

Chapter 19

Inventory of Landforms and Geomorphosites for the Promotion of Geotourism in South Andaman Island, India



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19.1 Introduction

The landforms of the Andaman and Nicobar Islands are very much attractive to the visitors for their geomorphological significances and scenic beauty along the Andaman Sea and Bay of Bengal. South Andaman is an administrative unit of district in which the main Andaman ridges and valleys and islands of the Andaman Sea and the Bay of Bengal are isolated from the main land area. So far, 39 islands of the Andaman Group have allowed visitors to explore their natural beauty and geomorphological features. Every year about 4.5 lakh tourists visit the island destination sites to explore the multiple recreational activities. The south Andaman Island system comprises island-fringed coral reefs, shore platform geomorphology, shore cliff features of geological and geomorphological significances, island platform, terraces with vegetation cover, hill ridges and highland surfaces, valley flats topography, limestone caves and other karstic features, waterfalls, and short flowing streams with their riparian environment (Paul, 1998, 2005, Paul et al., 2017, 2018a, b, 2021; Acharya et al., 2022; Gee, 1927).

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The present study attempted to explore the specific coastal features and island interior features of geomorphological significances for the promotion of tourism attractions and activities. Currently the geomorphological features and their natural heritage significance as well as the environmental values of the landscapes are accepted by the visitors and tourism department for promotion of destination sites in the island systems environment for making awareness among the tourists to understand the significance of the oceanic island environment. There are many attractive geomorphosites in South Andaman district recognised by visitors and selective eco-tourists. They are grouped as (i) coral reef tourism, (ii) shoreline geomorphological features (e.g., sea beaches, natural arch, sea caves, karstic tours, shore platform mangroves, vertical sea cliffs, beach rock features, etc.), and (iii) interior island features (e.g., waterfalls, limestone caves, mangrove creeks, ever-green forests, and hills and terraces, etc.). These geomorphic sites are well connected with Port Blair by roads and waterways with different forms of nature tourism, adventure tourism, and with developed recreational infrastructures.

Multiple processes like geological structures, rate of weathering activities, tectonics setup, marine processes tidal influences, significant wave height, and past sea level changes are the major factors for shaping and reshaping the landscapes in the tropical island environment. Such dynamic landform features produced by natural processes with vegetation covers and marine environment have generated their heritage value, environmental value, and scenic beauty for creating attractions to the visitors, tourists, excursionists, and others. Currently the areas of geomorphological significances are the major destination of the tourist from abroad. The study also highlighted the assessment of geomorphological values of the landscapes in South Andaman districts.

19.2 Materials and Method of the Study

South Andaman district is extended from Humphrey Strait (northern boundary) to extreme south end of Little Andaman (10° Channel) island, and the region is fringed by the Andaman Sea towards east and Bay of Bengal towards west (Fig. 19.1). The area is characterised by topographic diversities of longitudinal ridges and valleys, coastal embayments, islands, and fringing coral reefs. There are a number of short flowing streams across the coastal landscapes and along the main island interior landforms as longitudinal streams. The majority of the river system longitudinal profiles show the presence of two to three knick points along their courses. However, the island interior longitudinal streams have a relatively wider valley flat surface. The elevation of the South Andaman district ranges from 20 to 365 m (Mount Harriet) in height with significant relief features (345 m).

