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# GEOTOURISM MAPPING FOR SUSTAINABILITY: A BASIN ORIENTED APPROACH

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**Abstract:** Visit to geosites as geotourists constitutes a distinct subsector of natural area tourism, a specialized form of tourism concentrating on economic utilization of the geological resources under the umbrella of tourism industry. Subarnarekha basin, of India with its various hierarchies of geosites provides immense possibilities for geotourism development. Diversified topographic features, both multi-cyclic and polygenic landforms are geotourism resources of the regions. This paper is an attempt to classify the geosites of the Subarnarekha basin from geotourism mapping perspectives with wider goal of assuring sustainability in the field of geoheritage management.

**Key words:** geosites, geoheritage, geotourism, multi-cyclic, polygenic, sustainability, management

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## INTRODUCTION

The great diversity of landscapes and geological materials in association with the domain of knowledge on the evolution of earth and geological processes provides immense scope of geotourism, which could be dealt with river basin oriented approach from the standpoint of assuring sustainable development. Subarnarekha basin (latitudes 21°40′ N and 23°30′ N and longitudes 85°05′ E and 87°30′ E), which is located in the Indian state of Jharkhand, West Bengal and Odisha (Figure 1) is taken as a case study with respect to mapping of its geotourism resources using various techniques of geoinformatics. The concepts of geodiversity, geoheritage, geosites, geoconservation, geotourism and geoparks are found closely related and have significantly evolved in the last decade with the understanding that if the geoheritage sites are preserved, the geodiversity will be sustained (Wang et al., 2015). For conserving geoheritages, geotourism has been evolved as a policy instrument worldwide. Sectoral linkage is vital in this context in order to achieve inclusive development in the newly emerging tourism sub-field named geotourism. Tourism is actually an umbrella industry incorporating

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various sectors like transport, food and beverages, construction etc., linkages among which not only makes tourism the backbone of destination economy but also assures their individual growths. Such overall advancement of various sectors within the umbrella of geotourism is referred to as inclusive from conceptual standpoint.

