FINDING SUITABLE LOCATIONS FOR ECO-TOURISM DEVELOPMENT IN COX'S BAZAR

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FINDING SUITABLE LOCATIONS FOR ECO-TOURISM DEVELOPMENT IN COX'S BAZAR

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Thesis Acceptance Certificate

The thesis titled "FINDING SUITABLE LOCATIONS FOR ECO-TOURISM DEVELOPMENT IN COX'S BAZAR" submitted by Kazi Masel Ullah, Roll No. 1009152002F, Session: October 2009, has been accepted as satisfactory in partial fulfillment of the requirement of the degree of Master of Urban and Regional Planning (MURP) by Course and Thesis on 22 October 2012.

Board of Examiners

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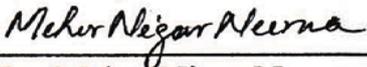BUET, Dhaka, Bangladesh.

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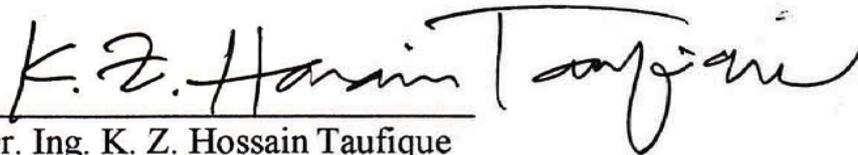BUET, Dhaka, Bangladesh.

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Candidate's Declaration

I hereby declare that this thesis has been prepared in partial fulfillment of the requirements for the degree of Master of Urban and Regional Planning (MURP) at the Bangladesh University of Engineering and Technology, Dhaka and has not been submitted anywhere else for any other degree.

_____

(Kazi Masel Ullah)

Student No: 1009152002F

Dedications

Dedicated to my Parents, Brothers and Sisters

ACKNOWLEDGMENT

ABSTRACT

Ecotourism is nature-based tourism, which involves enjoying nature, understanding local environment and culture. At the same time, ecotourism demands conservation of nature and improvement of local communities to make the environment and tourism sustainable. Thus ecotourism can be viewed as a panacea. But, in real world the actual performance of ecotourism make huge controversies. An ecotourism site, having full sustainability and complete conservation of all living and nonliving resources, is a very rare case. Deciding ecotourism activities for a particular area is a quite complex job and deserves subjective judgment. Land suitability analysis for ecotourism activities has similar effect, the complex decision making process. A lot of natural, environmental, social and economic factors influence the site selection for ecotourism activities. Experts from different backgrounds need to be involved in the site selection process. Furthermore, such decision making process should have consistency to get more accurate decision. The aim of this study is thus, to find suitable locations for ecotourism development in Cox's Bazar, Bangladesh.

To fulfil this aim at first resource maps were prepared based on general landuse classes. Then, within the area of those resource maps potential ecotourism sites were identified and ranked using Geographical Information System (GIS) and Analytical Hierarchy Process (AHP). AHP technique was used as this is a very useful technique to make subjective and consistent judgment as well as help to make ranking of decision choices. Five factors and fifteen criteria were identified to evaluate suitability of sites. Factors and criteria were selected based on literature review, local knowledge and expert's opinions. After ranking the suitable locations, the study result shows 76.32 sq. km (9%) area as highly suitable, 499.41 sq. km (56%) area as moderately suitable and 189 sq. km (21%) area as minimum suitable for ecotourism development in the study area. Also, another 124.65 sq. km (14%) area was found unsuitable for ecotourism for its highly agricultural and urban landuse. The highly suitable areas are characterized by hilly forest, most of the growth centres fall within the moderately suitable areas and minimum suitable areas are predominated by rural agricultural land.

Based on research findings some strategic recommendations have been suggested at the regional level. Major recommendations aimed at treating the highly suitable area as more 'natural' and for bringing them under conservation programs, creating tourist facilities in the moderately suitable areas by targeting growth centres and protecting agricultural land and encouraging local primary activities in the minimum suitable areas.

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ABBREVIATIONS AND ACRONYMS

AHP	Analytical Hierarchy Process
BBS	Bangladesh Bureau of Statistics
BPC	Bangladesh Parjoton Corporation
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CASR	Centre for Advanced Studies and Research
DEM	Digital Elevation Model
FAO	Food and Agricultural Organization
GDP	Gross Development Production
GIS	Geographical Information System
GoB	Government of Bangladesh
GPS	Global Positioning System
IPAC	Integrated Protected Area Co-Management
LGED	Local Government Engineering Department
MCDM	Multi Criteria Decision Making
MoU	Memorandum of Understanding
MURP	Masters in Urban & Regional Planning
NDVI	Normalized Difference Vegetation Index
NGO	Non-government Organization
RRA	Rapid Rural Appraisal
RS	Remote Sensing
UDD	Urban Development Directorate
UN	United Nations
UNWTO	The United Nations World Travel Organization
URP	Urban & Regional Planning
USAID	United States Agency for International Development
WCED	World Commission on Environment & Development

CHAPTER 1: INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Tourism is one of the leading industries in the world. The sector has direct contribution to the 5% of world GDP [1]. Tourism plays a great role in employment generation and revenue earning. Majority of the tourism activities are in the form of "mass tourism". However, in the last three decades, growing concern over environmental and social sustainability has encouraged tourism to function in an 'alternative' form. Traditional tourism or mass tourism has many detrimental impacts on local environment and communities. Such tourism is unsustainable in many cases. Ecotourism is an alternative form in making tourism and the environment sustainable. [2]

Ecotourism is the nature-based tourism which involves enjoying nature, understanding local environment and culture. At the same time, ecotourism demands conservation of nature and improvement of local communities. Thus ecotourism can be viewed as a panacea. But in real world implication, defining ecotourism is very complex. There is no fully realistic and standard definition of ecotourism. Different agencies and tour operators create varying nature of ecotourism activities. Some activities can be termed as 'soft' ecotourism, while, some are 'hard'. Some are 'natural' and some are 'unnatural'. Some tourism is environmentally exploitive, some improve environmental quality and some just minimize environmental impacts. However, there is no distinct demarcation among these contrasting typologies of ecotourism. So, deciding ecotourism activities is quite complex and deserve *in situ* knowledge as well as subjective judgment (for future reading see chapter -2).

Land suitability analysis for ecotourism activities has similar effect, the complex decision making process. A lot of natural, environmental, social and economic factors influence the site selection for ecotourism activities. Experts from different backgrounds need to be involved in the site selection process. Furthermore, setting the factors and criteria, finding their basic strength and weakness for making decisions are conflicting.

Several Multi-Criteria Decision-Making (MCDM) techniques have been evolved to structure the complex human decisions. Different MCDM techniques with the help of modern GIS technologies are used widely nowadays in spatial decision making process as well as for land suitability analysis. A number of researchers found that Analytical Hierarchy Process (AHP), which is a kind of MCDM techniques, can resolve the spatial decision making processes in a fruitful way with the support of GIS tool [3]. Some basic principles of AHP are allowing subjective judgment, maintaining consistency among varying decisions, making priority ranking etc. So, AHP with support of GIS can be used fruitfully for locational choice of ecotourism development as ecotourism looks some sorts of decisions based on subjective judgment, consistent expert opinions and choosing optimum location from a set of alternatives (explained in detail in chapter – 4).

Bangladesh has huge prospect of ecotourism for its unique natural and cultural settings. The country consists of tiny piece of land in respect of the world, but has vast surface of natural landscapes like rivers, mountains, sea, waterfalls, islands, forests etc. along with its plain land. The historical monuments, diversified cultural melange, presence of different tribal and ethnic groups and finally strong mental positive attitude towards outsiders show the real essence of ecotourism prosperity in Bangladesh. However, such prospects and great potentialities are remaining unexplored. Some popular tourist spots are suffering from adverse impacts of unbalanced and unplanned tourism development. So, the country has huge scope of ecotourism researches to explore its unexplored resources and make sure the sustainable tourism development.

Cox's Bazar is the tourist capital of Bangladesh. The district has the world longest unbroken sea-beach, hilly forests, wildlife, biodiversities, springs, coral reef, islands, heritages, different tribal peoples and cultures which has great potential to promote ecotourism [4] [5]. Nearly two million people visit Cox's Bazar in the peak season from November to March. But all these tourists form part of mass tourism. As a result local people are experiencing serious adverse impacts on their society, culture, economy and environment [6]. In order to mitigate these problems and to find a more sustainable form of tourism, ecotourism development is absolutely necessary and hence the need for such studies.

1.2. RATIONALE OF THE STUDY

Little research has been done in the academic arena of Bangladesh on the issue of ecotourism. In that sense, this research would highlight a broader theoretical perspective of ecotourism and would justify a broader scope of ecotourism in Bangladesh. Cox's Bazar is the most popular tourist destination in Bangladesh. Current haphazard and rapid tourism development in Cox's Bazar are causing lot of detrimental impacts (see previous section). So, the study is an attempt to explore the potential locations for ecotourism development in Cox's Bazar and the research results were used to set a guideline to manage the present unsustainable and unacceptable nature of tourism activities. This regional level study result can be used strategically for local level or detail planning. Besides, the study will act as a guide for researchers, planners and decision makers to analyze land suitability for other areas of Bangladesh.

1.3. OBJECTIVES

As evident from the title, the primary aim of the research is finding suitable location(*s*) for ecotourism development in Cox's Bazar. To fulfil this aim following specific objectives were set, which are –

1. Develop potential resource maps for ecotourism in Cox's Bazar.
2. Find suitable location (s) for ecotourism development in Cox's Bazar.

1.4. OUTLINE OF THE METHODOLOGY

1.4.1. LITERATURE REVIEW

Existing literature was reviewed for this study, and concepts and principles of ecotourism, its dimensions, typologies, criteria and indicators were studied rigorously. Understanding on global perspective of ecotourism was built by finding some country specific case studies. Different kinds of Multi-Criteria Decision-Making (MCDM) Models were studied and finally Analytical Hierarchy Process (AHP) was selected for this study. Ecotourism in Bangladesh perspective was described in light of these literatures and secondary data. The literatures were mainly published and unpublished materials, including thesis, journal articles, books, online documents, different organizational reports, policy papers, laws, government gazettes, information leaflets, brochures, etc.

1.4.2. SELECTION OF THE STUDY AREA

Initially the study area was supposed to be all over the district of Cox's Bazar. But later the study area was delimited from Cox's Bazar town and its surroundings to the end of Teknaf Peninsula and the St. Martine's Island (please see Map -1). The decision was taken based on following conditions –

- Within that area all the secondary information (specially the spatial data) was available but for the whole Cox's Bazar district.

- It would be much difficult job to conduct an in-depth study for all over the district that covers around 2492 square km.

- The delimited area encompasses all types of bio-physical and landform characteristics (forests, hills, beach, island, rivers, cannels, springs etc.) those exist in similar variations for the total area of Cox's Bazar District. So, by reducing the size of area would not influence the number of criteria selection for ecotourism study and still the new study area is about 890 square km which is a considerable size for the purpose of this study.

1.4.3. SECONDARY DATA COLLECTION

Remote Sensing (RS) image, existing geographical databases, maps were collected. Other secondary information likes relevant studies, reports, statistics, researches, official documents etc. were also collected. To collect the secondary information different government and non-government organizations like Forest Department, Bangladesh Parjoton Corporation (National Tourism Authority), Urban Development Directorate, Bangladesh Water Development Board, IPAC etc. were visited. Using the spatial and non-spatial secondary information a spatial database was prepared after preparing the resource maps (see Chapter-5). The datasets of the spatial database, type, shape and their sources are as the following table -

Map 1
Study Area in Cox's Bazar District

Cox's Bazar District in Bangladesh

Source: LGED

Legend
River
Highway
Study Area
District Boundary
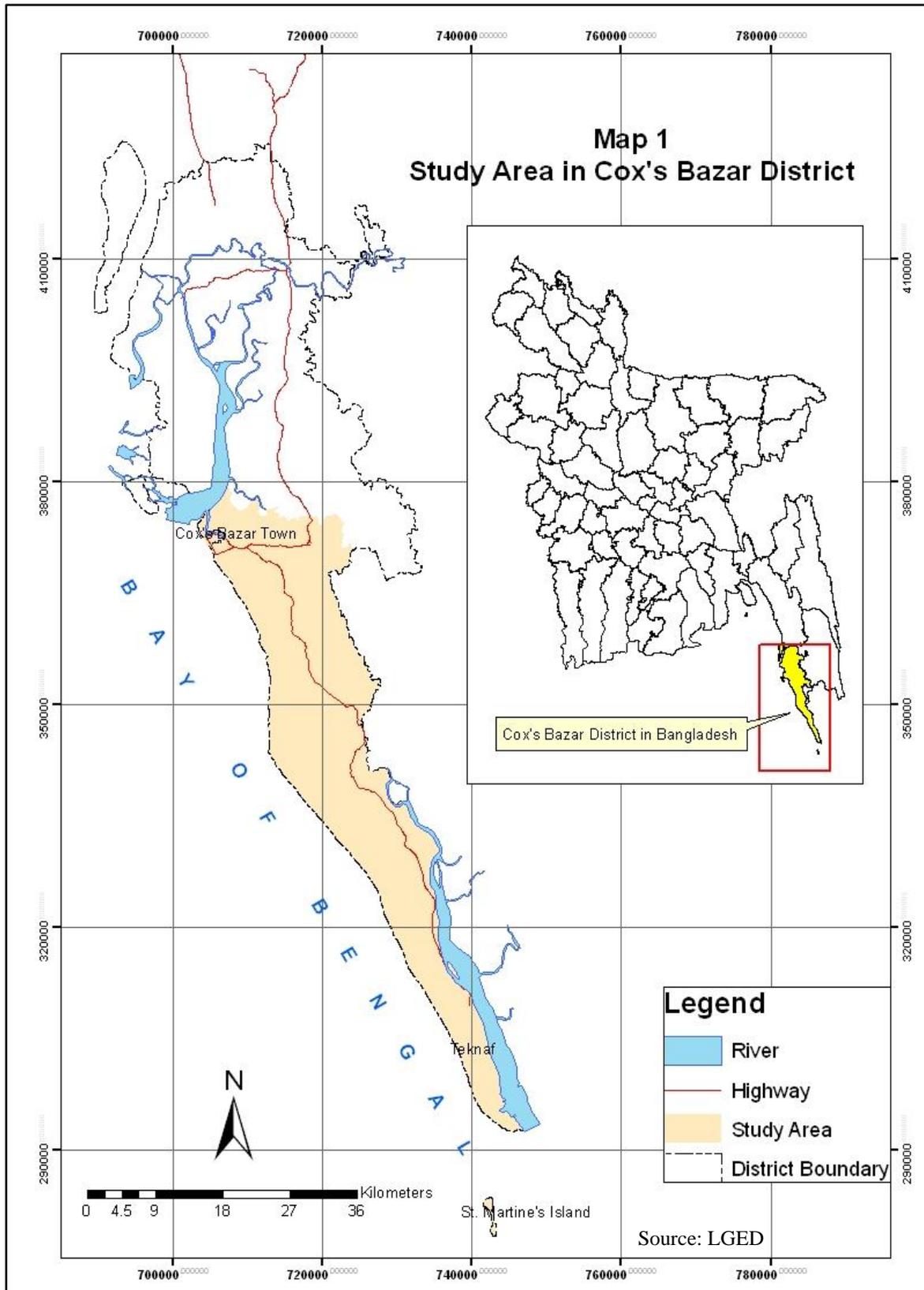
Table 1: Datasets of the Study Area

Dataset	Type	Shape	Source
RS Image (Quickbird, 4 band, 0.6 m spatial resolution)	Raster	Polygon	UDD
RS Image (Landsat, 7 band, 30 m spatial resolution)	Raster	Polygon	IPAC
Protection Class (Only reserve forest/Protected Area)	Vector	Polygon	Forest Department
Species Diversities	Vector	Polygon	Forest Department
Digital Elevation Model (DEM)	Raster	Polygon	Water Development Board
Tangible Cultural Heritages	Vector	Point	UDD
Ethnic Groups	Vector	Point	BBS
Road Networks	Vector	Line	Forest Department, LGED
Growth Centre	Vector	Point	LGED
Existing tourist sites	Vector	Point	BPC
Population Distribution	Vector	Polygon	BBS
Water Bodies (River, Cannel, lakes)	Vector	Polygon	IPAC, LGED
Coastline	Vector	Line	UDD, IPAC, LGED
Others (Spring, Cave)	Vector	Point	IPAC
Administrative Boundaries	Vector	Polygon	LGED
Landcover (Agriculture, Urban Area, Forest etc.)	Vector	Polygon	IPAC

1.4.4. PRIMARY DATA COLLECTION

Primary data was collected to understand the attitudes of the local peoples towards ecotourism and the locations of tribal communities. To understand the people's attitudes or community attitudes Rapid Rural Appraisal (RRA) technique was used at the growth centres and St. Martine's Island (please see Appendix -1 to get the name of the places where RRA surveys were conducted). RRA tool was used as the technique is useful to conduct qualitative survey in a quick and cost-effective way. The growth centers were

chosen for RRA study, because, every people are somehow connected to the nearby growth centers. It was not possible to study so many different communities individually. There is no designated growth centre in St. Martine's Island. But as the island is isolated from the mainland, so, separate RRA was conducted there. Locations of tribal communities were collected by using GPS survey. The field surveys were accomplished from 8-22 January, 2012.

