoai territory. Instead, Electric vehicles may be allowed but the travel frequency also should be restricted with time slots to avoid overcrowding.
(3) The marginal territory should be bounded by government acts to avoid any kind of discrepancies in official permission for house-building-related issues. Every drainage network of already built-up areas must be invigilated from time to time to allow free runoff from the Khoai outskirts.
(4) The naked grounds of Khoai Badland must be afforested with native plants to maintain the ecological niche of the native and migratory birds coming to Ballabhpur WLS (Wild Life Sanctuary).
(5) The metalled road piercing the Khoai from west to east (Ballabhpur to Prantik) must be given guard walls or metal fences.
(6) Trespassing to Ballabhpur WLS must be controlled.
(7) Outside visitors must be given eco-friendly leaflets having rules and regulations with a ticketing system to check their overcrowding and noise pollution.
(8) Both the Bolpur Municipality and Ruppurr Gram Panchayat must have an eco-friendly approach in any developmental decisions that prioritize the restoration of Khoai.

Conclusion: Every relief feature has its own scenic beauty and ecological significance. Khoai, the physical asset of the Rarh Bengal must be treated as one of the essential relief features not only for tourism development but for the ecological balance in our surroundings also. Many countries have already developed eco-tourism and have successfully developed geocomposites that bring more income in a healthy environment. Although the Birbhum district has paid attention to the socio-cultural development of this part of West Bengal, we should restore those relief features on which that development will depend. The present status based on the study reveals the fact that the Badland Topography has been treated only as a tourist spot and a generator of income for the surrounding villages. This unscientific way of using this age-old topography is at its threshold limit of existence. Immediate restoration is required to restore this unique landscape for future generations. Otherwise, it will be extinct soon and visitors will have to find it on maps, not in reality. So, before implementing any kind of economic developmental approach in Khoai like badland topography, everyone must have a physiographic and geographic significance and importance of those areas or regions. Then only overall physical cum economic and above all human development is possible.

Bibliography:

1. Das, Kanailal & Bandyopadhyay, Sunando. (1996). Badland development in a lateritic terrain at Santiniketan, West Bengal. 1996: National Geographer, 31(1-2), pp 87–103
2. Torri, D. & Calzolari, Costanza & Rodolfi, Giuliano. (2000). Badlands in changing environments: An introduction. Preface. Catena. 40. 119-125. 10.1016/S0341-8162(00)00119-3.
3. Shit, P. K., Bhunia, G.S. and Maiti, R. (2013). Assessment of Factors Affecting Ephemeral Gully Development in Badland Topography: A Case Study at Garbheta Badland (Pashchim Medinipur). March 2013: International Journal of Geosciences, 4(2), pp 461-470
4. Revised Land Use & Development Control Plan-2025 for Sriniketan–Santiniketan Planning Area. Sriniketan – Santiniketan Development Authority (A statutory Authority under Govt. of West Bengal). Report, May, 2016
5. Mukhopadhyay, M. (2018). A Strategic Plan for Environment Stewardship of Khoai landscape of Santiniketan and its surroundings, West Bengal. 2018: Geographical Review of India, 3, pp 1-6
6. Bhoumick, B., Gour, J. (2019). Micro-level Morphological Analysis of Khoyai Region (Part) in Birbhum District of West Bengal. March 2019: International Journal of Research in Social Sciences, 9(3), pp 713-724
7. Saha, A., Ghosh, M., Pal, S.C. (2020). Understanding the Morphology and Development of a Rill-Gully: An Empirical Study of Khoai Badland, West Bengal, India. In: Shit, P., Pourghasemi, H., Bhunia, G. (eds) Gully Erosion Studies from India and Surrounding Regions. Advances in Science, Technology & Innovation. Springer, Cham.