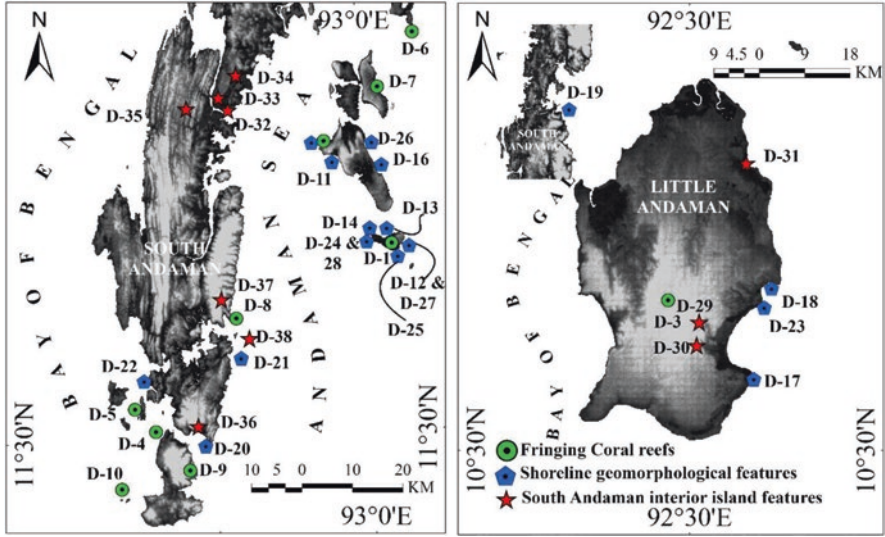


Fig. 19.1 Location of the destination for geomorphosites in South Andaman district, India

The study is conducted on the basis of survey of India (SOI) toposheets, shuttle radar topography mission (SRTM) digital elevation model (DEM), Google Earth Image, and repeated field survey during the research work in South Andaman (2016–2018). The geomorphosites have been explored and identified considering with their natural heritage landscape significances, and assigning the weightage for ranking the scientific values (Sce), ecological values (Eco), cultural values (Cult), and aesthetic-landscape (Est) values to estimate final geomorphic values of each destination site in the present study (Codrea et al., 2022; Kubalíková, & Kirchner, 2016). The entire geomorphosites are grouped into three different categories of geomorphological significances such as; (i) coral fringe coast (10 sites), (ii) shore fringe geomorphic features (12 beaches, 6 other features), and (iii) island interior landscapes (10 sites) in south Andaman district. Each criterion has been assigned a weight according to its importance for the South Andaman geomorphosites within this study. They have assigned the geomorphic values between 0 and 10, where 0 is the lowest value and 10 is the highest. Further, the integrated score for estimated values under four criteria is achieved in the study and a total of 38 destination sites are ranked as Rank-I, Rank-II, Rank-III, and Rank-IV for final geomorphic value. A framework of geomorphosite databases is prepared in the present study with their geomorphological values (V_{GEO}) following Eq. 19.1:

$$V_{GEO} = (Sce \times 0.01) + (Eco \times 0.30) + (Cult \times 0.15) + (Est \times 0.45) / 4 \quad (19.1)$$

19.3 Results and Discussion

19.3.1 Prospects of Tourism in South Andaman

Andaman Islands are considered to be a visitor's paradise because of several natural resources. During the early centuries the situation of the island was grim from a tourist's perspective. Compared to its actual potential, the development of the tourism industry in the island was disheartening. The South Andaman Island was isolated till the early twentieth century, although after the tsunami in December 2004 it gained popularity as a tourist destination. The island has a locational advantage due to the proximity of international maritime routes and hence has a great potential to attract tourists both from domestic and foreign locations. The island is situated close to South East Asian countries. This island is considered to be located in such an advantageous position wherein many of the international trade and tourism routes get initiated and terminated. Thus, the island has immense potential for tourism. The island offers three main categories of attractions for the tourists (Fig. 19.2b–g).