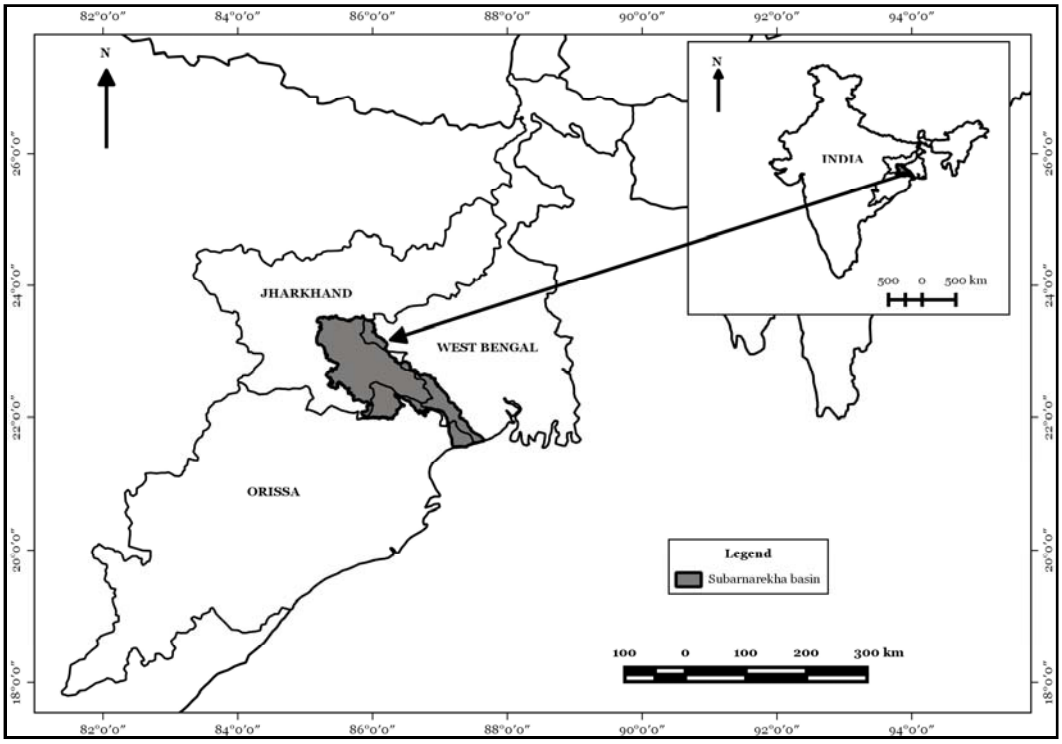


**Figure 1**. Location map of the study area (Source: Prepared by authors, 2017)

Geotourism may be defined as a specialized form of tourism centring the geosites (Newsome & Dowling, 2006). To be very specific, geosite as a landform represents the particular aspects of relief being determined by the morphogenetic processes and the geographic sublayer (Ilieş & Josan, 2009). The geosites include macro, meso and micro landforms available on the landscape attracting the attention due to their peculiarities and recreational uses. Being a mosaic of geological entities of special scientific importance, rarity or beauty, these features are representative of the region's geological history and of the events and processes that formed it (Zouros, 2007). They are either exposed on the earth surface naturally or appear due to cuttings or quarrying of the surface for the fulfillment of economic needs like road construction or mineral extraction. Such geosites are also called geomorphosites consisting of two components: a landform and a scientific value (Neches, 2013). Geotourism adds the third component i.e. a recreational value of the landscape.

Geomorphosites worldwide like the waterfalls, residual hills, gorges etc. possess not only an immense scientific value but also gain a considerably high economic value in terms of tourism return. Such return is manifested in the form of percolation of money from visitors to the local economy. Geotourism will be special relevance in such natural places where geology and geomorphology are the main attractions (Hose, 2000). In view of huge potentiality of geotourism development in Subarnarekha basin, it is essential to

assure sustainability from the initial stage of developing tourism infrastructure and superstructure. Environmental impact of the above-mentioned activities may cross the threshold limits of tolerance, if not regulated appropriately from the beginning. So, special care of these valuable geomorphosites are really required. The 'Do's' and 'Don't' of sustainable tourism should apply to geotourism, because these valuable geomorphsites must be preserved so that future generations will also utilize them (Haj Aliloo & Nekooei Sadr, 2011). However, in the management of geomorphosites, the research questions arise on the principles of identification of landforms to be protected and conserved (Bini, 2009). As it is not possible to conserve all geomorphosites, concentration should be on to conserve those geoheritages, which are rare and unique in terms of aesthetics and significance while interpreting the evolution of landscapes. Conservation of such geomorphosites can make a significant contribution to regional and environmental education (Bruno & Perrotta, 2011). The aspects of regional education are particularly important because geomorphosites are the outstanding expressions of regional geomorphologies, essential for understanding the evolution of the landscape. With the decay of those valuable geomorphosites, there is simultaneous loss of information about the earth's history and at the same time, it would result into enormous deprivation to future generations from geotourism perspectives. Under such circumstance, dynamic mapping of geomorphosites with reference to their vulnerability status is very important.

Due to lack of knowledge of geomorphological processes and formations as well as the diverse value of geomorphosites, appropriate educational measures are also urgently required for proper conservation and management of these natural landscapes (Giusti, 2010). A better understanding of the earth with reference to its geological attraction is the goal of geotourism which arises from the motivation of enjoying unique features amidst of landscape (Adriansyah et al., 2015). Human resource development, such as the trained guide force is vital involving local youth in this context. The importance and significance of geosites could also be imparted in the host society because of them, while the guests are naturally keen in understanding the geomorphological treasures. An increased awareness of general public arising from a better understanding of geomorphosites is necessary for geoconservation. The high degree of damage of attractive geomorphosites worldwide could be reduced by enhancing visitor awareness (Megerle, 2012). It may incorporate in situ notification as well as awareness campaign involving media. The knowledge of the complex geomorphosites should be made available very widely, especially to all in regional and local communities, rather than remaining within the preserve of scientists only (Bruno & Perrotta, 2011). Geotourism therefore may be initiated in any region as educational tourism so that it can be one of the most powerful tools for protecting the environment (Hassan et al., 2012). Geotourism mapping may contribute to the field of sustainable tourism by primarily focusing on the earth's geological features in such a way that fosters environment and cultural understandings and appreciation, simultaneously raising the awareness on conservation requirements. In case of Subarnarekha basin, the spectacular ranges and riverine tracts attract the visitors at the landscape scale. Meso landforms as gorges and residual hills and the impressive rock structures as micro landforms together develop geotourism attractions of Subarnarekha basin. The most attractive among the geosites in the region is however the series of waterfalls, concentrated particularly in the northwestern part of the basin. The famous waterfalls like Hundru, Johna, Dassam etc. are attracting visitors all over the year. Geotourism in India is addressed so far in administrative district level or concentrating on individual sites but basin oriented study is rare which is none but the research gap. In functional contexts, geological aspect of natural history is often not appreciated (Dahl et al., 2011). The geotourism research database and literature are also scant because of the lack of