1.4.5.   SHARING EXPERT OPINION, USE OF AHP AND GIS

After completion of data collection, expert opinions were shared to categorize the resources, to apply weights and rank them properly. Here AHP model was applied. Expert panel includes of 2 conservationist, 2 environmentalists, 2 tourism experts, and 3 planners. Experts were mainly interviewed from top officials of UDD, Forest Department and BPC. Others experts are senior consultants. Conservationists and environmentalists mainly expressed their opinions regarding wildlife criteria, tourism experts and planners expressed their opinions on overall criteria. The values of community characteristics were principally justified with the opinions of planners.

The weight values of each criteria obtained (by discussion with experts) were transformed into GIS and finally suitable locations were classified. The steps, those were followed under the GIS based AHP model, are quite elaborate. This is discussed in Chapter -5.

1.4.6.   DATA ANALYSIS

The data obtained through secondary information, PRA techniques and expert interviews was interpreted using maps and tables in GIS & MS-Excel. The Spatial Analyst tool in ArcGIS was used to perform overlay operations and identify suitable locations for ecotourism development.

1.4.7.   RECOMMENDATION

After obtaining study results and relevant findings some recommendations was made for effective development of ecotourism, guiding and managing mass tourism and formulating a regional level strategy for detail level planning. All information was then compiled in the form of a report.

1.5. SCOPE AND LIMITATION OF THE STUDY

The study tried to explore suitable locations for ecotourism development in Cox's Bazar based on some selected ecotourism criteria and factors. During the selection of factors and criteria literature were reviewed and expert opinions were obtained. Although it was an endeavor to identify all possible criteria and factors that suit local context, still there might have some other influencing criteria which were not considered in this study. Further study on this issue can minimize this gap. The weighting method of criteria in assistance with experts and literature reviews is based on subjective judgment. So, naturally there may have little pitfalls in the decision making process. The community attitude towards ecotourism could be justified more intensively in the context of large timeframe and availability of fund. This limitation is also true for the whole of this study. The available spatial data was in different formats, projection parameters, attributes and geometric shapes. So, to simulate all the different datasets into a common platform, similar projection parameters, geometric shapes, attributes and other prerequisite conditions were maintained. These conditions can make little distortion in the spatial data. The study fulfills a regional level goal that can help to prepare a strategic planning. Further research is earnest necessary for detail level planning to promote ecotourism activities.

1.6. ORGANIZATION OF THE THESIS

The thesis works have been presented in **six chapters**. **In Chapter 1**, the background of the study, justification, objectives, outline of methodology and scope and limitation of the study were drawn. **In Chapter 2,** ecotourism principles covering its conceptual definitions, dimension, typologies, criteria and indicators as well as the global and national perspectives of ecotourism were described. This chapter shows major theoretical part of the research. **Chapter 3** highlights the profile of Cox's Bazar district, the major part of which has been selected as study area. **Chapter 4** explains different GIS based Multi Criteria Decision Making (MCDM) techniques and justify why AHP has been selected for this study. **Chapter 5** presents major inputs, outputs and methodological operations of the research. This chapter explains how resource maps were prepared, how AHP has been used in different stage of criteria and factors and finally, shows the results and analytical discussions. Based on findings from all through the research works, some sorts of recommendations and conclusion were drawn in **Chapter 6**.

CHAPTER 2: ECOTOURISM PRINCIPLES AND IT'S PERSPECTIVES

As stated before in the previous chapter, the major theoretical background of ecotourism has been described elaborately in this chapter. A number of definitions have been referred to conceptualize the 'Ecotourism' term, but in real world situation, the actual performances of ecotourism make huge controversies. So, different dimensions of ecotourism and its different level of categories have been discussed. To set the criteria and indicators for identifying suitable locations of ecotourism for this own study, the criteria and indicators of previous studies were also explored. Case studies were done from one low income and two upper middle income countries to see the global perspective of ecotourism. Bangladesh perspectives have been observed in more detail manner where two in-depth case studies were done in addition with other policy level and institutional level information.

2.1. CONCEPTS OF ECOTOURISM

Mathienson and Wall defined "Tourism" as travel outside one's normal home and workplace, the activities undertaken during the stay and the facilities created to cater for tourist needs [7]. They treated tourism as a system with an originating area and a destination area with a travel component linking the two. The originating area and the destination area are further treated as demand side and supply side respectively.

Tourism is also viewed as global activities which promote employment and revenue generation. This is generally treated as 'mass' tourism. In the recent years new concepts of tourism, named as 'alternative' tourism, gained emphasize. Such tourisms are said to be consistent with natural, social and community values. Such values allow both hosts and guests to enjoy positively and share experiences [8]. Ecotourism developed 'within the womb' of the environmental movement in the 1970s and 1980s [9]. Growing environmental concern and at the same time emerging dissatisfaction with mass tourism generated increased demand for nature-based experiences of an alternative way.

Ceballos-Lascurain has given the first formal definition of ecotourism. According to his definition, Ecotourism is 'travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas' [10, 11]. Such definition highlighted the appreciation of nature-based experiences. Recent definitions are more concerned about the sustainable development. According to Wight, sustainable ecotourism imposes an 'ethical overlay' on nature-based tourism that has an educative emphasis [12]. Ross and Wall outline five fundamental functions of ecotourism; namely: (i) protection of natural areas; (ii) education; (iii) generation of money; (iv) quality tourism; and (v) local participation [13]. The last three fall under the dimension, 'sustainably managed'. The "Quebec Declaration on Ecotourism", in the framework of the UN International Year of Ecotourism, 2002, lists following elements to defining ecotourism [14] –

- Contributes actively to the conservation of natural and cultural heritage.
- Includes local and indigenous communities in its planning, development and operation and contributes to their well-being.
- Interprets the natural and cultural heritage of the destination for visitors.
- Lends itself better to independent travellers, as well as to organized tours for small groups.

So, ecotourism can be defined as the nature-based tourism which involves enjoying nature, understanding local environment and culture and at the same time, ecotourism demands conservation of nature and improvement of local communities. Thus many authors tried to highlight ecotourism as a panacea. But in the real world application retaining the real essence of ecotourism is very complex. Hence, beyond the broader views, defining ecotourism in more specifically is a controversial process, at least when we justify the essence of ecotourism for a particular area (in location term) of study. This will be much clear when different approaches of ecotourism typology are discussed. But before that it is necessary to discuss different dimensions of ecotourism at first.

2.1.1. NATURE BASED

The most prime characteristic of ecotourism is it is nature based. Valentine defines nature-based tourism as 'primarily concerned with the direct enjoyment of some relatively undisturbed phenomenon of nature' [15]. Different types of motivations for nature-based tourism have been suggested. These are the desire to get back in touch with nature, a desire to escape the pressures of everyday life, seeing wildlife before it is too late, and specific interests and activities such as trekking, birdwatching, canyoning and white-water rafting, kayaking etc. [16].

Valentine identified three main dimensions of nature-based tourism –

- Experience - different nature based tourism experiences vary in nature dependency, intensity of interaction, social context and duration.
- Style - different styles are associated with different levels of infrastructure support, group size and type, cultural interaction factor, willingness to pay and length of visit.
- Location - Locations vary in terms of accessibility (remoteness), development contribution, ownership and fragility [15, 17].

Now, the question is what is nature-based and what is not nature based experience? Does a sightseeing flight to Mount Everest qualify as a nature-base experience? A tourist, suppose, travels to Nepal and enjoyed the Annapurna range by sitting in a restaurant, but did not get closer to Himalayas. Is it termed as 'ecotourism destination'? [11]. Thus issues of interaction with nature, proximity, duration etc. matters how the ecotourism can be defined. Some authors qualify ecotourism if it takes place in an undisturbed nature. But if tourism takes place, will the nature be remained undisturbed? If the style of an ecotourism desire infrastructure supports and necessitate alteration of nature, then will it be treated as ecotourism? So, operational definitions of nature-based tourism as well as ecotourism need subjective judgment. [18].

2.1.2. ENVIRONMENTAL AND CULTURALLY EDUCATIVE

The objective of environmental and cultural education of ecotourism coincides with the following functions [11] –

The first function of environmental education is learning about plants, animals, landscapes etc. that are unique to an area. To varying degrees, individuals can tailor this learning to meet their own interests, for example by asking questions, moving closer, smelling, having eye contact with particular species and learning the mannerisms of species. This experiential form of learning is different from formal education, such as, the study of biology, zoology or ecology of areas.

The second function emphasize responsible tourism which pertain the knowledge, attitudes and/or behaviour of tourists, with a view to minimizing negative impacts and producing a more environmentally and culturally aware citizenry. For example, tourists can be educated about how best to minimize their impacts while visiting a site, and presented with a code of ethics for tourist conduct. The second function has much usefulness to avoid negative impacts for performing first function. In an experimental learning tourist may desire to be very closer with nature, for example touching a particular species. But this closeness may be harmful for that species. Here the second function guides the tourist to enjoy under a code of ethics or in a responsible way.

Apart from the tourist, local communities can be educated regarding the sensitive nature of natural areas, and how best to protect these areas and maximize tourism-related revenues and benefits. Industry can also be educated about best environmental and/or business practice.

2.1.3. SUSTAINABILITY DIMENSION

According to World Commission on Environment and Development (WCED) sustainability is 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' [19]. This definition of sustainability comprises a broad view. In more specific, there are wide level of discussions in defining sustainability as well as sustainable development. In more generalized view sustainable development imply conditions on making balance among environmental impacts, economic development, participatory processes, intergenerational and intra-generational equity, sustainable livelihoods and so on [11].

Bramwell and Lane [20] mentioned four basic principles of sustainable development and sustainable tourism development:

    i.   Holistic planning and strategy making;

    ii.   Preservation of essential ecological processes;

    iii.   Protection of both human heritage and biodiversity; and

    iv.   Development to ensure that productivity can be sustained over the long term for the future generations.

A well known list of principles and guidelines is developed by Tourism Concern in association with the Worldwide Fund for Nature (WWF) [21]. In that list there are ten sustainability principles accompanied with a list of recommendations. The first general principle compose following sets of recommendations –

    i.   prevent damage to environmental resources;

    ii.   act as a force for conservation;

    iii.   develop and implement sound environmental policies in all areas of tourism;

    iv.   install appropriate systems to minimize pollution from tourism developments;

    v.   develop and implement sustainable transport policies;

    vi.   adhere to the precautionary principle;

    vii.   research, establish and abide by the carrying capacity of a destination;

    viii.   respect the needs and rights of local people;

    ix.   protect and support the cultural and historical heritage of peoples worldwide;

    x.   carry out practices in a responsible and ethical manner; and

    xi.   actively discourage the growth of exploitative sex tourism

Anyway, two principles are common in most of the cases for formulating ecotourism principles. Those are –

    a.   Support local economies

    b.   Support conservation. [11]

There are variety of forms in support for local economies and conservation. Foreign exchange earnings, employment, infrastructure development, long-term economic stability and economic diversification can be recognized as potential economic benefits [22].

Finally, the sustainability of ecotourism can be suggested by ensuring following things –

- Conservation of natural environment,
- Preservation of cultural heritages,
- Benefits of the Local Communities both for the current and future generations.

2.1.4. ECOTOURISM VERSUS MASS TOURISM

The necessity of Ecotourism is more pronounced by distinguishing its difference with the mass tourism. Mass tourism tries to accumulate overwhelming population in the popular or attractive places. Local environment, culture and people's benefit are not concern of mass tourism. Environment can be adversely affected by mass tourism. Heavy rush of people in the destination deserve massive infrastructural development, make depletion of local natural resources. Some wealthy business owners outside of the localities and even outside of the country invest for tourist accommodation, food and entertainment. They receive the financial gain and nothing remains for the betterment of the localities. Mass tourism sometimes has serious detrimental effects on local cultures. Influx of drugs, prostitutions, obsessive tourist behaviours affect the cultural norms of the local communities. Mass tourism is the form of traditional tourism, that is dominated by short-term, free market principles and profit maximization is its prime goal [23 & 24].

While, ecotourism maintains the form of responsible travel [23]. It conserves the local environment, empower the local peoples for getting their own social and financial benefits, guide the eco-tourist to act in environmentally and culturally sensitive manners [11 & 21]. Thus ecotourism is treated as an alternative form of mass tourism in view to confirm sustainable tourism. Ecotourism is more sustainable than mass tourism as it tries to ensure environmental conservation and inclusion of the local community.

2.2. TYPES OF ECOTOURISM

There are differences in the definitions of ecotourism. The typology of ecotourism is based on those variations of definitions. The fact is different agencies and operators define ecotourism in different ways. They define according to the activities they facilitate. Someone can claim which activities should not be termed as ecotourism but in reality such debate is useless. Argument against certain ecotourism activities cannot prevent

those operators and agencies from labelling the term ecotourism. There is no copyright on the term. So, a useful way is to categorize the ecotourism activities to show in which categories the operators activities belong. [24]. A number of authors have made attempt in this regard which has been shown below.

2.2.1. SOFT – HARD

Laarman and Durst (1987)   discussed about 'hard' and 'soft' dimensions of ecotourism based on the level of interest or expertise in natural attraction and the degree of physical efforts or challenges require to enjoy for ecotourist (Fig. – 1) [25]. A 'hardcore' ecotourist has deep level of interest to nature or has expertise in a subject matter, like as, lifelong passion to watching birds or other natural observations. He is not worrying about the comfort of travel and living, travel in different circumstances, stay in the tourism places for long period, stay in wilderness situation and likely to travel for specialized ecotourism.

On the other hand, 'soft' ecotourist enjoy the nature superficially, in a mediated way. He has casual interest on natural attractions. He is reluctant to face discomfort, physical hardship. He wishes to enjoy within a fixed or limited time period, usually in short time. He likes to be surrounded by other tourists. While 'hardcore' ecotourist prefer specialized ecotourism, 'soft' ecotourist try to get multi-purpose or multidimensional travel experiences.
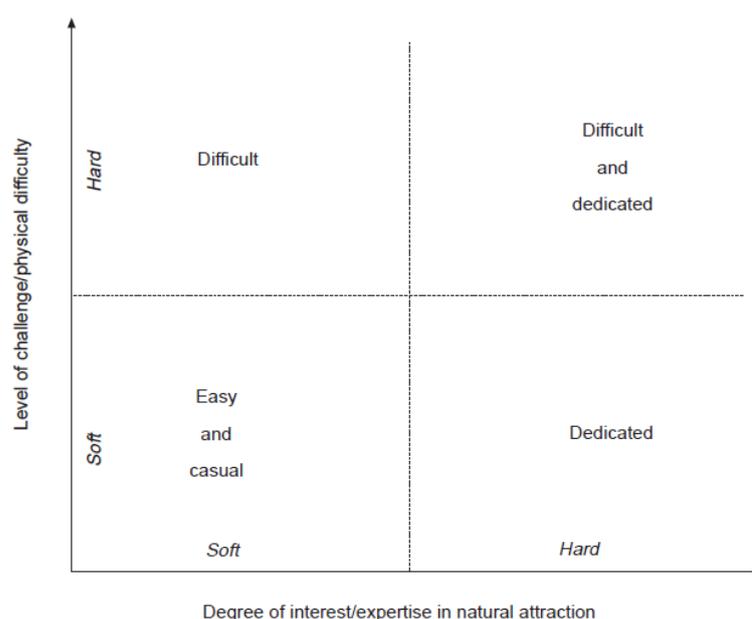
Figure 1: Hard and soft ecotourism [25].