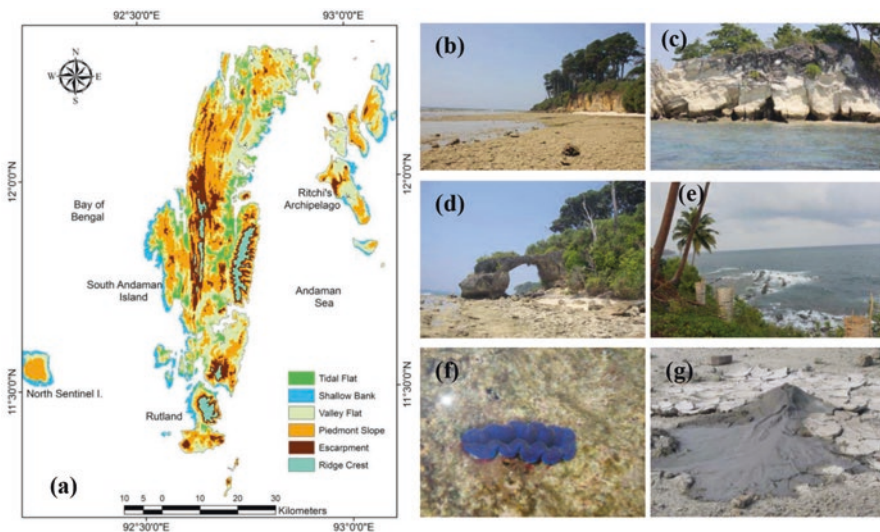


Fig. 19.2 (a) Terrain classification depicted the physiographic units of the South Andaman and the attractive geomorphosites of the South Andaman; (b) Cliff at Laxmanpur beach of Neil Island; (c) Notches and sea caves at the base of limestone cliff at elephant beach of the Havelock Island; (d) Natural arch at Laxmanpur-II beach at Neil Island; (e) Ophiolitic exposure at the south eastern part of South Andaman Island near Corbyn's cove island; (f) Living coral at Joly Buoy island; and (g) Mud volcano at Baratang island, South Andaman

Historical places: The Cellular Jail had been set up for the freedom fighters and prisoners prior to 1898. This island has got significant historical importance, as the first prison was constructed in this island. The Ross Island, which was then the administrative headquarters of the Britishers and for the Japanese troops, holds historical significance. Humphreygunj is another place of importance from the point of view of freedom fighters, wherein a large number of Indian patriots were shot dead by the Japanese. *Natural Beauty:* The breath-taking natural beauty of some islands like Jolly Buoy, Cinque Island, Red Skin Island, Havelock Island, Neil Island, and beaches like Corbyn's Cove, Chidiya Tapu, Radhanagar, Ramnagar, Laxmanpur, and Sitapur area are the major attractions for nature lovers. *Museums and Parks:* Several museums like Anthropological Museum, Samudrika Naval Marine Museum, Zoological Survey of India, Marine Museum, and parks viz., Mahatma Gandhi Marine National Park, Mount Harriet Park, Chidiya Tapu, are places of interest in South Andaman Island.

Thus, the above study depicts that there is a lot of scope in the field of tourism which is yet to be explored and developed in order to enrich the economic and social conditions. Although it has to be enhanced, retaining all the rules and regulations (as per coastal regulation zone (CRZ) notifications) deployed by the government for this group of Islands. The ecological balance should not be disturbed in any way to bring in additional facilities for the tourists. Andaman group of islands are a well-admired place by many such tourists who have travelled the place. But in order to make this place more attractive and bring in the list of wonders, proper resource management and publications will be planned in the near future.

19.3.2 Tourist Arrival in South Andaman

Andaman is a relatively new tourist destination in India. Earlier there had been a very less number of tourists who had shown interest for this place to visit the island. A statistic published by IP&T (Information, Publicity, and Tourism) and the A & NI Administration in 1980 reveals that the total number of tourists who visited the island was less than 10,000. Over the years the number steadily increased and crossed almost one hundred thousand (1,00,000) in 2004. Although due to the advent of the tsunami in the year 2004, the number of tourists who visited the place dropped to 32,381. The number increased to 1,95,369 tourists in the subsequent years.

19.3.3 Seasonality of Tourist Arrival

While considering the pattern of tourist arrival in the island, one of the interesting aspects to be studied is the season of tourist arrival. According to Butler and Poria (2001), there are two basic sources of the phenomena of seasonality – “natural” and

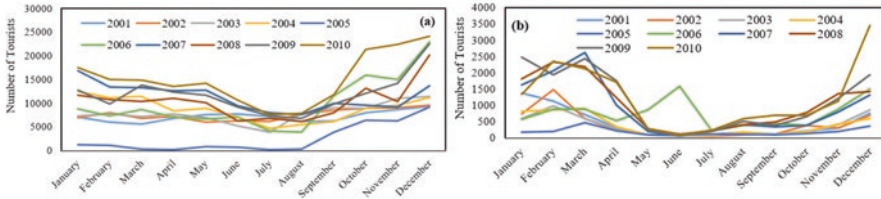


Fig. 19.3 The inflow of (a) domestic and (b) foreign tourists in South Andaman (2001–2010). (Source: Tourism Department of Andaman)