qualitative and quantitative studies (Allan et al., 2015). The purpose of the study is to explore the geosites of a river basin for appreciation and learning in order to promote a holistic approach instead of considering administrative units which divides a natural region into parts. From the educational perspective of geotourism, a river basin is taken as the study area for better interpretation of geomorphic processes and human activities centring the geosites. The rivers are not only the lifeline of the concerned basins but also the mother of the landscape. The Sustainable Development Goals (SDGs), i.e. the 2030 Agenda for Sustainable Development is a set of seventeen goals (UNWTO, 2016) to be taken into account for basin development through project initiatives concerning geotourism from the following perspectives:

a) The goal number 1 is aiming to eliminate poverty in all its forms everywhere. The role of geotourism in poverty alleviation is already found remarkable in case of rural area of southern Africa (Reimold et al., 2006). The multiplier effects of geotourism in terms of income and employment serve this goal. It is generally accepted as a thumb rule in admiring the advantages of geotourism that the attractive geomorphosites are usually located in remote backward areas. The fulfillment of goal number from 2 to 5 which are associated with eradication of hunger and achieving health, education status and gender empowerment may be subsequent progress in such backward areas with geotourism development.

b) The goal number 6 to 9 are dedicated to water, sanitation, energy, employment and resilient infrastructure development for which geotourism promotion may play a critical role.

c) Geotourism generates revenues, particularly foreign exchange for backward areas, vital for achieving goal number 10, i.e. reducing inequality within and among countries. A successfully developed geotourism site exerts such a positive influence that an inclusive safe, resilient and sustainable settlement can grow in its vicinity fulfilling goal number 11 in serving the purpose to accommodate the international visitors also. Ensuring sustainable consumption and production patterns (goal number 12) is a process supported by continuous assessment of geotourism project outcomes.

d) It is out of the interest of the beneficiaries obtaining income and employment from geotourism, the host communities of geotourism areas will be voluntarily engaged to combat climate change as well as to adopt terrestrial ecosystem restoration campaigns which help to achieve goal number 13 and 15 respectively. The subsequent goals like peaceful and inclusive societies (goal 16) or global partnership for sustainable development (goal 17) are also attached to the monitoring of performance level in site management. From the perspectives of attaining success in the management of natural heritages, the concept of geoconservation has further strengthened the sustainable model of geotourism (Rodrigues et al., 2011).

When a geosite is promoted for geotourism purposes, it may become a 'geopark' if sustainable management and planning have been undertaken for its designing (Raharimahefa, 2012). Upper Subarnarekha basin has a number of sites having potentiality to be converted into geoparks. The followings are the values for which a network of geoparks is appreciated in geotourism planning:

-Earth heritage values since geosites, which may vary in size from a square meter to thousands of square kilometers, are undoubtedly appraised as outstanding landscapes.

-Aesthetic values added based on extent of beauties of concerned geoheritages.

-Ecological values as the landscape supports its natural ecosystem otherwise become extinct.

-Educational and scientific values in understanding the earth science through appreciation and learning.

-Economic values since geotourism in geoparks earn income, thereby appreciated for achieving community empowerment as well as betterment of living conditions.

Recognizing such cross sectional nature of geotourism, the following objectives have been undertaken for the present study:

1. Identification and classification of major geoheritages of Subarnarekha basin.
2. Zonation and mapping of geosites of Subarnarekha basin from the perspective of geotourism.
3. Evaluate the scope of introducing additional recreational measures to make geosites much more attractive.

Tourism maps available are mostly based on administrative or political boundaries. Appropriate mapping representing landscape in different levels is vital to satisfy a geotourist for which basin oriented approach is to be advocated. A geotourists' map may be defined as a map that is used to communicate with a public of non-specialist and that visualizes geoscientific information as well as tourist information (Regolini-Bissig, 2010). It is essential to create attractive and efficient maps, which may serve for the purpose of geoconservation and education imparting to geotourists (Serrano & González Trueba, 2011). The purpose of the study is to address the research gap of sustainability studies on the spatial context for which Subarnarekha basin, a backward area well endowed with valuable geotourism resources is taken into consideration.