2.2.2. NATURAL – UNNATURAL

Miller and Kaae (1993) described ecotourism by using two polar extremes (figure -2) [26]. In the one pole the human behaviour is truly unnatural for all tourism (including ecotourism). That is, whatever the management strategy, human is separated from nature and human activities has negative impact on it. In this view, ecotourism is impossible. In the other pole human is treated as one of living organisms – fauna – of the nature. Here human behaviour is natural, human interact with the natural process and unable to behave unnaturally. In this sense, all tourisms are ecotourism and vice versa. But this two extremist view is just hypothetical. In reality, the definitions of ecotourism fall somewhere between the two extreme poles. Thus Miller and Kaae described the concept of ecotourism in a diverse number of definitions and applications according to the relatedness with the nature.
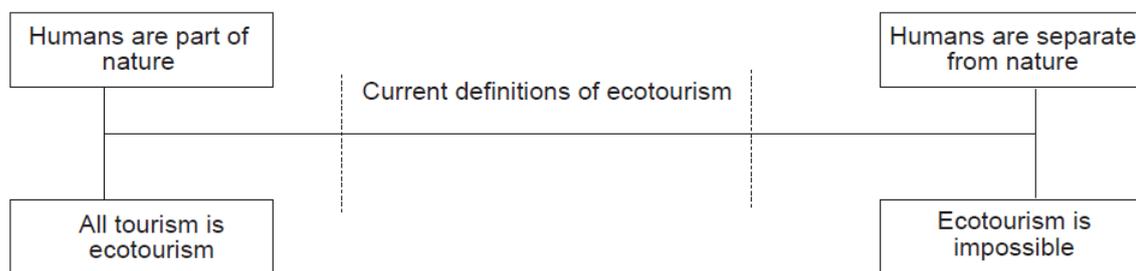
Figure 2: Humans as natural and Unnatural influences and ecotourism [26].

2.2.3. EXPLOITIVE – PASSIVE – ACTIVE

Another approach to classify ecotourism is considering the degree of impact on natural environment. This view is also related to the ethics of ecotourism. Many authors (as described in previous sections) highlighted this ethical view on natural environment and it can be perceived from their views, 'doing right thing'. But it is very difficult to classify which thing is right and which is wrong. Aldo Leopold (1949) made a guideline, "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." [27]. From this guideline ecotourism operations can be also classified like as follows (figure – 3) –

- Positive – the ecotourism operations that improve quality of environment in a more responsible manner.

- Exploitive – the operations that detract the quality of environment and make worse.

- Passive – between the other two types of ecotourism that simply try to minimize the impacts on natural environment. [28].

This continuum classification shows which ecotourism is more desirable than the others and can argue to play the roles of ecotourism operators and agencies in more responsible ways.
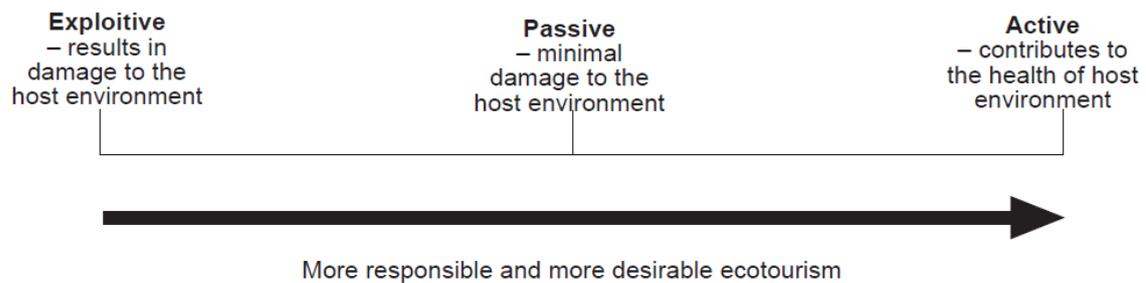
Figure 3: The continuum of ecotourism types [28].

2.3. CRITERIA AND INDICATORS OF SUITABLE LOCATION OF ECOTOURISM

Ecotourism has strong correlation with sustainable tourism. In view of this sustainability many researchers have formulated number of criteria and indicators for ecotourism planning, management, monitoring and development. Whatever the objectives of those studies, the researchers goals were site specific and appreciated different suitability options for different locations.

Fung, T. (et. al) used two broad criteria for ecotourism planning in Yan Chau Tong (Double Haven) Marine Park and its surrounding area of Hong Kong – conservation and recreation. [29]. The conservation criteria comprise factors like –

- Potential habitats of invertebrates
- Potential habitats of vertebrates
- Vegetation cover
- Distance from cultural heritages and villages
- Site of Specific Scientific Interest (SSSI)

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The first three criteria were synthesized as Hong Kong as well as the Marine Park has a variety of ecological habitats, with diverse animal and plant species. The Lai Chi Wo beach, situated within the park, was designated as a SSSI in 1979. So, this area was treated as a contributing factor of ecotourism planning. Although it was described about the attraction of cultural heritages and villages, but why this factor had been considered in conservation criteria was not described.

Suitability of recreation was identified based on four types of recreational activities - camping, snorkel diving, heritage visit and hiking. Each activity's location suitability was justified by following placement of different factors and constraints. For example, the suitability of camping site has two factors and two constraints. The factors are slope and accessibility (distance from footpath). Slope is a safety indicator. The gentler the slope is the more safety of camping and vice versa. The constraints are land and grassland. The land was treated as a constraint to avoid water bodies which are not suitable for camping. Grassland was set as constraint as it is the most possible site for camping and such land cover make sure that the land is free from woods and mangroves.

Kumari, S. (et. al) used five indicator indices to identify potential ecotourism sites in West District of Sikkim State in India [30]. The indicator indices were Wild Life Distribution Index (WDI), Ecological Value Index (EVI), Ecological Attractivity Index (EAI), Environmental Resiliency Index (ERI) and Ecotourism Diversity Index (EDI). They first identified primary variables which are landform, elevation, landuse/forest cover, vegetation diversity, density and endemism, wildlife (mainly birds and butterflies), tourism attraction features and the infrastructure facilities. The ecotourism indices values were determined using these primary variables. For example, number of species found at a particular elevation was used to generate WDI.

A similar study was also conducted by Bunruamkaew, K. (et. al) in Surat Thani Province of Thailand [31]. They identified five factors as indicators of sustainability, which are land ecosystem, landscape/naturalness, wildlife, topography, accessibility and community characteristics. These factors were determined based on nine criteria including visibility, landuse/cover, reservation/protection, species diversity, elevation, slope, proximity to cultural sites, distance from roads and settlement size (population size). For instance,

factor of community characteristics was evaluated by rating the ranges of distance from roads and settlement size.

Although the above two studies have emphasize on nature and consideration of community characteristics in some order, but both the study do not imply the cultural heritages as a function of selecting potential ecotourism site. Bhattacharya, P. and Kumari, S. (2004) comprised the issue in deeply manner. They identified local food, traditional dresses, languages, religious rituals and other customaries, which are included as cultural heritages, as valuable resources for ecotourism promotion [32].

Whatever the aspect of criteria; either environmental, ecological, social, cultural, recreational etc; almost all the approaches of criteria selection in the studies are site specific. Authors applied their subjective judgment, which can be based on stakeholders survey, expert opinion, literature reviews or anyway, in realm of their *in situ* knowledge.

2.4. GLOBAL PERSPECTIVE OF ECOTOURISM

The United Nations World Travel Organization (UNWTO) estimates that in 2007 the market volume of ecotourism was 7% of international market [33]. According to *Travel Week*, sustainable tourism could grow to 25% of world's travel market by 2012 [34]. So, Ecotourism is going to play vital roles day by day in economic perspective. As stated before, ecotourism can be defined in different ways according to its inclusiveness of nature and people, status of the management regime, types of activities or facilities operated by different tour operators and agents etc. For this very reason it would be a tough job to estimate the actual number of ecotourism destinations in the world. Buckley, R. C. (2003) identified 172 number of case studies by continents in his book, titled by "Case Studies in Ecotourism", where 34 cases are from Africa, 42 from Asia-Pacific Region, 44 from Australia and New Zealand, 31 from South and Central America, 17 from North America and Europe and 4 cases from the Arctic and the Antarctic regions. Each of the cases comprises one or more criteria or components of ecotourism or shows as an operational model of ecotourism. To set the criteria of ecotourism Buckley replicated his definition of ecotourism, "a nature-based product or setting; active management to reduce environmental impacts; an environmental education component; and a direct or indirect contribution to conservation of the natural environment, which

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commonly requires close cooperation with and practical benefits for local communities." [35 & 36]. Between 1996 and 2006, international tourism in developing countries expanded by 6% as a whole, by 9% for Least Developed Countries, and 8% for other low and lower-middle income economies [37]. So, ecotourism should get special focus for the perspective of developing countries. In this paper case studies have been drawn from three developing countries –Maldives, Malaysia and Nepal. Nepal is a low income country, Malaysia and Maldives are upper middle income country (World Bank, 18 July 2011) [38]. These countries were selected from low income and upper middle income groups so that it can help to visualize what is the present situation of Bangladesh as a low income country as well as developing country and to set the vision if Bangladesh suppose to move from low income group to upper middle income group. However, except Malaysia, other two countries are located in the same South Asian region as like Bangladesh. The study area, Cox's Bazar, has attraction of wildlife, beach, island and mountains. So, these study areas also have been selected for sharing ideas in similar natural conditions.

2.4.1. MALDIVES – ISLAND TOURISM

Maldives is well known in the international arena for its beach and island tourism, which provide 60% of foreign-exchange earnings, 20% of gross national product, 10% of employment. To minimize the environmental impacts and protect the cultural values, Maldives took the policy of enclave resorts, with tourism development restricted to specified and previously uninhabited islands, one resort per island. According to this policy, officially declarations are: no other development is permitted on the islands concerned; native Maldivians are not permitted on the resort islands unless they work for the resorts; and tourists can only travel to inhabited islands with a guide, and must then return to their resorts each night. Such policy excluded the low-budget tourists. But high value enclave beach tourism was promoted without making environmental and cultural impacts, government revenue from tourism rose steadily from US$5000 in 1987 to US$57,000 in 1999. Maldives Government uses the foreign currency earned from tourism for education, health and telecommunication purposes of all of the citizens. However, there is debate that government incentives are highly centralized, maximum benefits goes to capital city, peoples surrounding the enclave beaches get little benefits. [36 & 39].

2.4.2. COASTAL KAMPUNG TOURISM, MALAYSIA

The Kampungs are small dotted fishing villages of eastern coastline of peninsular Malaysia. The beaches, islands and forests in eastern coastline attracted many visitors since early 1970s. At that time visitors were mainly low-budgeted independent backpackers who were mainly dependent on home-stay and small-scale accommodation in active fishing villages. During that period growth of tourism was gradual, but in 1980s both the scope and extent of tourism development was massive and it continued since a marketing campaign known as Visit Malaysia Year in 1990. In the following years large-scale tourism was developed along the coastline [40].

In 1970s the backpackers were mainly foreign tourists. Later domestic tourists were also attracted by the small-scale kampong tourism. So, the foreign tourists were moving to other villages and in this process, the layout, structure and social life of the villages have changed considerably. For example, at Pulau Tioman in 1983, most residents were engaged in subsistence fishing, whereas, by 1992, 90% were directly or indirectly involved in tourism. Many villagers have become highly successful entrepreneurs and there has been considerable and extensive damage to near-shore marine and coastal environments. At Palau Tioman, for example, by 1984 over 50% of the coral colonies had been damaged by boat anchors; by 1995, 20–40% of individual coral colonies had been killed by sedimentation; and concentrations of the faecal bacterium *Escherichia coli* in the coastal waters were almost 100 times higher than the global recommended standard for safe bathing [40]. Although the nature of the community involvement in the tourism activities in eastern coastline goes well with today terminology of "ecotourism", still there have significant environmental, social and economic impacts.

2.4.3. NEPAL – MOUNTAIN TOURISM

Nepal is world famous as trekking and mountaineering destination. By the late 1990s, over 400,000 people visited Nepal each year, generating US$1.64 million per year and employing between 12000 and 15000 people. Around 75% of these visitors purpose was general sightseeing and 15% of them travelled especially for trekking and mountaineering. There was also strong overlapping of white-water rafting with trekking. For trekking visitors need permit. So, number of trekking is correctly recorded. In 1997, there were over 90,000 trekkers, 40,000 independent and 50,000 travelling with organized

trekking groups. In the same year, there were 120 expeditions involving 861 mountaineers and employing 7000 local support staff. [41].

The economic, social and environmental impacts of mountain tourism in Nepal are severing. In the villages of major tourist spots, like Annapurna Range and Everest, subsistent agricultural production has been diminished by tourism activities. Agricultural land was replaced by hotels, lodges, restaurants, stalls etc. Farmers have cultivated cash crops for sale to tourists; working directly as porters, cooks and guides for group treks. With this additional income Sherpa families prefer their children to get western life rather than the monastic education. One of the very major environmental impacts is generating a large amount of non-biodegradable wastes. It has been estimated that, during the late 1980s, trekkers were leaving over 55 t of litter per year in the Annapurna area alone [41]. Poor sanitation, inadequate toilet facilities along with other human waste have extensively contaminated the streams and river water. The demand of firewood for lodges and tea stalls has contributed to deforestation. However, situation is now changing. A minimum-impact code for tourists has been set while adopting the projects like, "Annapurna Conservation Area Project (ACAP) [36 & 41].

2.4.4. REMARKS

So, from the above case studies we get different pictures and problems in case by case basis. In Maldives government policy on enclave resorts has minimized environmental impacts, protected the local cultural values and increased foreign-exchange earnings. The policy has pitfall for not providing direct benefits to the local or nearby communities. Government has successfully tackled this issue as this is an upper middle-income country and government has capacity to take the burden of people without allowing them to be direct beneficiaries of tourism. However, it would be better if government earnings from tourism activities are utilized for the people in a uniform way. In Nepal hard-core ecotourism activities, like trekking, mountaineering etc. are found. But the country has faced serious economic, social and environmental impacts. The country has limited capacity to maintain environmental sanitation and protect its degradation. On the other hand, the upper middle-income country, Malaysia is suffering for its early stage tourism development which was uncontrolled and unplanned, but, carried solely economic benefits to the local peoples.

2.5. ECOTOURISM IN BANGLADESH PERSPECTIVE

Tourism in Bangladesh is still in premature stage. Although there are lot of potentialities for the development of tourism sector in Bangladesh, but the net gain from this sector is substantially low. So, in view to best use of this potentialities, Government under the Ministry of Civil Aviation and Tourism adopted the new "National Tourism Policy, 2010", which is an updated version of "National Tourism Policy, 1992". In context of this research, some major objectives out of total thirty objectives in the new policy are –

1. Preparing Master Plan at national, regional and local level for development of tourism.
2. Identification of tourism products (attractions), development and promote selling.
3. Promoting tourism activities after preservation of local culture and traditions.
4. Promoting ecotourism after protecting the environment and ecological balance.
5. Declaring the "Tourism Protected Area" and creating "Exclusive Tourist Zone". [42]

Although there is no official definition of ecotourism from the line ministry, but the objective no. 3 and 4 are close to essence of ecotourism. The other objectives are much relevant with the land suitability analysis. To fulfil objective 5, the National Parliament passed a law in the same year of 2010. According to the law government can declare an existing or a potential tourism area as "Tourism Protected Area" and can control any activities within this area. In addition, government can declare "Exclusive Tourism Zone" within a tourism protected area, where government, itself or with the involvement of private sector, autonomous body, any legal organization or an individual, can take over the area. [43]. The law entitled both public and private initiatives for tourism development, but the law do not clarify what measures should be taken if the livelihoods of the local people is affected by tourism development activities within this protected areas. Besides, there are limited guidelines or set criteria in the law or in the aforesaid policy for selecting tourism protected areas. Bangladesh Parjoton (Tourism) Corporation is the prime organization under the Ministry of Civil Aviation and Tourism to promote tourism activities in the country. No exemplary initiative for promoting ecotourism activities has been found from this organization.

Ecotourism in Bangladesh primarily qualify as forest-based tourism. 10.7% of total forest area already has been declared as "Protected Areas" under the Wildlife (Preservation) (Amendment) Act, 1974. The prime aim of a protected area generally is to conserve, maintain and or manage the natural resources. In Bangladesh there is no clear definition of protected area. So, the designated protected areas within the forest jurisdictions of Bangladesh are only those areas which have been notified under the above mentioned act. Total protected areas are 262961.50 ha. There are 15 National Parks covering around 17% and 31 Wildlife Sanctuaries covering around 83% of total protected areas (Please see the notified protected areas in Bangladesh in Appendix − 2). There are other conservation sites which include Botanical Gardens, Eco-Park, Safari Park etc. [44 & 45]. To conserve, protect and manage with sustainability of the forest land and biodiversity of the protected areas, in 2004, the Ministry of Environment and Forest lunched an ambitious program entitled "Nishorgo" [45]. Under this program a number of ecotourism sites have been developed. For example, Satchari National Park, Lawachara National Park, Sundarban Wildlife Sanctuary, Hakaluki Haor ECA (Ecologically Critical Area), Chunati Wildlife Sanctuary, Sit-Kunda Eco-park, Modhupur and Bhawal National Park etc. [46]. These sites are mostly visible and accentuated spots for ecotourism activities. This paper will highlight two sites for in-depth study – the Lawachara National Park and Sundarban Wildlife Sanctuary.