“institutional”. The natural seasonality is the result of variability in climatic conditions like temperature, rainfall, daylight, etc., in the destination. Seasonality is an important issue in the Andaman Island because the tropical regions like the Indian subcontinent experience extreme temperatures, high rainfall, and humidity which results in the reduction of tourist demand at certain times of the year. Institutional seasonality according to Butler is the result of human decisions that can be due to a combination of factors like religious, cultural, ethnic, social, etc. In A & NI, the monthly tourist arrival data shows a great impact of seasonality during the calendar year (Fig. 19.3a). An analysis indicates that there is no high variation in the arrival of domestic tourists in different months of the year, though a marginal increase is found to take place in the months of November, December, and January. This is mostly due to the comfortable climatic condition that prevails in the island during that time and due to the public holidays. The number of incoming foreign tourists across the year varies significantly. The foreign tourists visited the island mostly during the winter time, that is from mid-October to mid-March, while there is a sharp decline observed during summer to monsoon (Fig. 19.3b).

19.3.4 Tourist Places and Tourism Activities

The Andaman is well known for its natural beauty, but the tourist spots are concentrated in certain specific areas. Below are the places that are well known for their tourist attractions in South Andaman. Tourism holds a significant role in boosting up the economic conditions of any place. This has a direct positive impact on the social and economical conditions of the place. After a generic survey was conducted, it was thus concluded that tourists have a strong fascination towards relaxing and swimming on the beaches present in the island. They have strongly recommended the scenic beauty of the place. Besides it has been analysed that tourists like to avail various water sports activities like snorkelling and scuba-diving. Red Skin, North Bay, and Jolly buoy are famous for corals where tourists are taken to enjoy snorkelling. Glass-bottomed boats are also available to view the corals from the transparent glasses. In Havelock and Neil Islands, often foreigners are

found engaged in snorkelling without any assistance of the localities. Wandoor provides such a facility wherein tourists are taken from Havelock by a dongle. Professional Association of Diving Instructors (PADI) are available for assistance. Moreover, it has been observed that mostly foreigners across the world have a passion of trekking through the natural trails near Havelock and Neil Islands. Apart from international tourists, domestic tourists have shown interest by exploring the scenic beauty of the nearby places across the island. Cellular Jail, Corbyn's cove, Anthropological Museum, Samudrika Museum, Mahatma Gandhi Marine National Park, and Mini Zoo are considered to be few places of attraction.

19.3.5 Tourism Industry & Economy

The island is a reservoir of natural resources that influence the economy of the island. The major sources of revenue of South Andaman Island are agriculture, handicrafts industry, hotel, restaurant business, and transport business. But the interesting fact is that all these industries are well connected to the tourism industry of the islands. Handicraft industry, which is one of the major sources of income for the people in Port Blair, is a major attraction for tourists. The products are made up of shells which have a high demand across the world. People living in the coastal areas indulge themselves in the practice of shell crafting. The shells are collected, cleaned, and processed suitably followed by shaping different designs to ornament gift items as well as decorative items which can be used to adorn houses. Timber and wood works are another major section of handicraft industry. The island is a home of several kinds of timber species. These timbers are cut into different shapes and sizes to make furniture, mats, and other products which has drawn the attention of several tourists.

19.3.6 Estimated Geomorphic Values of the Geomorphosites

All the landscape systems of South Andaman district are categorised into three different types of geomorphological significances. They are identified as: (i) ten destination sites under coral reef coasts; (ii) eighteen destination sites under shoreline geomorphological features; and (iii) remaining ten destination sites under island interior landscapes for the assessment of scientific values, ecological values, cultural values, and aesthetic-landscape values in the study (Table 19.1). As per the scientific values and ecological values the highest weightage value is assigned for eight destination sites of island interior landscapes; and considering the cultural values and aesthetic-landscape values the highest weightage value is assigned for six destination sites for coral reef coasts and six destination sites of the interior landscapes in South Andaman (Fig. 19.4). A total of 38 destination sites are

distributed in the three major landscapes of the oceanic island systems. Among them, seven destination sites of coral reef coasts are located along the island fringes of the Andaman Sea, whereas, only three destination sites are located in the Bay of Bengal. The fifteen destination sites of shoreline geomorphological significances are represented by the Andaman Sea coastal fringe areas of South Andaman district, but the remaining three numbers of destination sites are distributed in the Bay of Bengal fringe coastal areas and especially on little Andaman Island. However, the island interior geomorphic and ecological features are mostly distributed in the main island landscapes complex of the South Andaman district.