## MATERIALS AND METHODS

A Geographical Information System (GIS) approach is undertaken for conducting the present study. The Subarnarekha basin, which is selected as study area with its versatile geotourism resources, is digitally demarcated following the boundary demarcated by renowned Indian geomorphologist Prof. S. C. Mukhopadhyay in his thesis entitled "Geomorphology of the Subarnarekha Basin" (1980). The geomorphic features of the basin are vectorized and a number of layers for each and every geosites have been prepared for mapping and analysis purpose. For representing the macro landforms in landscape level, Digital Elevation Model (DEM) has been taken into account (Figure 2) to fulfill the prime objective of identifying the riverine tracts and the ranges for geotourism purpose. Extensive survey has been conducted with Global Positioning System (GPS) for monitoring anthropogenic changes of the geosites in the region as well as for studying their sustainability status. The recreational use of the geomorphosites is the main concern and the perception study involving local people and the tourists have also been made in this context.

The techtonic history and multi-cyclic as well as polygenic nature of landform development of Subarnarekha basin is so unique that this particular basin is found conducive for mapping of its geotourism resources. The unequal uplifts or tilts in the different parts of the basin have caused the developments of striking differences in the topographic expressions within the basin (Saha, 2015). The geography of the Subarnarekha basin incorporates undulating plateaus, uplands consisting of gorges and waterfalls with exposed rocks of granite, gneiss, pegamatite and also some flat plains with deposits of red and laterite soil (Gupta & Mitra, 2004). The complexities of geomorphological processes operated on the Subarnarekha basin is manifested from various evidences of erosional, structural or geomorphic surfaces contributing to geomorphosites. Escarpments, gorges, lateritic-capped plateaus, waterfalls, superimposed drainage, badlands, residual hills and some other topographical expressions are among its valuable geotourism resources subjected to multilayered mapping. Mapping has been done in this study separately for the waterfalls, residual hills and gorges in GIS environment to serve the purpose of identification and classification of most outstanding geoheritages. Further, their zonation is studied with the application of techniques like Nearest neighbour analysis and overlay under the GIS

domain. The feasibility of introduction of a number of recreational activities involving the geosites have also been highlighted in consideration with their economic and environmental viabilities as revealed from the primary surveys.