2.5.1. LAWACHARA NATIONAL PARK

The park is located in Kamalganj Upazila (Sub-district) of Moulavibazar District. It was originally under the West Bhanugach Reserve Forest of Moulavibazar Range and was notified as National Park in 1996. The gazetted area of the park is 1250 ha. The wildlife diversity comprises 460 species, of which 167 are plants, 4 amphibians, 6 reptiles, 246 birds, 20 mammals and 17 insects. The Lawachara National Park is one of the most popular birding areas of the country and is the "best park to watch rare Hoolock Gibbon" [47, 48 & 49]. In the first three months of 2008, the number of visitors in Lawachara National Park was around 22,000 [44].

The tourist attractions of the park are primarily facilitated by three designated walking trails – half-hour trail, one-hour trail and three-hour trail. There are differences in wildlife diversities and landscapes for each trail. Depending on the duration of trails, they can be divided from soft to hard tourism. Somewhere it is plain while somewhere the trails are

hilly. There are number of observation spots under each trail. All over the park there are thematic maps, signs, decks, sitting places etc. for helping tourists to getting nature's education and other information, knowing heritages, finding enjoyments, maintaining ethical manners and getting rests. The site is used to safeguard the conservation values ecologically, biologically and socio-economically. Regulation of water, control of soil erosion, irrigation, and carbon sink are the main ecological functions. Biological values are providing shelter to important flora and fauna, habitat connectivity, presence of threatened and endemic species. The park also has socio-economic values. It provides the livelihood opportunities for a number of communities including ethnic minorities. Two *Khasia* ethnic communities are another tourist attraction. They are important cultural heritage from ecotourism perspective. [47].

According to a bi-ministerial decision between the Ministry of Environment & Forest and the Ministry of Health, some part of the eastern boundary (nearly 1 km) of the Lawachara forest was given to an NGO called HEED under long term lease [47 & 50]. The major activities of that NGO are on the issue of health, education and economic development. Its ongoing and previous activities are not linked with any forestry activities like conservations, plantations, ecotourism promotion, maintaining biodiversity etc. So, it was not appropriate to provide land to that NGO within the forest jurisdiction.

2.5.2. SUNDARBAN WILDLIFE SANCTUARY

Sundarban is the world largest mangrove forest. The forest is located at the south western part of Bangladesh and covers three districts (Satkhira, Khulna, and Bagerhat). Total area of Sundarban reserve forest is 600,017 ha that covers around 50% of the total forest area of Bangladesh. Protected area under Sundarban reserve forest is 199,299 ha that comprises three wildlife sanctuaries – Sundarban East Wildlife Sanctuary, Sundarban West Wildlife Sanctuary, and Sundarban South Wildlife Sanctuary [46]. Around 2,5000 tourists visit these places annually [44].

Sundarban is very reach for its biodiversities. Within these wildlife sanctuaries there are 375 faunal species which include around 35 reptiles, 315 birds, 42 mammals and 291 fish species. The forest is reach in mangrove species like the Sundori, Gewa, Keora, Goran etc. (in local name). Birds like Woodpecker, Crocodile, Monkey, Deer, and Dolphin along with many other fauna are attractions of Sundarban. However, the paramount

attraction is the Royal Bengal Tiger. Sundarban produce good quality of testy honey. Tourists are thrilled during their journey through river and cannels within the forest. [44 & 46].

There are around 104,429 households around the surrounding communities of Sundarban Wildlife Sanctuaries. Traditionally these villagers are deeply tied with this forest for their livelihood. Predominantly they are dependent on the forest for fishing activities and honey/wax collection.

Actually the works of Nishorgo Program for promoting ecotourism in Sundarban is not much distinguishable. Because, from the time being Sundarban was identified as popular tourist spot. The Forest Department and National Tourism Authority have taken many initiatives to foster tourism development in Sundarban. Sundarban has been recognized as world heritage site. Sundarban Wildlife Sanctuaries have gotten high priorities in the eyes of the Government and donor communities. Many private tour operators are working for facilitating tourism in Sundarban. Different types of projects are being implemented on and around this forest area where lately climate change is the burgeoning issue. However, Nishorgo is working in the process of management and conservation of Sundarban Wildlife Sanctuaries. This management and conservation procedures are almost similar to the initiatives taken in the other protected areas like Lwachara National Park.

2.5.3. MANAGEMENT OF PROTECTED AREA UNDER NISHORGO PROGRAM

The management and conservation purposes of the Protected Area under Nishorgo program is served most prominently with support of Integrated Protected Area Co-management (IPAC) project. The project is funded by USAID in collaboration with Government of Bangladesh's Ministry of Environment and Forest and Ministry of Fisheries and Livestock. The major features of the Co-management include [46 & 51] –

- Formation of Co-management council and committee, village conservation forums, people's forums etc. With these committees and forums stakeholders from public, private, civil societies, local governments and institutions, local communities, ethnic minorities and many others elected and official representatives are involved for forest management.

- Development of eco-tourism support in the forest area including training a cadre of eco-guides from local communities as well as establishment of eco-cottage near the sanctuaries or parks.

- Establishment of entrance fee for revenue collection and 50% of the tourism fee accrue to the Co-management committee for development of forest and livelihood of local people.

- Alternative Livelihoods Development training and support for forest dependent communities like MoUs between local communities and national buyers in both fisheries and handicrafts.

2.5.4. REMARKS

So, the essence of ecotourism in Bangladesh has been institutionalized through Nishorgo Program. However, the program is more than the ecotourism development. The primary purpose of the program is conservation and sustainable management of the protected areas. With some few example of ecotourism development under Nishorgo Program we cannot say ecotourism has gotten impetus in Bangladesh. Because in terms of revenue collection there is little contribution of this ecotourism sites on the national economy as well as local people. There are limited accommodation and other tourist service facilities within the forest areas. These facts not only reduce the number of soft tourists but also local people are deprived from economic gain that occurs for tourist multiplier effect. It is true, for the conservation and management of forest, accommodation and others massive infrastructure based tourist facilities should be limited within the forest areas. But, there should have alternative means. Finally, the ecotourism sites are solely forest based. Other tourism options like beach-tourism, island tourism, cultural tourism etc. also should be focused.

CHAPTER 3: PROFILE OF THE STUDY AREA

The objectives to narrate this chapter are to give an overview of the study area and at the same time highlighting some points those are linked to factors and criteria of ecotourism land suitability evaluation, like, population, landuse, topography, flora and fauna, traffic and transportation and existing places of tourism attractions.

3.1. LOCATION

The study area lies on the southern part of Cox's Bazar District. The area start from Cox's Bazar town and its surrounding area, end up to the end of Teknaf peninsula and also includes the St. Martine's Island. The study area is bounded by Bay of Bengal on the west and south; Bandarban district, Myanmar and Naf River on the west. (Please see the Map 1 & 2).

3.2. AREA AND POPULATION

The study area has an area of about 890 sq. km. Total population of the study area is 631729, which is around 36% of total population of Cox's Bazar district. The density is 710 persons per sq. km. The male-female ration is 53:47. There are 103522 households. The average size of household is 6.1. Around 61% of households are engaged with agricultural activities. Other activities are business, employment, construction, religious services, transport and communication etc. There is no data available on earnings from tourism sector. Around 30.19% of people are literate, meaning that, the people who are able to write in any language. The number of tribal households found in the study area is 176 that make a total population of 1155. The tribal communities are mainly *Rakhain.* [52]

3.3. ADMINISTRATIONS

The study area covers Teknaf, Ukhia, most of the part of Ramu and a portion of Cox's Bazar upazila (sub-district). There are two Pourashavas (municipality), 20 Unions (local rural government unit) and 56 Mouza (land administration unit) in the study area. The pourashavas are Cox's Bazar and Teknaf town.

3.4. PHYSIOGRAPHIC CHARACTERISTICS

3.4.1. LANDUSE

The study area covers 48% of residential or homestead and agricultural land, 43% of vegetation area, 7% of waterbodies and 2% of beach and other sandy areas. The agricultural lands are used for crop cultivation, salt cultivation and shrimp cultivation. The vegetation coverage includes forest areas, bushes, social forestry and other plantation areas.

3.4.2. TOPOGRAPHY

Some areas are plain, some are low lying areas, some are marshy and some major parts of the study area are hilly. The elevation of the study area ranges from below 1 meter to 224.36 meter. The slope ranges 0 degree to 10.35 degree. (Source: Water Development Board).

3.4.3. CLIMATE

Cox's Bazar is very much suitable for its moist maritime climate. The temperature ranges from 14.8°C to 32.5°C. Rainfall is very heavy from May to October. Annual rainfall is about 3378 mm. (Source: Bangladesh Meteorological Department).

3.4.4. FLORA AND FAUNA

Cox's Bazar is a wonderful land for its unique biodiversities. The study area covers four important places of biodiversity – The Teknaf Game Reserve, St. Martine's Island, Inani and its surrounding reserve forest and Himchari and its surrounding reserve forest. A more detail information on the flora and fauna of these places has been mentioned in section 5.2.2 (Species Diversities).

3.4.5. TRAFFIC AND TRANSPORTATION

The Cox's Bazar town is directly connected with Dhaka-Chittagong-Cox's Bazar National Highway. A regional level road passes from Cox's Bazar town to Teknaf town that provide major accesses up to the end of Teknaf peninsula. A lot of feeder roads joining with the National and Regional highways make most of the study area easily accessible. St. Martine's Island is connected with Teknaf town by waterway that takes in Naf River and Bay-of-Bengal. An Airport also exists in Cox's Bazar town.

3.5. PLACES OF TOURISM ATTRACTIONS

3.5.1. KOLATOLI POINT

The place is an entry point of sea-beach at Cox's bazar town. After Laboni Point it is the most popular beach point of the District.

3.5.2. HYMCHARI

Here, both the sea and the hill located in two opposite direction can be view from one single point. The place is also popular for its stunning waterfalls.

3.5.3. RIZU KHAL

The Cannel, named Rizu Khal, formed special beauty of this area. The cannel with its surrounding uninhabited landmass adjacent to the sea and hill makes the beauty.

3.5.4. INANI SEA-BEACH

This is a calm and crowd free sea-beach. This beach is popular for its golden sand and clean shark-free water which is ideal for swimming. In addition, there are coral rocks along the beach.

3.5.5. TEKNAF

Three tourist spots are located surrounding the Teknaf town. One is the Teknaf sea-beach which has much rural flavor. The Shahparir Dwip, a place at the shoreline, is the end point of the mainland of Bangladesh. The Teknaf Ghat, that provides water transportation route to St. Martine's Island, has a beautiful water front. The blue Naf River and the Hills on the River Bank make the view scenic.

3.5.6. ST. MARTINE'S ISLAND

This is a small island located at the south-east end of Bangladesh. This is the only coral island of the country. The blue sea water of the island is different from other areas. There are lots of coconut trees in the island; hence, the island is also called 'Narikel Jinjira'.

3.5.7. HILLY FOREST

The places of Whykong and Nhilla under Teknaf Game Reserve are popular for their hilly forest lands. The areas are rich for their biodiversities.

3.4.8. ARCHEOLOGICAL SITES

The Aggamedha Buddhist Kyang, Ramkut Temple, Buddhist Temple at Ramu etc. are some spots, which are culturally and historically significant for the study area.

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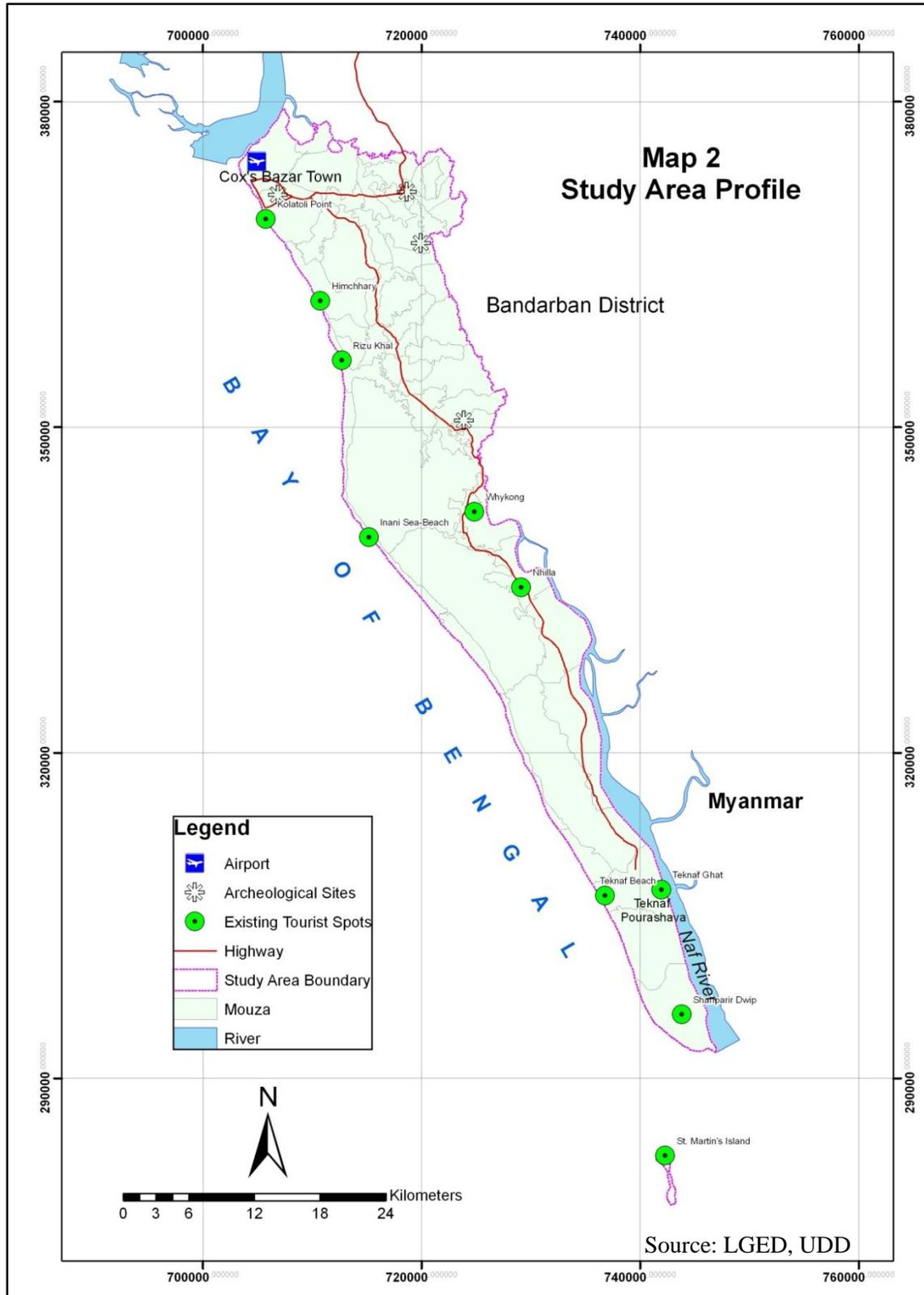
CHAPTER 4: MCDM AND GIS FOR LAND SUITABILITY ANALYSIS

One of the motivations of this research work was to apply Multi-Criteria Decision Making (MCDM) technique for making a better evaluation of ecotourism land suitability. So, this chapter highlights some fundamentals and importance of MCDM, discuss principles of two types of MCDM techniques (Fuzzy logic and AHP), which are useful for land suitability analysis in combination with GIS, and finally, justify why AHP has been selected for this study.

4.1. MULTI-CRITERIA DECISION-MAKING (MCDM)

Human decisions are not always simple rather full of complexity and conflicting. Multi-Criteria Decision-Making (MCDM) or Multi-Criteria Decision Analysis (MCDA) techniques deal to simplify such complexities those arise for handling large amount of complex information in a consistent way. There are many MCDM techniques and their number is still rising. The variations in MCDM approaches occur due to several reasons like, types of decision, time availability, amount or nature of data, the analytical skills of those supporting the decision, administrative culture and requirements of organizations etc [53]. However, from literature reviews two basic types of MCDM techniques can be distinguished – multiple attribute decision making (MADM) and multiple objective decision making (MODM). MADM identify best alternative from a set of finite number of alternative solutions. While, MODM deals with infinitive number of alternatives [54]. This paper highlights MADM techniques.