Considering the above geomorphic significances with values of four criteria, the final geomorphic values are estimated for the 38 destination sites in the study. The result shows that the Rank-I category geomorphosites include four destinations, island interior landscapes. The rank-II category geomorphosites include eight destinations of coral fringed coasts, island interior landscapes, and shore fringe geomorphological importance. However, the rank-III category of destinations include 14 geomorphosites and Rank-IV category destinations include 12 number of

Table 19.1 Assessment of geomorphic values for the 38 geomorphosite destinations in South Andaman district based on scientific values, ecological values, cultural values, and aesthetic-landscape values. The final integration scores and their ranking to identify the category of geomorphosite in the emerald islands

Major category of the landscapes	Geomorphosites	Geomorphological Values (V_{GEO})				Score	Rank
		Scientific value (Sce)	Ecological value (Eco)	Cultural value (Cult)	Aesthetic-landscapes value (Est)		
Fringing coral reefs	Neil Island (D-1)	6	6	5	4	1.1025	Rank-IV
	Havelock Island (Elephant beach point) (D-2)	6	5	5	5	1.14	Rank-IV
	Little Andaman (D-3)	7	5	6	7	1.405	Rank-III
	Jolly Buoy Island (D-4)	8	7	6	6	1.445	Rank-III
	Redskin Island (D-5)	8	8	7	8	1.7825	Rank-II
	South Button (Havelock Island) (D-6)	7	7	5	6	1.405	Rank-III
	Henry Lawrence Island (D-7)	7	7	6	8	1.6675	Rank-II
	North Bay Island (D-8)	6	6	5	4	1.1025	Rank-IV
	Rutland Island (D-9)	7	8	7	8	1.78	Rank-II
	Twin Brothers Island (D-10)	7	6	7	7	1.5175	Rank-III

(continued)

Table 19.1 (continued)

Major category of the landscapes	Geomorphosites	Geomorphological Values (V_{GEO})				Score	Rank
		Scientific value (Sce)	Ecological value (Eco)	Cultural value (Cult)	Aesthetic-landscapes value (Est)		
Shoreline geomorphological features	Beaches						
	Radhanagar Beach (D-11)	8	6	5	6	1.3325	Rank-III
	Sitapur Beach (D-12)	5	4	4	5	1.025	Rank-IV
	Bharatpur Beach (D-13)	6	5	4	4	0.99	Rank-IV
	Laxmanpur Beach-I (D-14)	5	5	3	4	0.95	Rank-IV
	Elephant Beach (D-15)	5	6	4	5	1.175	Rank-IV
	Kala Pathar Beach (D-16)	4	6	3	5	1.135	Rank-IV
	Hut Bay Beach (D-17)	6	7	4	4	1.14	Rank-IV
	Buttler Bay Beach (D-18)	6	8	5	5	1.365	Rank-III
	Karmatang Beach (D-19)	7	8	5	5	1.3675	Rank-III
	Munda Pahar Beach (D-20)	6	7	5	6	1.4025	Rank-III
	Corbyn's Cove Beach (D-21)	7	5	4	5	1.105	Rank-IV
	Wandoor Beach (D-22)	7	5	4	5	1.105	Rank-IV
	Other features						
	Kalapathar limestone topography (D-23)	8	7	6	4	1.58	Rank-III
	Laxmanpur-II natural arches (D-24)	8	8	6	6	1.88	Rank-II
	Ramnagar shore platform mangroves (D-25)	5	8	3	6	1.625	Rank-II
	Vijaynagar shore platform mangroves (D-26)	5	8	3	5	1.5125	Rank-III
	Sitapur white claystone cliff (D-27)	6	5	3	5	1.335	Rank-III
Neil Island beach rock platform (D-28)	5	5	2	3	1.025	Rank-IV	

(continued)

Table 19.1 (continued)