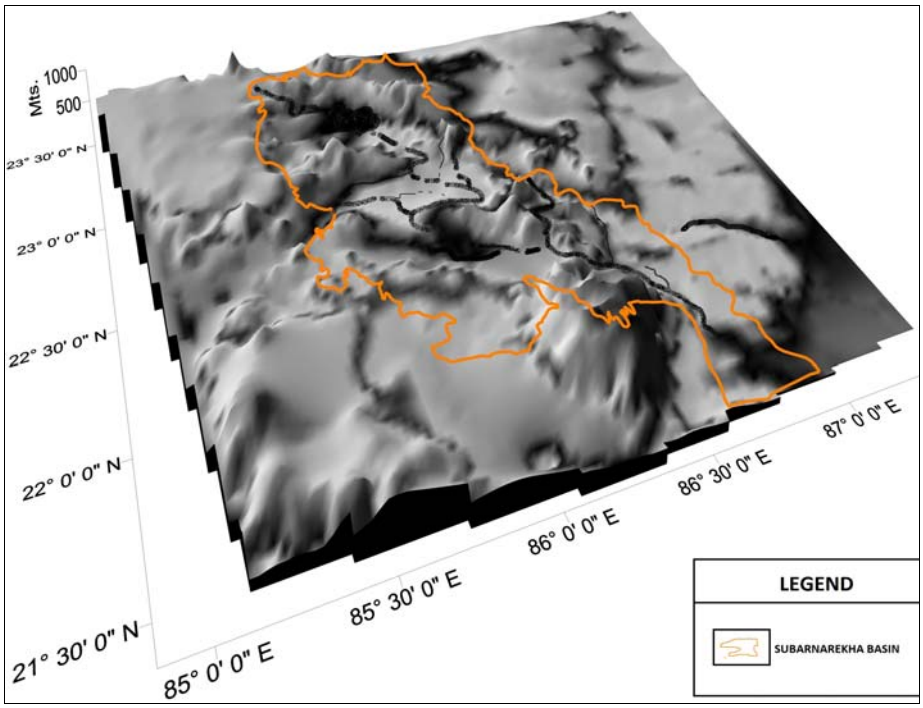


**Figure 2**. Macro landscape represented by DEM (Source: Prepared by authors, 2017)

## RESULTS AND DISCUSSIONS

The geomorphic history of the Subarnarekha basin is associated largely with regional uplift in late Tertiary period accompanied with warping or faulting which results into a number of attractive sites involving waterfalls and gorges. As the Himalayas experienced three major uplifts during Oligocene, middle-Miocene and Pleistocene so the Subarnarekha basin a part of the Chota Nagpur Plateau, bears the evidences of such three upheavals (Mukhopadhyay, 1980). The late-Tertiary uplift was in the form of a block movement with sharp warping resulting into conspicuous landscape diversities although the basin area is originally a part of Precambrian metamorphic terrain. The Quaternary and Recent ornamentation on the initial basement actually transforms the Subarnarekha basin as a geotourism paradise. It is a polycyclic area, which presents an attractive landscape evolving out of the spatial erosional processes with structural, topographic, geotectonic and lithological characteristics, being subject matter of educational tourism with geological and geomorphological base. Among the geosites available in Subarnarekha basin as revealed from the tourist perception survey, waterfalls ranks first. These waterfalls are the result of the breaks in the thalwegs of the river Subarnarekha as well as its tributaries flowing over the concerned erosion surfaces and particularly the scraps manifesting a number of knick points related to the history of late Tertiary and Pleistocene uplifts. A number of waterfalls like Hundru, Jonha, Hirni actually represent the line of block uplift of the late Tertiary period. The following waterfalls (Figure 3) of Subarnarekha basin are very popular:

**1) Hundru falls:** Hundru falls is the most famous and picturesque waterfall, created on the course of the Subarnarekha river, which falls from a height of 98 m. The fall is about 45 km. away from Ranchi town on Ranchi-Purulia road. A beautiful plunge-pool is created at the base of the falls, resulting from the erosion by the constantly falling of water. The diverse rocky formation around the falls also adds additional attraction to the geotourists. It is also known as one of the most popular trekking destinations in the region and a spot for recreational bathing.

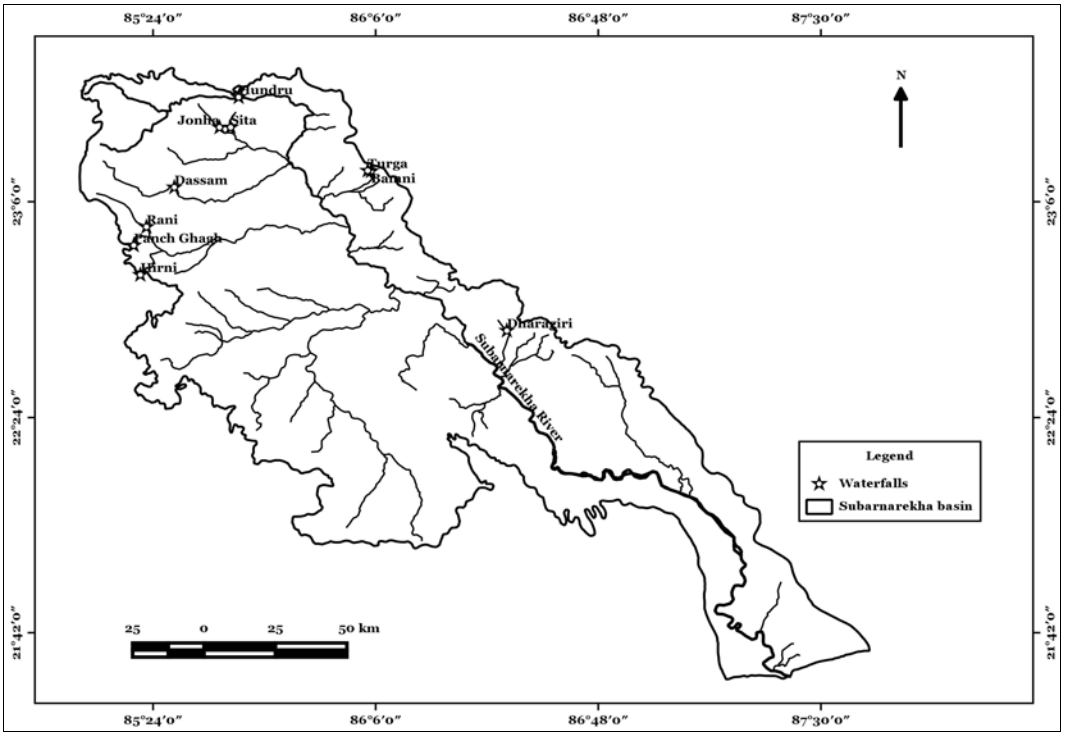


**Figure 3**. Regional concentration of Waterfalls in Subarnarekha basin (Source: Prepared by authors, 2017)

**2) Johna falls:** Johna falls named after the nearest village Johna, 40 km away from Ranchi is an example of hanging valley falls with a height of 43 m where the Gunga river hangs over its master stream called Raru river. It is also known as Gautam Dhara because it is believed that Lard Buddha once bathed here.