4.2. MCDM AND GIS FOR LAND SUITABILITY ANALYSIS

MCDM combined with spatial analysis form Spatial Multi Criteria Evaluation (SMCE) which are much popular techniques now a day due to extend of GIS technologies [55]. Such techniques are quite useful for land suitability analysis. Land suitability analysis is the process to determine whether the land resource is suitable for some specific uses and to determine its suitability level [56]. So, in this process of analysis there need to set wide variety of criteria, spatial and non-spatial, based on different objectives. Geographic

Information System (GIS) is the powerful tool for input, storage and retrieval, manipulation and analysis, and output of spatial and attribute or non-spatial data. Hence, suitable MCDM technique embedded with GIS can be used successfully for land suitability analysis, that is, for identifying suitable locations against given purposes. From a number of literature survey two GIS based MCDM techniques are mostly found for land suitability analysis. –Fuzzy Logic and Analytical Hierarchy Process (AHP).

4.2.1. FUZZY LOGIC

Fuzzy logic was introduced by Lofty Zadeh in 1965 in his "Fuzzy Set Theory". It is a useful technique to make reasoning of real world objects which are full of vagueness and uncertainty. The usefulness of fuzzy logic can be highlighted by comparing with the traditional Boolean logic or binary theories. In the traditional logics where just "yes" or "no", "true" or "false" are the options of choice, in contrast, fuzzy logic allows multi-valued theory where intermediate values like "moderate", "high", "low" etc. can be determined. In the traditional theories the membership functions are 0 or 1. In fuzzy logic the membership value of an element is somewhere in 0 to 1 under some defined intervals. Thus fuzzy logic can be treated similar to probability theory and the results are said to be approximate rather than exact and fixed. But defining the interval of choices (like "moderate", "high", "low" suitable landuse) in fuzzy logic is much tricky and need highly expert orientation. The method requires complex process of comparison and applying ranking system in this method gives unreliable results. The method comprises considerable amount of calculations and the situation will be more complex where the number of criteria will be large. [57 & 58]. However, a prominent feature of fuzzy logic is that it considers objectivity in the decision making process which seems much scientific.

4.2.2. ANALYTICAL HIERARCHY PROCESS (AHP)

AHP is one of the most popular MCDM techniques developed by Saaty [59]. It is used to identify the best one from a set of alternatives with respect to several criteria. The principle utilized in AHP is to solving problem by forming hierarchies. At first, a hierarchy tree is drawn to segregate each criteria into lower sub-criteria at two or more levels. At the top of hierarchy tree the goal is set and then major criteria and sub-criteria are fixed. Thus AHP help to make assessment from lower criteria; each criteria and sub-

criteria have individual performance to fixing the goal. Then, a basic step of AHP is to prepare *comparison matrices*. The score for comparison matrices are calculated from relative importance between each pair of criteria, that is pair-wise comparison. To calculate scores for pair-wise comparison, Saaty suggested a 9 degree scale where available values are member of the set: {9, 8, 7, 6, 5, 4, 3, 2, 1, ½, 1/3, ¼, 1/5, 1/6, 1/7, 1/8, 1/9}, 9 represent absolute importance and 1/9 the absolute triviality. The final basic step in the AHP is evaluation of the comparison matrices under measurement theory. A standardize eigenvector is extracted from each comparison matrix. It helps to assign weights to criteria and sub-criteria [57 & 3]. Assembling the weights allows us to make priority, ranking of our alternatives and decisions. For each level of hierarchy a parameter, *Consistency Ration*, is calculated to check if our preferences are consistent for comparing criteria. This is a very strong mechanism of AHP to structure our subjective judgments and conflicting decision in an organized and meaningful way.

In this section the AHP method has not been described in more detail. The research itself identified the AHP for its working tool (please see the following section). The detail steps of AHP have been described in the following chapter (Chapter 5) where the major works of this thesis work have been presented.

Every MCDM technique has some advantages and disadvantages. As stated before, the selection of MCDM approach depends on the types of decision, time availability, amount or nature of data, the analytical skills of those supporting the decision, administrative culture and requirements of organizations etc. and overall the purpose of the study. AHP is widely useful technique but it is not free of pitfalls. Some researchers criticized AHP for its unbalanced measurement scale, and its inability to deal with uncertainty and imprecision of the decision maker's perception [60]. But fact is human decision cannot always judge everything precisely. Where the real world is full of uncertainty, there people have to choose the best possible outcome. In this sense, AHP is a fruitful technique. Its hierarchical procedure discomposes the complex decision into a manageable number of levels. It maintains consistency during the comparison and assigning weights to the criteria to resist the contradictions in decisions. Thus it helps to decide like as, if A is more preferable than the B. By accumulating different criteria into different level, AHP allows to share opinions of expert knowledge, respective interested groups, beneficiaries or related stakeholders in the decision making process [57]. The

qualitative subjective judgment can be justified under quantitative measurement theory, which make AHP a very useful and easy to use decision making tool. The quantitative measurements finally allow making ranking where best possible outcome can be determined.

4.3. WHY AHP HAS BEEN SELECTED FOR THIS STUDY

From Chapter-2 we found making acceptable definition of ecotourism is tricky – 'soft' or 'hard', 'natural' or 'unnatural', exploitive-active or passive etc. are some quality of ecotourism defined by different agencies and operators in different ways. However, there are different dimension of ecotourism; nature based, environmentally and culturally educative, sustainability, conflict with mass tourism etc. Under these dimensions and typology a lot of criteria and sub-criteria, like ecosystem, landscape/naturalness, wildlife, topography, accessibility and community characteristics etc. can be set to ensure the ecotourism activities. So, AHP is necessary here to set the criteria in a structured way. Features under this criteria and sub-criteria may exist in separate locations or can coexist in a single location. So, each criteria need to be evaluated individually as well as need to sum up all the criteria on a given location for estimating its level of preference. AHP embedded with GIS can easily handle the matter with their measurement and overlay techniques. As we see, ecotourism is a vague term in many cases, so subjective judgment is an essential part to allow or treat ecotourism in a place with greater sensitivity and sustainability. AHP allow subjective judgment in more consistent way by minimizing the contradictions among the set of decision criteria. Ecotourism includes lot of disciplines, different stakeholders as well as experts. So, for better ecotourism planning, involvement of all the experts and non-experts groups of people is necessary. AHP has due advantage in this matter. For a greater area like Cox's Bazar, several potential ecotourism sites can be selected. There a ranking process is necessary to justify the suitability in terms of "high", "moderate" or "low" suitability. For this final reason along with others, AHP has been selected for this study, which is, identifying suitable locations of ecotourism in Cox's Bazar.

CHAPTER 5: APPLICATION OF AHP ON THE STUDY AREA

An outline of methodology was drawn in Chapter-1. This chapter discusses most of the operational works done in this research in detail manner. So, here discussion were made step-by-step in consideration of data inputs, theory, principles, calculations and tools applied under the measurement theory of AHP; and at last, results were presented and discussed.

5.1. PREPARING THE RESOURCE MAPS
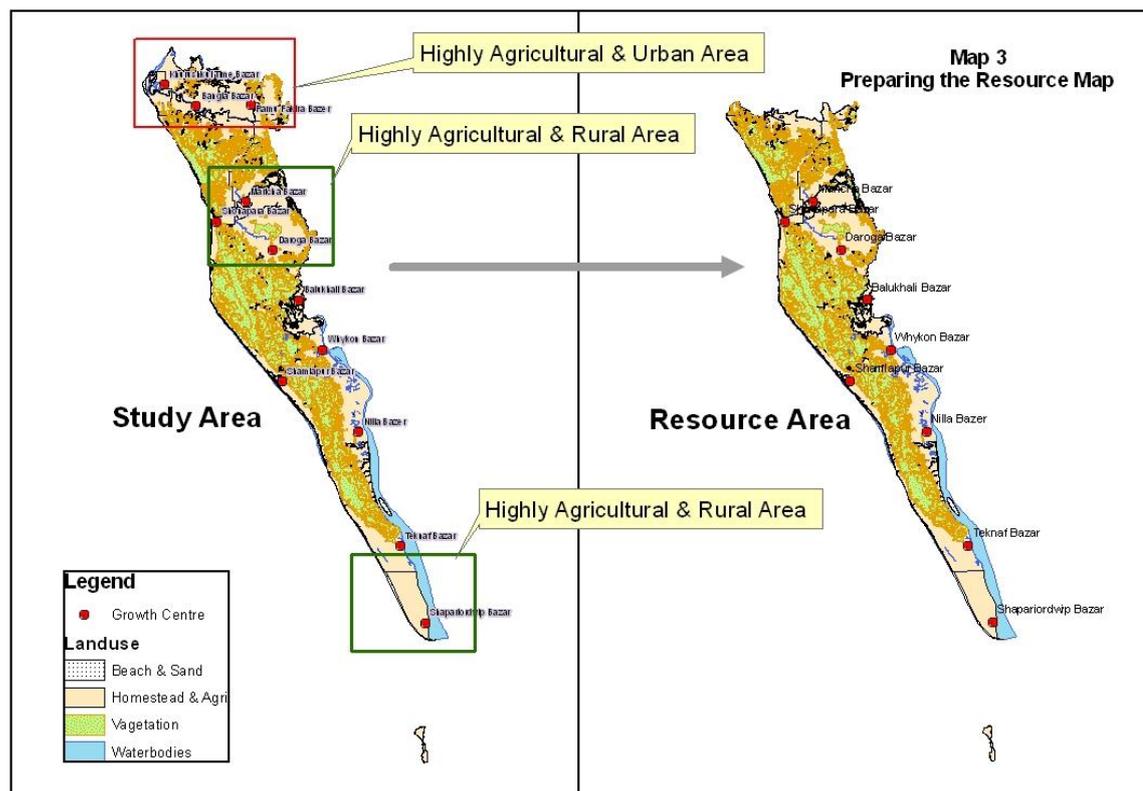
In generally the study area was classified in four landuse classes – (i) Homestead or residential and agricultural landuse, (ii) vegetation, (iii) waterbodies and (iv) beach and sand areas (please see section 3.4.1). Ecotourism deserves naturalness. So, densely urban area and vast agricultural land are not suitable for ecotourism. The northern most part of the study area has around 65 sq. km of homestead and agricultural land which is larger than any other part of similar landuse. This area includes densely Cox's Bazar town and it

surrounding densely areas. So, this area has been removed from the study area. The outer boundary of the resultant area was used to extract growth centers, existing tourist spots, DEM and other datasets within that area. The datasets extracted under this boundary are in fact the resources of ecotourism. Please see the Map 3. The growth centers in the red box area do not appear in the resource map. There are other areas (in the green boxes) which have extended agricultural and homestead lands. But these areas are mainly rural. So, these areas have not been deducted from the study area.

5.2. SELECTION OF CRITERIA

In AHP process selection of criteria and their sub-criteria is a crucial stage. Because, selection of criteria influence the judgment by segregating one criteria from other and at the same time, giving more importance to one criteria over other. By synthesizing numbers of literature reviews, local contexts and expert opinions a number of criteria and sub-criteria have been selected for this study. The sub-criteria were further divided into several factor ratings depending on their importance or preferences at different levels. The justification of selecting those criteria, sub-criteria and factor ratings are as follows –

5.2.1. NATURALNESS

The naturalness or scenic attractiveness can be evaluated from interpretation of landscapes. Evaluating the properties of landscapes in terms of landform and landuse can be a useful tool for the assessment of naturalness that can be harnessed for the tourism development [61]. Recent studies have applied several techniques for this assessment. A more pronounced technique in this era of modern GIS technology is "Viewshed Analysis". Using this technique one can identify the areas which are visible from an observation point or line. Then he can easily analyze which visible area is in near distance or which is in far distance according to his own distance criteria. In context of this study the determining landform factors of naturalness are –

Sea

"Cox's Bazar is the longest unbroken sea-beach in the world". This is a widely published statement. The sea and its elongated beach is the major tourism element of Cox's Bazar. So, in view to give the maximum priority, sea has been considered as a different sub criteria of naturalness from other natural factors. In the actual mapping works a coastline was drawn for the viewshed analysis of sea and beach.

Other Waterbodies

Rivers, cannels and lakes have some value for exaggerating natural attractions. So, waterbodies were treated as another criterion of naturalness.

Springs and Caves

In the study area there are some places of springs and caves. These places have different taste for tourists. These criteria should be overlaid on other criteria. So, these places were defined as different criteria of scenic attraction.

A typical job was to find out the visible range for the interpretation of naturalness. It is natural the vagueness and haziness of objects increase with increasing distance. Bishop and Hulls [62] made a classification based on distance between the observer and the object. They restricted the maximum observable distance to two kilometers as beyond this range visual impact of the object is minimum. They classified distance into three ranges – near range (<250 meter), middle range (250 meter < to <750 meter) and far range (750 meter < to <2 km). The near range is the foreground distance zone where detail information of landscape features such as tree limbs, leaf pattern, movement in water, geomorphologic features and building details etc. are visible. In the middle range the observer can identify individual trees, building types, river pattern etc. The far range is the background zone where textures are weak or sometimes non-existent and changes in patterns can be distinguished by changes in colour. In the current study same visible ranges were used to make factor rating of naturalness.

Landform or landuse criteria like forest density, elevation etc. are also contributing factors for scenic attractiveness. But from the ecotourism perspective they have some distinct values. They offer some extraordinary recreational and educational elements. For example, hilly areas are used for trekking, forest areas allows jungle life, make visitors familiar with wild plants and animal species etc. So, those natural factors were reflected separately in other major criteria.

5.2.2. WILDLIFE

The wildlife has been categorized into three criteria – forest density, reservation or protection class and species diversities.

Forest Density

Initially forest area was determined from 0.6m Quickbird Image. To do this job Normalized Difference Vegetation Index (NDVI) was calculated. NDVI is a useful technique to distinguish between vegetation and non-vegetation area. Vegetation canopy has higher reflectance in near infrared region (NIR) than substances like water, bare soil, sand etc and has lower reflectance in visible red region. For this fact NDVI is calculated by following formula –

NDVI = (NIR-R) / (NIR+R)

Where, NIR = Near Infrared band and R = Red band of visible spectral reflectance length.

NDVI value ranges from -1 to +1. Different ranges of NDVI values show different land classes. For example, values 0.3 to 0.8 show dense vegetation canopy, soils consist low positive values between 0.1 to 0.2, water has very low positive or slightly negative values etc. [63 & 64].

In the current study after calculating the NDVI from Quickbird Image, rigorous visual interpretation was maintained on the same image for creating a land class. It was visualized that in general, higher NDVI values (>0.5) show agricultural region, moderate NDVI values (0.2 – 0.5) show forest texture, lowest values (<0.2) show no vegetation, fallow agricultural lands, waterbodies, sands and bare soil etc. But more careful observation shows that there are many overlapping between the value ranges of agriculture and that of forest, between forest and fallow lands. Actually, NDVI has some limitations for such land classification. Atmospheric effects, soil effects, spectral effects, anisotropic effects etc. are some common phenomenons that influence the NDVI calculation. So, NDVI need to be calculated with great caution. Intensive ground truthing is necessary. New measurement parameters may be necessary to set [63 & 64]. These processes need higher level of expertise also. To avoid such costly and timely job, in this study some ancillary data were used (source: Forest Department) –

- Forest Jurisdiction Map
- Vegetation Map
- Landclass (using Landsat image)

With support of these ancillary data forest lands were categorized into three categories – high density forest, moderate density forest and low density forest. The lands, which have high moderate NDVI value, enclosed by forest jurisdiction boundary, falls under the forest landclass of Landsat image as well as shown as high forest area in the Vegetation Map; have been shown as high density forest areas. The landclass, which have high or low moderate NDVI values, falls under the plantation and Garjan forest area of the Vegetation Map; has been classified as moderate density forest area. The landclass, which have low moderate NDVI values, covers herbs/shrubs/bushes areas in Landsat image and falls under the low forest area of the Vegetation Map; has been classified as low density forest area. Although the Vegetation Map showing forest areas were available but it was used as ancillary data. Because, the map was prepared in mid 1990s. By this time, there may have rapid changes in forest lands.