Major category of the landscapes	Geomorphosites	Geomorphological Values (V _{GEO})				Score	Rank
		Scientific value (Sce)	Ecological value (Eco)	Cultural value (Cult)	Aesthetic-landscapes value (Est)		
South Andaman Interior Island features	Whisper Wave Waterfalls (D-29)	9	9	7	6	2.04	Rank-I
	White Surf Waterfall (D-30)	9	9	7	8	2.265	Rank-I
	Dugong Creek (D-31)	9	9	6	8	2.2275	Rank-I
	Baratang mangrove creek (D-32)	8	7	6	7	1.9175	Rank-II
	Baratang limestone cave (D-33)	9	8	7	8	2.19	Rank-I
	Baratang mud volcano (D-34)	9	5	3	4	1.365	Rank-III
	Jarawa Reserve Forest (Hill Forest) (D-35)	8	8	6	7	1.9925	Rank-II
	Munda Pahar Forest (Chidiya Tapu) (D-36)	7	7	4	5	1.57	Rank-III
	Mount Harriet peak (D-37)	8	8	5	7	1.955	Rank-II
	Ross Island (D-38)	7	5	6	4	1.3825	Rank-III

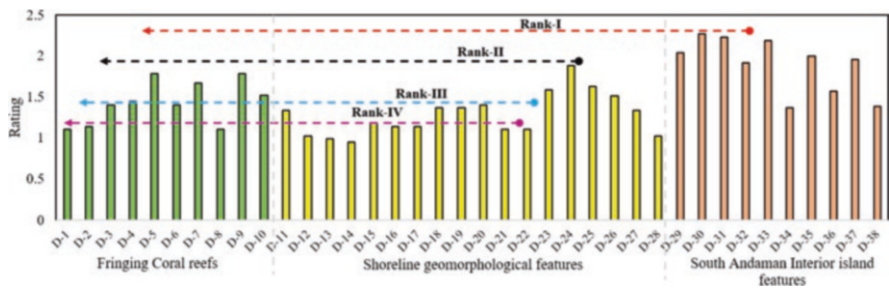


Fig. 19.4 Estimated ranking for geomorphosite destinations based on scientific values, ecological values, cultural values, and aesthetic-landscape values in South Andaman district

geomorphosites in the South Andaman district. The rank-I geomorphosites are connected with easy access routes and they are geomorphologically most significant with their four significant values. The Rank-II geomorphosites category destinations are accessible and explored by the adventure tourism process along the island fringes, coral reefs, and island interior landscapes. Geomorphosites of Rank-III and Rank-IV categories are located far away from Port Blair and their access is

relatively not easy in comparison to Rank-I and Rank-II destination sites. The SRTM DEM and SOI toposheets helped to identify the different terrain characters of south Andaman district. As many as six major terrain units are identified after the consideration of contour patterns and generation of a Digital Elevation Model for the study area (Fig. 19.2a). The Google Earth image is used for the validation of geomorphic characteristics for each destination site in South Andaman district. A repeated field survey method helps to monitor the features and tourism significance of each geomorphosite. The 38 geomorphosites are identified and plotted in a framework scheme to estimate the geomorphic values. They are classified into three major groups with estimation of scientific values, ecological values, cultural values, and aesthetic-landscape values.

19.4 Conclusion

The natural landscape of South Andaman district attracts a large number of domestic tourists and foreign tourists in the emerald islands. The domestic tourist is involved in the tourism process for a few days (7–10 days) under a package tour guided by different tourism agents and tour operators in the island. However, the foreign tourists visit the different geomorphosites of isolated island landscapes and stay for a month or more in the eco-huts. They actually rely on the aesthetic-landscape values of the geomorphosites and various adventure tourism practices with coral watching, sun bathing, and nature hunting in the islands.

The tourism department of Andaman promotes eco-tourism in multiple islands where the minimum tourism recreation infrastructure are available. The assessment of geomorphological values of the various destination sites will provide a very good data base, a framework of geomorphosites for managing the travel and tourism process by the coastal managers and administrators in a sustainable way. Environment regulations of 2009 are advocated in favour of tourism lobby in the Andaman group of islands. The island protection zone is strictly followed for the construction of touristic recreational infrastructures as per the size of the island (smaller island and big island). Therefore, there are a lot of opportunities to promote eco-tourism, nature tourism, and geo-tourism activities. The assessment of geomorphosites along with their geomorphological values will help in the promotion of the tourist activities in this manner.

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