**3) Dassam falls:** Dassam falls is about 40 km away from Ranchi on Tata road near Taimara village of Jharkhand. It is a natural cascade across the Kanchi river, a tributary of Subarnarekha river. It falls from a height of 44m. The falls is surrounded by gorgeous landscape.

**4) Hirni falls:** Hirni falls created on the course of the Ramgarth river plunges down 37 metres in a broad torrent. This beautiful scenic falls is located in West Singhbhum on Ranchi-Chaibasa road, 75 km away from Ranchi.

**5) Panch Ghagh falls:** Panch Ghagh is the collective name for a group of five waterfalls formed in a row due to breaking up of the Banai river falls from a good height. It is situated on Ranch-Chakradharpur about 6 km from Khunti.

Apart from these popular waterfalls there are other falls based on which a waterfalls tourism circuit can be developed. Circuit planning on geotourism resources

largely depends on their locational status. In order to evaluate the locational status of the waterfalls from geotourism perspectives, a Nearest neighbor analysis has been attempted. The result (0.806) computed with the help of QGIS software clearly indicates their regional concentration, that is very much suitable for separate waterfall circuit development. The spectacular other geomorphosites such as residual hills have brought about great diversity in the wide undulating plains at different altitudes. Geomorphosites are considered as geotourism resources not only because of their intrinsic value (e.g. aesthetic, scientific) but also due to their extrinsic values like ecological, economical, historical or cultural (Gavrila et al., 2011). Being originated through multifaceted past and present geomorphological processes, these residual hills of polycyclic landscape are locally known as 'buru' or 'dungri' having a number of distinct breaks in their slopes. A number of 'dungris' are made up of large boulders exhibiting the form of dome-on-dome residuals (Pugh, 1967). They are the result of unequal rate of weathering and erosion of softer rocks such as mica-schist and phyllites and harder rocks such as granophyres, quartzites and chlorite schists etc (Mukhopadhyay, 1980). These residuals hills are mostly spread in the northern and eastern portions of the Subarnarekha basin illustrating the expression of the geological structure and characters of these rocks in the formation of an erosional landscape. Lithology is of dominant importance in its genesis as exhibited in the formation of deeply incised valleys and picturesque landscapes over which the residual hills are scattered.

The important residual hills of the study area, which are already attracting the visitors, include Ajodhya hills, Ranchi hills, Bhoram hills, Tagore hills, Dalma hills, Raisindri hills and Lota pahar. The erosion surfaces found are warped and much dissected resulting from rejuvenation of the drainage systems consistent with uplift under fluvial cycle of erosion. Such a great number of residual hills with picturesque appearances represent the uniqueness and beauty of the Subarnarekha basin. Most of the monadnocks are conical shaped but due to lateritic capping, a number of flat-topped 'burus' are also found. The morphological features (shape, size, slope angles, nature of peaks and altitude) of these residual hills are deeply related to their potentialities on geotourism development. There are numerous opportunities for developing rock climbing, paragliding, hiking, ropeways etc. on specific sites, which can attract visitors especially inclined to adventure tourism. Transformation of them as geotourists by imparting scientific knowledge and interests for understanding the landscape ecology is the challenge, which in the long run may fulfill the objective of geoconservation.

Gorges represent one of the most attractive geotourism resources of the study area. Gorges impresses through their extremely diverse morphology, narrow cross section, the spectacular steep slopes, level difference from the valley thalweg etc. Gorges are often the result of erosion by antecedent rivers. The word gorge means a narrow passage, with precipitous, rocky sides, enclosed among the mountains, smaller than a canyon and more steep-sided than a ravine (Peyrowan & Jafari Ardekani, 2014). In the geographical layout of large gorges, the roles of structural control by large-scale regional joints and fault systems have been found significant (Scheidegger, 1994). They are resulting from any of the following geomorphic events (Goudie, 2004):

a. Incision of a river against an uplifting landmass
b. The superimposition of a channel across resistant rock
c. The outburst of floodwaters across a landscape
d. The headward retreat of a knick point or waterfall

An antecedent river can erode its bed rapid enough through valley incision to maintain its present course against the rising landmass. As long as the uplifting continues, the river constantly deepens its valley through active downcutting. In this way,

the river develops very deep and narrow gorges across the uplifted land as found in Dalma area. A number of gorges including Barabinda, Ghoralang, Manikui, Kandraberia are the outcome of such geomorphic process (Figure 4).