Reservation or Protection Class

The Reserved Forest area or protected forests are declared in Bangladesh according to the Forest Act, 1927. Under the Bangladesh (Wildlife Preservation) Order, 1973, Game Reserve, National Park and Wildlife Sanctuary are declared [65]. The later declared areas can be treated as protected areas of Reserve Forest area. These areas are especially cared for conservation and management of natural resources. Undisturbed recreational facilities are also promoted in these areas. So, the reserved forest areas were classified into two sub-criteria – Protected Areas and other remaining Reserved Forest areas. It can be easily presumed the protected areas got higher priority for ecotourism development.

Species Diversities

The number of species diversity shows the richness of biodiversity of any wildlife habitat. Besides recreation ecotourism also serve the purpose of education. Knowing wildlife, exotic plants and animals are part of ecotourism. But, this education is not learning like a person of a disciplinary background or of a scientific community. This education in conjunction with recreation has effects on a person's long term memory. So, just number of species in not only attraction of ecotourism but some specific exotic species and wilderness are also major attraction in this aspect. For example, the Royal Bengal Tiger is the most prominent attraction of Sundarban. In this sense, four locations have been identified within the study areas for factor ratings of species diversity criteria based on number of species diversity, presence or visibility of some specific exotic flora

or fauna and wilderness. Other areas were treated as not suitable for species diversity criteria as those areas are neither forest nor island but usual rural settlement. A short brief on species diversity of those four locations are as follows –

Teknaf Game Reserve

The Game Reserve supports highest biodiversity of Bangladesh. The place is habitat of 290 plant, 55 mammal, 286 bird, 13 amphibian and 56 reptile species. The major attractive animal of this Game Reserve is elephant. It is the home for one third of total elephant population of the country [66]. This Game Reserve has gotten highest priority among the all factor ratings.

St. Martine's Island

St. Martine's Island is a popular place for its marine habitat. It is called the only coral island of Bangladesh. The island has 66 coral species, of which 19 are fossil corals, 36 are living corals and rest of them are soft corals. It is an important nesting ground of 3 marine turtles. Among the other faunas the Island has 120 bird species, 11 reptile species and 19 mammal species. It has 260 plant species. The Island is abundant of coconut tree; hence, locally it is called "Narikel Jinjira", where "Narikel" means coconut. [67]. This Island has gotten second priority.

Inani

Inani and its surrounding forest areas have 317 plant species, 42 amphibians, 166 reptiles, 728 birds, and 126 mammals [66]. In terms of number of species it has gotten higher priority than the 4th factor, Himchari.

Himchari

This hilly forest has 55 mammal, 286 bird, 13 amphibian, 56 reptile and 117 plant species.

5.2.3. TOPOGRAPHY

There are three components of topography – elevation, slope and aspect. In this study aspect has not been considered as the study area is considerably large. The elevation and slope factors have been classified according to the local condition.

By making visual comparison with Satellite Image, it was found elevation at >100 m is high hilly area, 50-100 m elevation range is medium hilly area, 25-50 m is low hilly areas and 0-25 m is simply plain land. An elevation range of >100 m is most suitable for tourism, while 50-100 m elevation has moderate suitability and so on. Sometimes elevation larger than 400 m has low suitability as that elevation level is too laborious except for too hardcore tourists. But in the study area this condition does not exist. The highest peak of the study area is about 211 m. Elevation below 25 m is plain land, so, it is not suitable for ecotourism in topographical perspective.

Smooth slope is easy to trek. In the study area, the slope condition is much convenient for trekker. The highest steep slope is only 10.35 degree. So, slope suitability from high to low suitable can be classified as interval of 0-5° and >5°.

5.2.4. CULTURAL HERITAGES

Ecotourism is culturally educative. So, two types of Cultural heritages have been defined − tangible cultural heritage and intangible cultural heritage.

Tangible cultural heritages include historically and archeologically significant places, sculptures, and monuments etc. which are physically visible.

Intangible cultural heritages comprise traditions, customs, languages, social values and other aspects of human activities. To study such intangible cultural heritages would be a huge job. So, in the current study, five community groups have been identified based on their languages and ethnicity which are different from that of the mainstream population of Bangladesh. The communities have been identified from Bangladesh Bureau of Statistics [68]. These community groups are mainly tribal people. GPS positions of tribal people were collected during field survey to trace their exact locations.

For determining the factor ratings of cultural heritages Euclidian Analysis was applied according to the proximity of cultural sites. Euclidian distance at 0 -15 km from cultural site got highest priority, 15-30 km interval got second highest and 30-45 km interval distances got lowest priority. Distances larger than 45 km was treated as not suitable. This proximity ranges were fixed according to the literature reviews, expert opinions and local context which are based on the conveniences of trip for a day. For example, within 0-15

km distances, a tourist can easily make trip with any motorized or non-motorized vehicles or even by walking. Both motorized and non-motorized vehicles are available in Cox's Bazar. Then, within 15-30 km distance a tourist can easily visit with a motorized vehicle. Within 30-45 km distance his cost and time of journey will be high. Above the 45 km distance means a long trip for a day which may be inconvenience for a tourist.

5.2.5. COMMUNITY CHARACTERISTICS

From environmental and ecological perspective community characteristics are not an important factor of ecotourism. But for the long term sustainability economic benefits should be ensured (please see the section-2.1.3). To attain long term economic benefits, involvement of local communities is must. Ecotourism looks relative undisturbed and unspoiled natural resources. So, settlements with no or low inhabitants are more attractive for ecotourism than densely populated settlements. This is also true for infrastructures like road networks, that is, fewer infrastructures are more desirable for ecotourism. But such a typical ecotourism is close to much natural, hard and passive forms of ecotourism (please see section-2.2). These extreme forms of tourism will not be economically viable in context of our country. Several researches identified that some major problems in our tourism industry is lack of accommodation facilities, limited infrastructure facilities etc. [69, 70 & 71]. Findings from those researches justify that tourists of Bangladesh are primarily soft tourists. Economic viability cannot be maintained without participation of those soft tourists. To create service and infrastructure facilities for those soft tourists, existing growth centers could be some core zones for service and infrastructure development. Existing growth centers are partially or fully urbanized in nature. So, concentration of development within or surrounding of these growth centers will minimize impacts on nearby natural places, will promote number of tourist destinations as well as tourist numbers and local people will be benefited from this increased number of tourists. In Cox's Bazar, the existing tourist spots are prominent places for their natural beauties and cultural heritages. So, these places should get a distinct weight to calculate overall ecotourism performance.

So, from the above discussions five different community characteristics can be drawn –

Distance from roads

There are three types of roads – National Road, Regional Road and Feeders or others tertiary roads. Areas within 5 km buffer from National and Regional roads will not be suitable criteria for ecotourism as we wish to avoid close proximity of heavy infrastructures. Areas within 10-15 km distance from National and Regional roads got higher priority than that of 5-10 km distance. While, areas at more than 15 km distances got highest priority. It was found the available data on tertiary roads is not complete. So, to avoid discrepant effect of that data, no criterion was set for tertiary roads. However, this would not make effect on overall results and findings. Because, from the Satellite Image it was easily visualized that most of the places of study area are connected with some sorts of tertiary roads either it is metal, paved, unpaved or footpath. So, making buffer at even 2 km distance from those roads would cover the whole study area that would analyze the total study area in a common single parameter.

Proximity to Growth Centers

Growth centers are township and market places of their rural hinterlands. For factor rating of growth centers, similar to cultural heritages, Euclidean analysis has been applied. But based on spatial distribution of growth centers the distance intervals were set similar to road criteria.

Proximity to Existing Tourist Spots

The more close to the existing tourist spot the more convenience for journey time and cost. For analytical purposes proximity was classified into three equal intervals – 0-5 km, 5-10 km, 10-15 km.

Settlement Size

Settlement size was categorized according to the ranges of population density (population/sq km) of Mouzas. Mouzas having high density (above 2000 person/sq km) is not suitable for ecotourism since those areas are densely urban areas. Different ranges of population density are at equal interval of 0-500, 500-1000, 1000-1500 and 1500-2000 person/sq.km. Here, population at 0-500 range got highest priority and consequently, population at 1500-2000 range got lowest priority.

Community Attitude

Community attitude levels were examined by field survey. The field survey was conducted using Rapid Rural Appraisal (RRA) tool. The RRA meetings were performed on any suitable place, like, tea stall or nearby local government office etc., of every

growth centre. The growth centers were chosen for RRA study, because, every people are somehow connected to the nearby growth centers. It was not possible to study so many different communities individually. There is no designated growth centre in St. Martine's Island. But as the island is isolated form the main land, so, separate RRA was conducted there. During the RRA no direct question was asked to people to know their attitude strength. They were asked to describe at first what benefits they would get if tourism is promoted in their localities. What would be the negative impacts? Would they permit tourism if negative impacts are minimized? In other words, if they would permit ecotourism? What are their suggestions to minimize negative impacts or to promote ecotourism? Then, by synthesizing their views and opinions, the level of attitude strength was justified (please see Appendix – 1(B)). It was found all groups are positive towards ecotourism development. So, the attitude strength was not further classified into different levels.

Now, the factors, criteria and their ratings justified in the above discussions can be shown in the following table –

Table 2: Factors and Criteria of Ecotourism.

Factors	Criteria	Unit	Factor Rating				
			Class-1	*Class-2*	*Class-3*	*Class-4*	*Not suit.*
Landscape/ Naturalness	Visibility (sea)	Value range	Near range (<250 m)	Middle range (250-750 m)	Far Range (750-2000m)	-	>2km
	Visibility (other water bodies)	Value range	Near range (<250 m)	Middle range (250-750 m)	Far Range (750-2000m)	-	>2km
	Visibility (waterfalls, cave)	Value range	Near range (<250 m)	Middle range (250-750 m)	Far Range (750-2000m)	-	>2km
Wildlife	Forest density	Density	High density	Moderate density	Low density	-	No Forest Area
	Reservation/ protection	Protection class	Protected	Not protected	Low	-	No protection class

	Species diversity	Diversified Area	Teknaf Game Reserve	St. Martin's Island	Inani	Himchari	No specific area
Topography	Elevation	Meter	>100	50-100	25-50	-	0-25
	Slope	Degree	0-5	>5	-	-	-
Cultural heritages	Proximity to Tangible culture	Kilometre	0-15	15-30		30-45	>45
	Proximity to Ethnic group	Kilometre	0-15	15-30		30-45	>45
Community characteristics	Distance from National and Regional roads	Kilometre	>15	10-15	5-10	-	0-5
	Proximity to Growth centre	Kilometre	0-5	5-10	10-15	-	>15
	Proximity to Existing Tourist Spots	Kilometre	0-5	5-10	10-15	-	-
	Settlement size	Density (population /Sq.Km)	0-500	500-1000	1000-1500	1500-2000	>2000
	Community attitude	Positive ness	Positive				

5.3. PREPARING COMPARISON MATRIX

A useful step of AHP is making Comparison Matrix. The comparison matrix is prepared from Pair-wise Comparison. A Pair-wise Comparison, suppose comparison on how important is the *A* than the *B*, is performed in 9 degree preferences scale as suggested by Saaty [59]. At each higher level of scale shows higher importance than the previous lower level (Table-3).

Although Saaty suggested his 9 degree preferences scale for qualitative judgment based on experiments but at the same time his stance was flexible. Other suitable scale can be followed. Many authors criticized Saaty's numeric scale and several authors tried to improve that scale in alternative ways, but still no unique scale has been suggested other than Saaty's scale [72, 73, 74 & 75]. On the other hand, Saaty's ratio scale is easy to

understand for decision makers and researchers from wide level of backgrounds are using this scale successfully to ease conflict decision making process.

Table 3: Fundamental Scale used in Pair-wise Comparison [76]

Intensity of Importance	Qualitative Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak	
3	Moderate importance	Experience and judgments slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another and dominance is demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation

To make the pair-wise comparison between two factors or criteria under 9 degree preferences scale following diagram was used –

Naturalness	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Wildlife

Figure 4: Diagram to choose preference level between Naturalness & Wildlife.

Using this diagram, at first an expert fixes his stance, either both criteria are equally important or not. If they are equally important, then the value is 1. If they are not, then the expert takes his position where he prefers. If he prefers naturalness to wildlife then he takes left side positions of 1 and vice versa. Finally according to Saaty's 9 degree preferences scale (table-3) he marks his actual value of preference. In his diagram, the naturalness got a weak favor over the wildlife. So, the value of 2 at the left side of 1 was highlighted. Thus pair-wise comparisons were made for all the factors. The number of pair-wise comparison can be calculated using the following formula [76] –

$$\frac{n(n-1)}{2}$$

Where, n is number of total criteria or factors. Suppose, we have 5 factors in our study. So, the numbers of pair-wise comparison were 10 at the first level.

After making pair-wise comparison, Comparison Matrix is prepared. For example, a 5 by 5 matrix was prepared for the 5 factors. Please see the Table-4. The diagonal values of the

matrix are always 1. We filled up the upper triangular matrix at first. If the values are at the left side of 1 (like Figure-5), we put actual judgment. If it is at the right side of 1 then we put reciprocal value. For example, for comparison between naturalness and wildlife, naturalness got higher priority and the value 2 was put at the left side of 1 in diagram scale. So, we put 2 in the column 2 and row 1 of the matrix. Similarly, for comparison between topography and community characteristics, we favored community characteristics and put the value, 3, at the right side of 1. So, the value in column 5 and row 3 of matrix is 1/3.

After filling the upper triangle we fulfill the lower triangle with the reciprocal values. The formula is simple. If a_{ij} is the element of row i column j of the matrix, then the lower diagonal is

$$a_{ji} = \frac{1}{a_{ij}}$$

So, we get the following complete comparison matrix for the factors and criteria at first two levels (table – 4, 5, 6 & 7).

Table 4: Factor Matrix at First Level.

	Naturalness	Wildlife	Topography	Cultural heritages	Community characteristics
Naturalness	1	2	3	5	1
Wildlife	½	1	2	4	½
Topography	1/3	½	1	3	1/3
Cultural heritages	1/5	¼	1/3	1	¼
Community characteristics	1	1/5	3	4	1

Table 5: Criteria Matrix-Naturalness, at Second Level.

	Sea	Other Water bodies	Spring/ Cave
Sea	1	9	2
Other Water bodies	1/9	1	1/7
Spring/Cave	½	7	1

Table 6: Criteria Matrix-Wildlife, at Second Level.

	Forest Density	Protection Class	Species Diversity
Forest Density	1	7	4
Protection Class	1/7	1	½
Species Diversity	¼	2	1

Table 7: Criteria Matrix-Community Characteristics, at Second Level.

	Road	Growth Centre	Tourist Spot	Settlem- ent Size	Community Attitude
Road	1	¼	1/8	2	1/7
Growth Centre	4	1	1/5	4	½
Tourist Spot	8	5	1	7	3
Settlement Size	½	¼	1/7	1	1/7
Community Attitude	7	2	1/3	7	1

At the second level of hierarchy, topography and cultural heritage factor have only two criteria each. These criteria have not been considered for comparison matrix. Later, simple normalized values were assigned for these criteria where the sum of total values is 1. It was done, because, it would not make inconsistency in judgment as they have only one pair each. However, such approach would recover a basic weakness of scaling method in AHP. For example, if a gets extreme favor at 9, then b gets extreme triviality at 1/9. Such dispersion in measurement has influence on weight calculation. But, an expert can think b should get 2 if a get 9. In the later section we will see the implication of this issue.

The third level, factor rating, is in fact the decision choices from a set of alternatives. At this level similar normalized values (0 to 1) were assigned.

5.4. ESTIMATING WEIGHT FOR FACTORS AND CRITERIA

For estimating weight for factors and criteria at first level and second level (excluding topography and cultural heritage) following steps were followed [76] –

- Summing each column of comparison matrixes prepared in previous section (section – 5.3). For the example of factors at first level, we get –

	Naturalness	Wildlife	Topography	Cultural heritages	Community characteristics
Naturalness	1	2	3	5	1
Wildlife	½	1	2	4	½
Topography	1/3	½	1	3	1/3
Cultural heritages	1/5	¼	1/3	1	¼
Community characteristics	1	1/5	3	4	1
Sum	3.03	5.75	9.33	17.00	3.08

- Dividing each element of matrixes with the sum of their columns. Here we get normalized relative weight where the sum of each column is 1.

	Naturalness	Wildlife	Topography	Cultural heritages	Community characteristics
Naturalness	0.33	0.35	0.32	0.29	0.32
Wildlife	0.16	0.17	0.21	0.24	0.16
Topography	0.11	0.09	0.11	0.18	0.11
Cultural heritages	0.07	0.04	0.04	0.06	0.08
Community characteristics	0.33	0.35	0.32	0.24	0.32
Sum	1	1	1	1	1

- The Normalized Principal Eigen Vector was obtained by averaging across the rows –

$$W = 1/5 \begin{bmatrix} 0.33+0.35+0.32+0.29+0.32 \\ 0.16+0.17+0.21+0.24+0.16 \\ 0.11+0.09+0.11+0.18+0.11 \\ 0.07+0.04+0.04+0.06+0.08 \\ 0.33+0.35+0.32+0.24+0.32 \end{bmatrix} = \begin{bmatrix} 0.32 \\ 0.19 \\ 0.12 \\ 0.06 \\ 0.31 \end{bmatrix}$$

The normalized principle Eigen Vector is also called Priority Vector. As this is normalized, so, the sum of elements of priority vector is 1. Each element of priority vector shows the relative weight of its corresponding criteria. For example, the relative weight of wildlife is 19%. But, before finalizing this relative weight consistency of preferences was checked.

- To check the consistency, at first Principle Eigen Value was calculated. The calculation was obtained from the summation of products between each element of Priority vector and the sum of columns of the comparison matrix.

$$\lambda max = 3.03(0.32) + 5.75(0.19) + 9.33(0.18) + 17(.06) + 3.08(0.31) = 5.10$$

- Then Consistency Index (CI) was calculated using following formula to find the deviation or degree of consistency –

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

So, in the first level example CI = 0.026

- The Consistency Index is used by comparing with the Random Consistency Index (RI), the appropriate one. By Prof. Saaty, from 500 sample matrices, Random Consistency Indexes were defined against different number of criteria. For, example RI is 0.58 and 1.12 for 3 and 5 numbers of criteria respectively.

- Finally, Saaty proposed Consistency Ratio (CR), which is a comparison between Consistency Index and Random Consistency Index. It can be shown with the following formula –

$$CR = \frac{CI}{RI}$$

With this formula we get CR = 0.023 in our five factor example. Saaty suggested if the CR is less than or equal to 10%, then, the inconsistency is acceptable. In our all cases of study (both at the first level and second level), the CR values were remained below 10%.

To do the whole weight estimation job, the calculation formulas were designed in MS Excel program. During sharing with expert opinion, experts were asked to give their preferences values on a 9 degree scale (like Figure-5). Based upon their judgment, if the values of CR were shown as greater than 10%, then experts were asked to repeat their task with different measurement. A major challenge here was to aggregate different preferences values of experts into a single rating value. It was not possible to call all the experts for a group discussion and finalize the single ratings by them. So, to solve the problem, experts explanations on preferences ratings were collected, they were interviewed repeatedly to come up with a common preferences, their explanations were carefully analyzed in light of literature reviews and field work experiences, and finally,

author himself finalized the single rating values based on those experts ratings, explanations, literature reviews and field experiences.

As stated previously, the weight of criteria under topography and cultural heritages were calculated by using simple normalized values. Here no reciprocal value was considered. For example, in topography, the elevation and slope were scored 8 & 6 at 9 degree scale. To get the weight the values were normalized by dividing with their sum. So, we get weight value of 0.57 for elevation and .43 for slope.

At the end of this stage we get the overall weight by multiplying the weight gotten in level one with that in level two. Please see the following table –

Table 8: Criteria Weight at First Two Level

Level 1		Level 2		Overall Weight
Factor	W1	Criteria	W2	(Wi=W1xW2)
Naturalness	0.32	Sea	0.6	0.19
		Other Waterbodies	0.06	0.02
		Spring/Cave	0.34	0.11
Wildlife	0.19	Forest density	0.71	0.13
		Protection class	0.1	0.02
		Species diversities	0.19	0.04
Topography	0.12	Elevation	0.57	0.07
		Slope	0.43	0.05
Cultural Heritages	0.06	Tangible culture	0.5	0.03
		Ethnicity	0.5	0.03
Community Characteristics	0.31	Road	0.05	0.02
		Growth centre	0.14	0.04
		Tourist spots	0.5	0.16
		Settlement size	0.04	0.01
		Community attitude	0.26	0.08

Then similar to topography and cultural heritages, the weights of factor ratings or third level criteria were assigned. At this level there is no overlapping condition in the decision choices. So, such similar approach was taken. Please see the following table –

Table 9: Criteria Weight at Third Level.

Criteria	Unit	Factor Rating		
		Attribute	*Score*	*Weight*
Sea	Value range	Near range	9	0.53
		Middle range	6	0.35
		Far range	2	0.12
Other Waterbodies	Value range	Near range	9	0.53
		Middle range	6	0.35
		Far range	2	0.12
Spring/Cave	Value range	Near range	9	0.53
		Middle range	6	0.35
		Far range	2	0.12
Forest Density	Density	High Density	9	0.47
		Moderate Density	6	0.32
		Low Density	4	0.21
Reserved/Protected Area	Protection Class	Protected	9	0.7
		Non-protected	4	0.3
Species Diversities	Diversified Area	Teknaf Game Reserve	8	0.32
		St. Martine's Island	6	0.16
		Inani	3	0.11
		Hymchari	3	0.11
Elevation	Meter	>100	9	0.5
		50-100	7	0.39
		25-50	2	0.11
Slope	Degree	0-5	7	0.58
		>5	5	0.42

Proximity to Tangible Culture	Kilometer	0-15	8	0.44
		15-30	6	0.33
		30-45	4	0.22
Proximity to Ethnic Group	Kilometer	0-15	8	0.44
		15-30	6	0.33
		30-45	4	0.22
Distance from National and Regional Highway	Kilometer	>15	8	0.44
		10-15	6	0.33
		5-10	4	0.22
Proximity to Growth Centre	Kilometer	0-5	8	0.44
		5-10	6	0.33
		10-15	4	0.22
Proximity to Existing Tourist Spots	Kilometer	0-5	8	0.44
		5-10	6	0.33
		10-15	4	0.22
Settlement Size	Density	0-500	8	0.4
		500-1000	6	0.3
		1000-1500	4	o.2
		1500-2000	2	0.1
Community attitude	Positiveness	Positive	-	1

5.5. EVALUATION AND RANKING INTO GIS

The spatial database was prepared with data layers, where each data layer represents a particular criterion. The attribute of this data layers follows the factor rating classes of criteria. When a particular criterion was not applicable or suitable from ecotourism perspective, then the area was treated as not suitable (*Not suit.*) and that area got zero value. **Please see the criterion maps in Appendix -3.** Techniques like buffering, feature to raster and raster to feature conversion, field calculation, raster calculation, classification and reclassification techniques were applied to assign weight values of each criterion in raster format. The raster calculations and other required operations were performed on 300 m grid cells. Then each dataset was multiplied by their overall weight

in raster calculator and then, all the resultant datasets were overlaid or aggregated. Thus a composite map was prepared. The calculation can be shown by the following equation –

$$S= \sum_{i=1}^{n} W_i * X_i$$

Where, S is the suitability index. Wi are the overall weights which were gotten previously by multiplying the weight of first level and second level criteria. Xi scores are normalized value of lowest level factors.

Finally, the suitability index was classified into three classes to rank the study area into most suitable, moderate suitable and low suitable locations.

5.6. Results and Discussions

After finishing all level of calculations we get four types of suitable locations for ecotourism development in Cox's Bazar according to a FAO guideline [77] (please see Map 4) –

- Highly suitable area
- Moderately suitable area
- Minimum suitable area
- Not suitable area

The highly suitable, moderately suitable and minimum suitable areas were ranked by classifying the suitability index. Following ranges of values of suitability index were gotten for each suitability types –

Table 10: Suitability Type Index

Value of Suitability Index	Suitability Type
0.01 – 0.12	Minimum Suitable
0.12 – 0.22	Moderately Suitable
0.22 – 0.32	Highly Suitable

The not suitable area was identified at earlier during the creation of resource maps. (Please see section 5.1). Later this area was converted to 300 m raster dataset to make comparison with other types of suitable areas.

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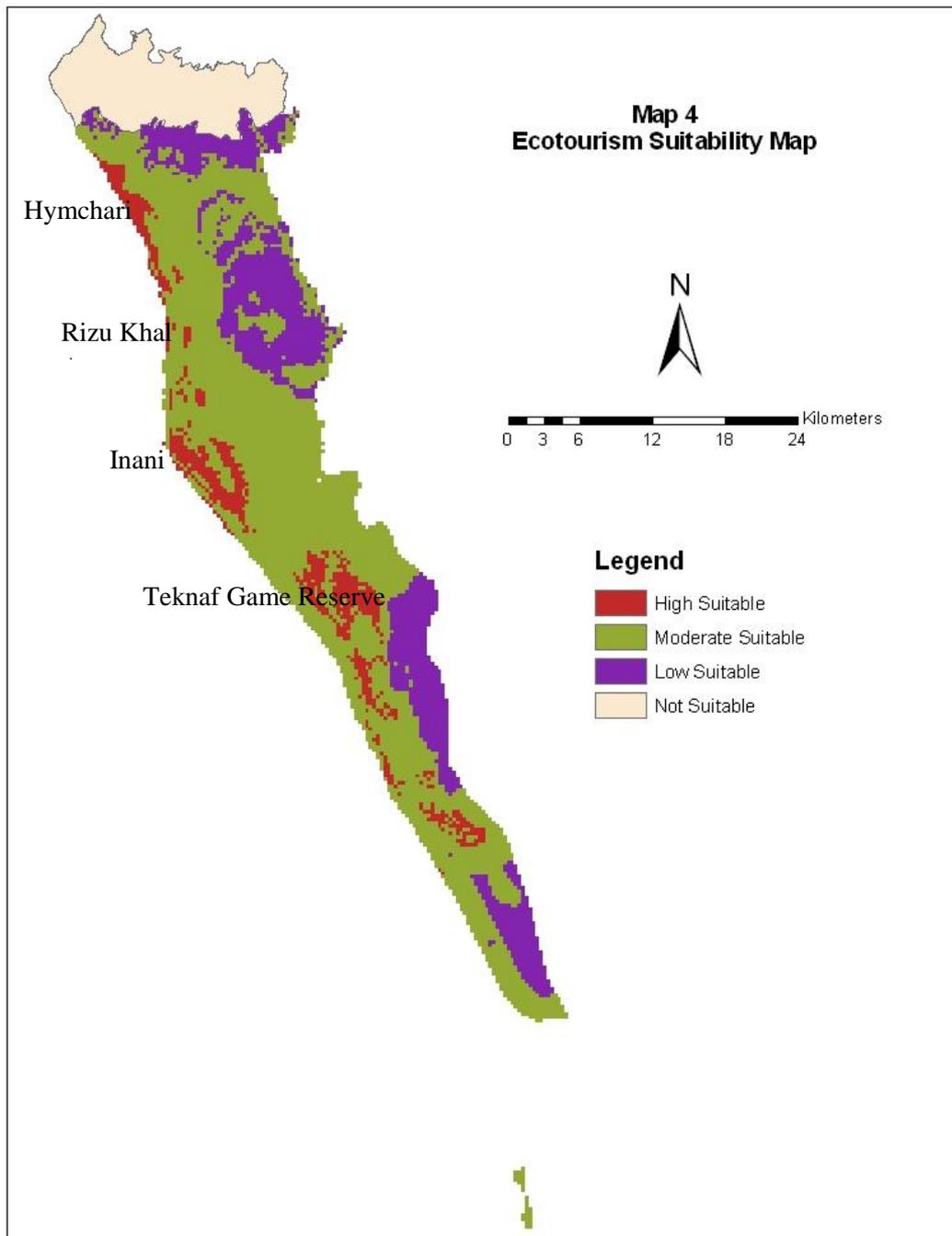
Number of grid cells found for highly suitable areas is 848 covering 76.32 sq km that is lowest (9%) among all suitable types. The moderately suitable sites are the major portion of whole study area at a percentage of 56. Its number of grid cells gotten form the evaluation is 5549 that occupy about 500 sq km. Minimum suitable type is the second highest covering 2100 grid cells, 134.28 sq km area and 21% of total study area. A significant portion (14%) of the study area is not suitable area for ecotourism development. However, 76% of the study area shows promising suitability for ecotourism development. Please see the following table –

Table 11: Area of Suitability Types

Suitability Type	No. of Grid Cells	Area (sq km)	Percentage (%)
High	848	76.32	9%
Moderate	5549	499.41	56%
Minimum	2100	189	21%
Not Suitable	1385	124.65	14%
Total	**9882**	**889.38**	**100%**

The result shows following areas are highly suitable from ecotourism perspectives –

- Himchary to Rizu khal beach and its surrounding areas
- Inani sea beach and its surrounding reserve forest areas
- Intermittently extended areas of Teknaf Game Reserve.

The highly suitable areas primarily lie on hilly and forest regions. Those areas under Teknaf Game Reserve got lower weight against naturalness factor as they are located at greater distances from the sea than the maximum visible range (2km). However, these areas are not still popular for tourism, hence, they were not included as existing tourist spots. So, undoubtedly, these areas are much rich for wildlife and topographic factors that qualified them as high suitable areas. Many parts of Teknaf Game Reserve area are not highly suitable, because those areas have low density of forest (please see Map 5). Better forest management can improve the coverage of high suitability of Teknaf Game Reserve. Similar statement is also true for Hymchary areas. Himchary is enriched by spring and designated protected area. Whereas, the areal extend of Himchary's high suitability index from beach is lower than that of Inani. It happened because the forest density of Himchary is significantly lower compared to the case of Inani. A common scenario of all the highly suitable areas is low density of population (please see Map 6).

The minimum suitable areas are predominated by rural homestead and agricultural landuse. Unique rural cultures can be the main driving force to promoting ecotourism activities in these areas.

Some popular tourist spots like Kolatoli Point, St. Martine's Island, Teknaf Beach, Teknaf Ghat, Shahparir Dwip, Whykong, Nhilla fall under the moderately suitable areas