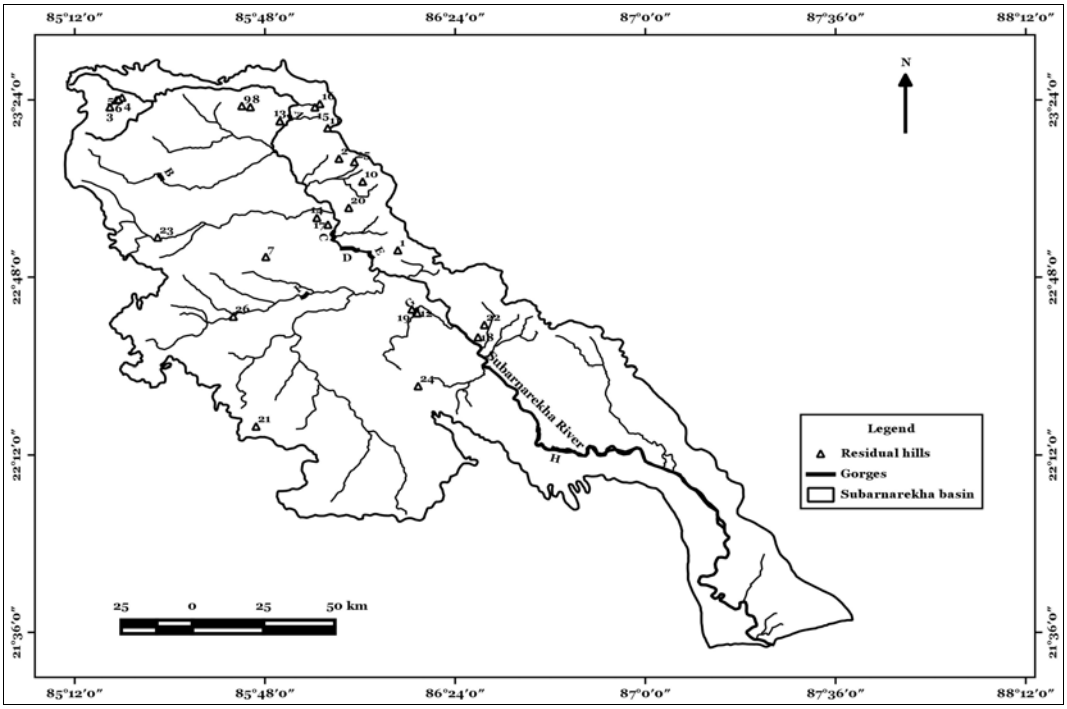


**Figure 4**. Residual hills and Gorges as geotourism resources (Source: Prepared by authors, 2017)

**List of Residual hills** - 1.Dalma hill 2.Ajodhya hill 3.Ranchi hill 4.Bhoram hill 5.Morabadi hill 6.Tagore hill 7.Raisindri pahar 8.Lota pahar 9.Holong pahar 10.Pakhi hill 11. Ashra hill 12.Rangamati hill 13.Kocho hill 14.Jamda buru 15.Sikra hill 16.Kopla hill 17.Barabinda hill 18.Phul Dungri 19.Narwa hill 20. Anda Dungri 21. Bicha Buru 22. Burudih hill 23. Marangburu 24. Turliga Parbat 25. Red hill 26. Lukud Buru

**Name of Gorges** - A. Silli gorge B. Pansakam gorge C. Barabinda gorge D. Manikui gorge E. Kandarberia gorge F. Ghoralang gorge G. Rangamati gorge H. Jamsola gorge.

The steep and narrow gorges developed by the Subarnarekha river are manifestation of tectonic upliftment (Mukhopadhyay, 1980). Being part of geological and geomorphological heritages, the presence of waterfalls initiates enormous geotourism potentials, which not only comes from their beauties but also from the pattern of the exposure of rocks (Adriansyah et al., 2015). The headward retreat resulting the recession of waterfalls forms the Hundru ghagh gorge (Subarnarekha river), the gorge below Jonha falls (Raru river) and the gorge below Dassam fall (Kanchi river) which are very attractive geomorphosites from geotourism context (Singh, 2006).

For the actual development of geotourism, it is essential to offer a number of additional options that visitors can choose from a variety of geotourism-based products (Lima et al., 2013). The spectacular ranges, particularly the Dalma ranges have extensive geotourism potentials. The individual hills and hillocks are the sites of alternative tourism planning, possible with the introduction of one or more of the following recreational activities:

**1. Airplane Over flight:** If introduced for the zone after viability assessments, the airplane over flight may become popular because of the beauty of the natural landscape, consisting of the escarpments and the mighty river.

**2. Paragliding:** A number of suitable paragliding sites can also be identified with extensive surveys aiming to secure the safety of the consumers. After making EIA (Environmental Impact Assessment) on the proposed projects, necessary security measures should also be adopted.

**3. Ropeway:** Ropeways connecting the hills are essential to popularize geotourism in the region. Most of the hilltops are gifted with religious shrines and the ropeway connectivity to reach such shrines may serve both pilgrimage and tourism simultaneously. Ropeway infrastructure needs huge investment. The fund diversion for ropeway construction would be economically viable if pilgrimage tourism and geotourism advance hand in hand in the study area.

**4. Rock Climbing:** Rock climbing is becoming increasingly popular for the youths of new generation. The selection of practical field sites for learning rock climbing is vital and there are several sites in Subarnarekha basin, which are already designated as ideal in this context by the experts practicing in this field.

Trekking along the river from any point of its lower course to discover its source is among other potential geotourism activities in the region. Canyoning can be introduced as a seasonal adventure tourism activity on selected parts of the river. Angling is another recreational option, very much suitable in some of the locations on the river. It is noteworthy to mention that geotourism has common benefits for local people of the area by improving their economy (Akbari & Moradpoor, 2014). Value additions to the geotourism landscape with utilization of further mapping options, e.g. thematic maps on individual resource and facilities are essential in this context.

## CONCLUSIONS

The great diversity of landscapes provides immense scope of geotourism promotion in Subarnarekha basin. Geotourism is like an interactive industry, where every component needs to go hand in hand in order to encourage conservation of geomorphosites and also promote recreational activities for the general public (Swarna et al., 2013). Economically Subarnarekha basin is a backward area and the common people residing in the region are suffering from extreme poverty. Some parts of the region have also earned the bad name as disturbed area due to Communism influenced extremist activities. It is alleged that poverty has driven the tribal people to join with the extremists. Tourism can contribute positively in the economy of the region by its multiplier effects on income and employment. The efforts in this context have already been made through promoting nature tourism, wildlife tourism and cultural tourism by governmental and non-governmental agencies, which are found partly successful in some isolated pockets. It is noteworthy to mention that in many developing countries where millions of people are still living in poverty, governments are directed to integrate sustainability as a new paradigm for development aiming to poverty eradication.

Geotourism is a relatively new concept to be implemented, which probably has the maximum potentialities in the context due to availability of a number of geosites in different scales throughout a region like the study area concerned. Since the conservation objects are very much fragile, a high level of maintenances is required for two main reasons:

a) Preservation of the value of geoheritages

b) To cope with the threats increasing with human activities

A model approach is however prescribed in the transition from the geomorphosite evaluation to the geotourism interpretation to achieve sustainable development of

geotourism (Neches, 2013). Initially understanding geology and geomorphology was key (Hose, 2006) which has further extended to landscape interpretation approach (Newsome & Dowling, 2010). Focus on community involvement (Boley, et al., 2011) relates it with sustainable development contributing to the alleviation of poverty in geotourism areas (Reimold et al., 2006). The space in geotourism context set up a working landscape, where nature and people come together for geoconservation perspective (Yolal, 2012). Collaboration between governmental agencies and private sector is advocated for achieving sustainability in geotourism development (Adriansyah et al., 2015). It ensures the better addressing of vulnerability issues since geomorphological processes and human activities are leading to geomorphosites degradation (Irimus et al., 2011). Analysis of carrying capacity for each and every geosites, optimization of environmentally friendly tourism infrastructure, effective management with a thrust on high maintenance and designing intense collaboration with local communities to ensure geoconservation are necessary to achieve this goal. Long-term sustainable tourism is only possible through intensive actions and collaboration between the stakeholders to minimize the conflict caused by different interests in order to gain support for responsible tourism (Ghanem & Saad, 2015). Mapping is pre-requisite for any of such discussions in order to assess the existing resource base and their potentialities with reference to different levels of planning. With the subsequent monitoring of the promotional activities concerning geotourism from its initial phase, the case study reveals how a GIS based basin oriented mapping approach may contribute to a paradigm shift in managing geosites under the umbrella of sustainable tourism.

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