rather than high suitable areas. The factors behind this reason are minimum or no influence of wildlife and topography as well as presence of high population density. Still these spots can be potentially utilized for soft base and environment friendly tourism development. The spots are either close to sea or Naf River. Water front development and at the same time its proper management can be option for enhancing tourism activities in these spots.
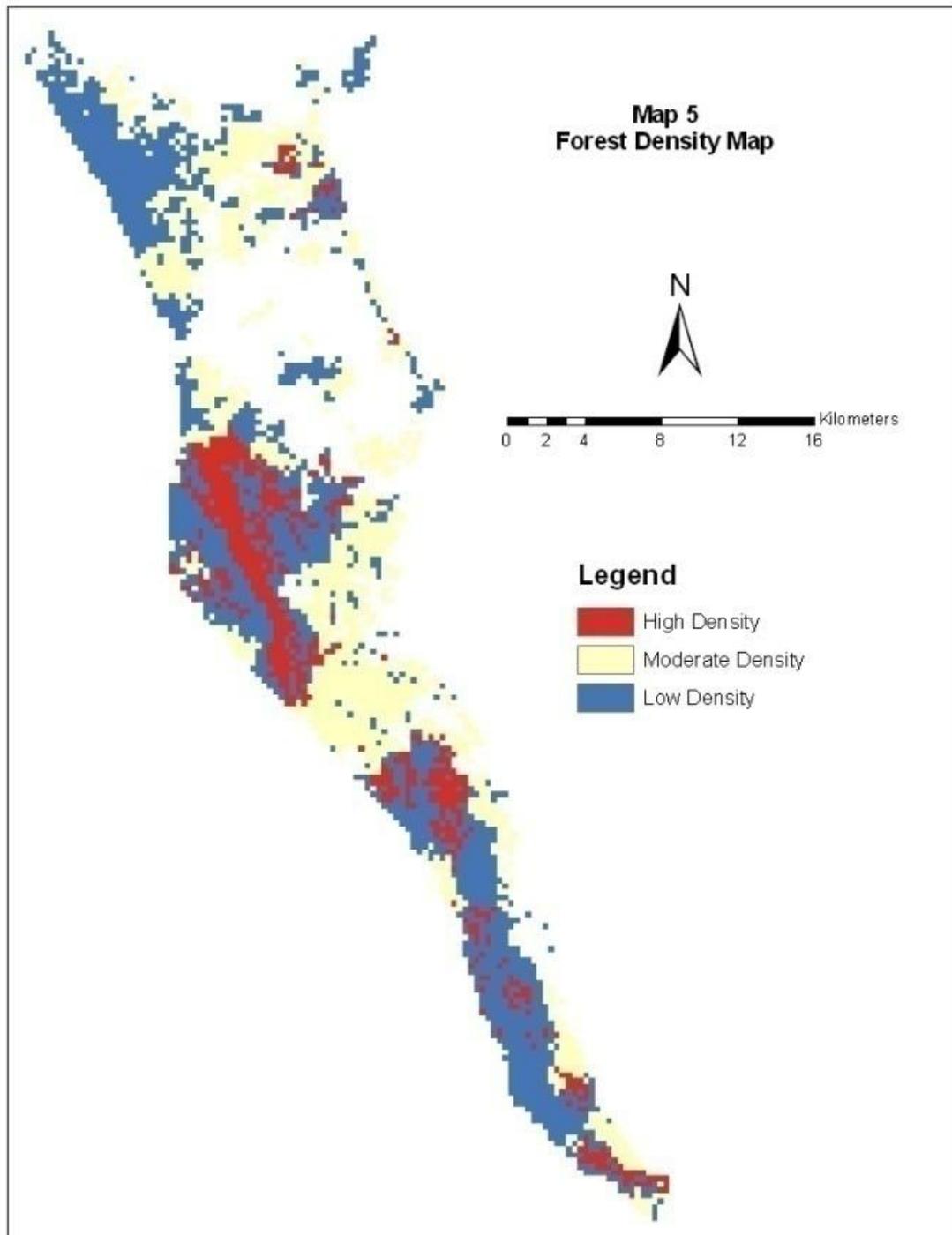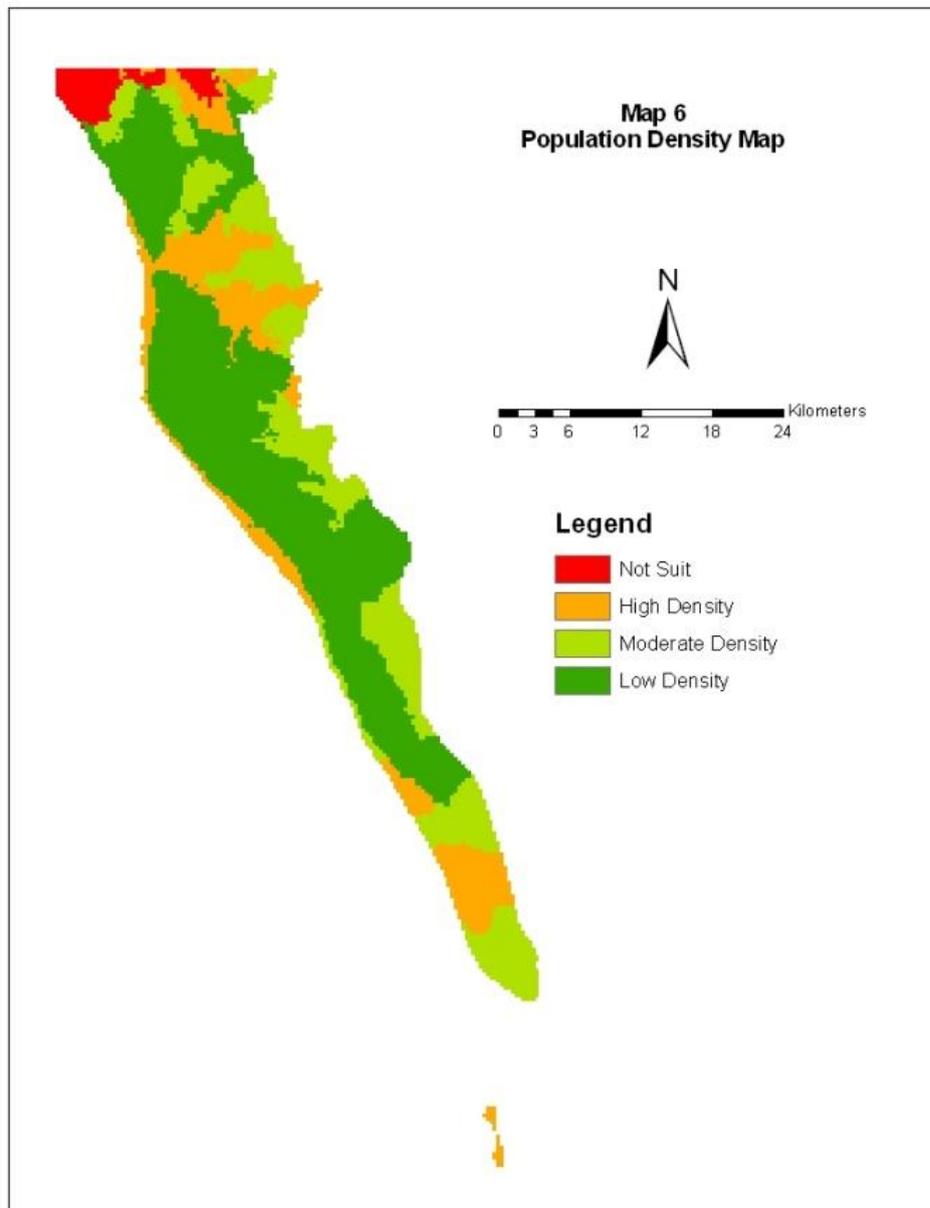
Except the Daroga Bazar and Nhilla Bazar, all other growth centers fall under the moderate suitable areas. No growth centre falls under the high suitable areas (please see Map 7). So, it creates an opportunity to focus the development of infrastructures, accommodations and other tourist's civic services within and around this growth centers. Such development approach will be beneficial in the following ways –

- Existing development potentials within and around growth centre towns or township centers will be utilized.

- Local community will be directly benefited by providing goods and services to the tourists as theses growth centers are the prime market places for the local communities.

- Detrimental impacts for infrastructural development on high suitable areas, which are ecologically sensitive, will be minimized.
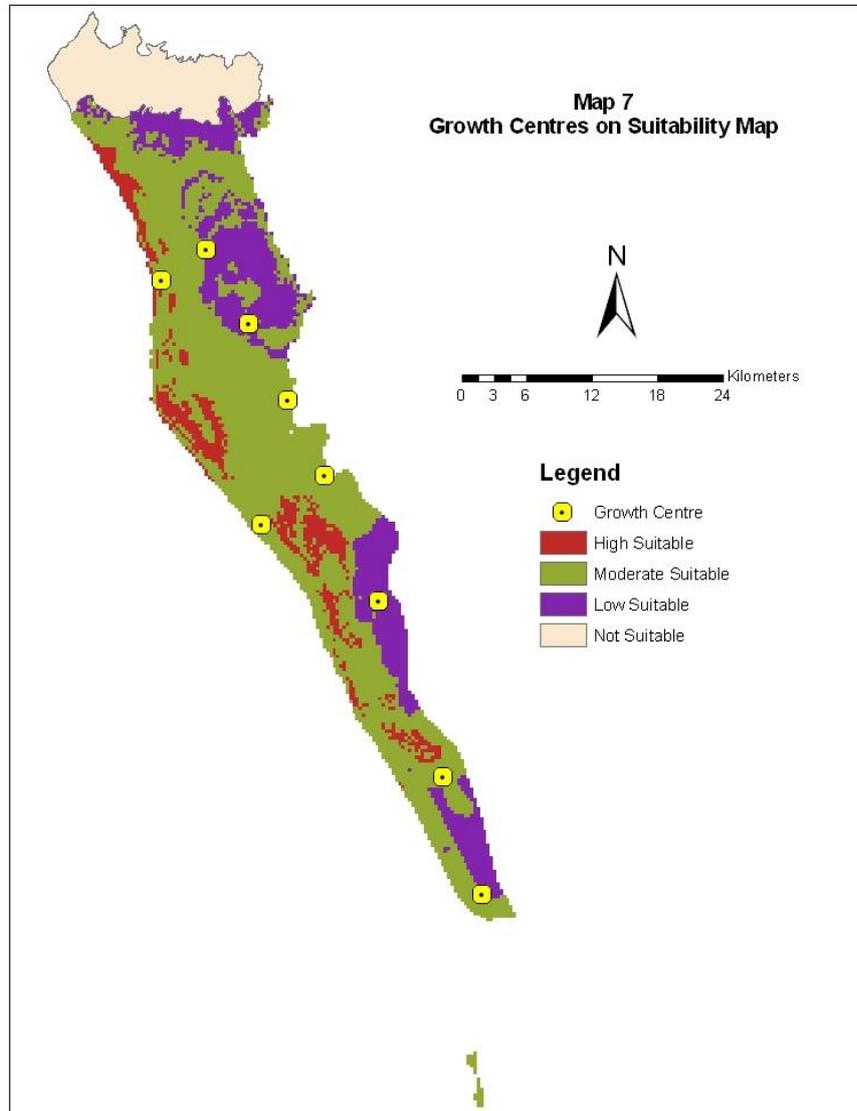
- Few accommodations (publicly) are permitted within the reserved forest areas. So, places like Kudum Guha, Teknaf Nature Park, and Toinga Hill etc. within Teknaf Game Reserve do not create greater tourist demand. The potentiality of these spots can be utilized by creating accommodation facilities at their nearer growth centers.

- Tourist will get real essence of cultural education by staying with the local communities.

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- Currently most of the tourists concentrate to Cox's Bazar town. By scattering tourist facilities through these growth centers will minimize the overburden number of tourists at Cox's Bazar town.

- Number of tourist venues will increase, that will ultimately promote number of tourists.

CHAPTER 6: RECOMMENDATION AND CONCLUSION

Ecotourism, which is primarily nature base, demands conservation of nature and improvement of local communities beyond setting mechanisms for ensuring tourist attractions. Ecotourism deserves strong sustainability of environment, social, economic and all other aspects of living and non-living resources. But, the actual performance of ecotourism in real world phenomenon makes huge controversies. So, different dimensions as well as different categories of ecotourism have been formulated by different authors. Based on those dimensions and categories along with considering the national, international and local context a set of factors and criteria for ecotourism site suitability evaluation were formulated for this study. Using those factors and criteria, this study identified potential suitable locations for ecotourism development in Cox's Bazar. According to the previous chapter, after completing all the methodological operations of the study we got three types of suitable areas for ecotourism development – highly suitable, moderately suitable and minimum suitable areas. In Chapter-2 the global and national perspectives of ecotourism have been highlighted. This chapter makes an endeavor to formulate some orders of recommendation for each type of suitable areas based on those perspectives as well as considering ecotourism sustainability options. Finally, a conclusion has been drawn to summarize the key findings and indications of this research.

6.1 RECOMMENDATION

A major policy option for Bangladesh according to 'National Tourism Policy, 2010' is preparing master plan at national, regional and local level for development of tourism (please see section 2.5). This study can be much helpful for preparing a regional level plan that will be a strategic plan as well as a guideline for local level planning. Following strategies can be formulated for the development of ecotourism in the study area –

6.1.1. DEVELOPMENT OPTIONS FOR HIGHLY SUITABLE AREAS

- These areas should be utilized for more natural, more active and more dedicated and hard base ecotourism development.

- Special program like Nishorgo Program at Lawachara National Park should be taken for the conservation of these areas.

- The adjacent forest areas having low forest density should be included with the high suitable areas for the similar program. Such program will enhance the current forest conditions.

- Like Maldives, high suitable areas should be facilitated with limited number of accommodations and price should be high for the visitors staying at those accommodations.

- Entry fees should be imposed for every tourist. The earning from these fees can be utilized for the management of the spots and for the betterment of local community.

- Facilities like footpath, trail, watch tower etc. should be created for trekking, bird watching, animal observations etc.

6.1.2. DEVELOPMENT OPTIONS FOR MODERATELY SUITABLE AREAS

- As stated before, moderate suitable areas under reserved forest area can be improved as high suitable area by taking forest enhancement and conservation programs. It will be an active form of ecotourism.

- Growth centers should be targeted for generating tourist infrastructures, accommodations and other service facilities.

- Detail Action Plan in the realm of Urban Planning should be adopted within and surrounding of growth centers, which are town or township centers and market places in nature.

- Waterfront development can be initiated for the existing tourist places within moderate suitable areas. Recreational facilities like canyoning, white-water rafting and kayaking can be facilitated. On and near the beach and river bank, sanitary facilities should be ensured, small cottages can be allowed, but, buildings or other permanent structures for accommodation, shopping and restaurant facilities should be restricted to minimize the environmental impacts. For the example of Malaysia, we found how near-shore marine environment and coastal environment was degraded for it early stage tourism development along the Coastal Kampungs.

6.1.3. DEVELOPMENT OPTIONS FOR MINIMUM SUITABLE AREAS

- The low suitable areas should be prioritized for protecting agricultural lands and primary agricultural activities of the inhabitants. In case of Nepal, It was seen how massive tourism caused adverse impact on agricultural lands and people's primary activities. In the villages of major tourist spots of Nepal, agricultural lands were replaced by building, lodge, restaurant, stalls etc. Most of the people became engaged with tourism activities. They lose their traditional cultures.

- The rural lands of these low suitable areas can supply foods and other primary goods for the tourists coming at the nearby higher suitable areas. So, people in these areas should be connected with the tourism activities through a supply chain management.

- Tourists can be encouraged to visit these areas for enjoying and learning unique rural life styles.

6.2. CONCLUSION

Tourism in Bangladesh is still in a premature stage, while, ecotourism is quite a new dimension. The unique opportunities in Cox's Bazar can bring it among the lists of world top most popular tourist destinations. But for better sustainability in all aspect of social, economic and environmental conditions, ecotourism is earnest necessary. Setting the principles of ecotourism is contradictory from case-by-case basis. The ecotourism nature in Cox's Bazar should be neither too hard nor too natural. Because, the physiographic characteristics of Cox's Bazar do not allow it to be qualify as hardcore tourist destination, like Annapurna. However, almost all the tourists in Bangladesh are likely to enjoy soft base tourism activities. So, minimum infrastructures, accommodations and other tourist facilities should be created. At the same time, conservation is necessary for ecologically sensitive areas. So, based on findings, this study recommended conservation of highly suitable areas which are ecologically sensitive but carry greatest attractions of ecotourism, and proposed urban planning through the growth centers of moderate suitable areas to provide tourist service facilities. Using GIS based AHP, the study have fulfilled the goal of a regional level planning. The suitable locations of ecotourism have been identified. Considering the inherent characteristics of each type of suitable locations some strategies of development have been formulated. Further researches are necessary to make

suggestion on detail level planning. However, this research only showed a way of site suitability analysis. More researches are necessary to understand different dimensions of ecotourism in perspectives of Bangladesh.

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APPENDIX – 1

A

Table A-1: Date and List of the Places (Growth Centres) of RRA Survey

Upazila Name	Union Name	Mouza Name	Place Name	Survey Date
Ukhia	Halda Palong	Maricha Palong	Maricha Bazar	19/01/2012
	Jalia Palong	Jalia Palong	Shonapara Bazar	18/01/2012
	Raja Palong	Uhala Palong	Daroga Bazar	17/01/2012
	Palongkhali	Ukhiarghat	Balukhali Bazar	16/01/2012
Teknaf	Whykong	Uttar Nhilla	Whykong Bazar	15/01/2012
	Baharchara	Shilkhali	Shaplapur Bazar	12/01/2012
	Nhilla	Dakshin Nhilla	Nhilla Bazar	11/01/2012
	Teknaf	Teknad	Tkenaf Bazar	10/01/2012
	Sabrang		Shahporirdwip Bazar	9/01/2012
	St. Martrin Dwip	Zinzira Dwip	St. Martine's Island*	8/01/2012

*There is no designated growth centre in St. Martine's Island. But as the island is isolated form the main land, so, separate RRA was conducted there.

B

CASE STUDIES

COMMUNITY ATTITUDES TOWARD ECOTOURISM

Location: Whykong Bazar

Peoples from Whykong Bazar and its surrounding villages think that tourism has both beneficial and adverse effects. They think if tourist come in potential number, then, the current market will expand. They will sell their goods and agricultural productions, handicrafts, services etc. in higher prices. By creating accommodation facilities for tourists they will earn money. People will get more job opportunities by working in

hotels, restaurants, as guide etc. The land price will increase for providing tourist facilities. Government will show interest to improve the infrastructure and other civic service facilities. They think the negative impacts of tourism are also significant. For example, the local price of goods and commodities will increase substantially during the tourist season. Drug and prostitution business will destroy their social values. Huge wastes will be generated from tourists. Government program may occupy lands from local people and local people may be evicted. Outsider entrepreneur can grab the potential business opportunities due to tourist influx, while, they will just play the laborious roles with minimal earning.

However, they think the negative impacts can be minimized. If government and local institution regulate the price of daily essential goods and services, drug and prostitute business are protected by security officials, proper solid waste management is ensured, tourist local market mechanism is controlled by local people and government own the land under the ownership of original owner (for example by taking lease), do not make eviction or make sure the rehabilitation, then, local people will not show obligation against tourism.

The suggestions people made to minimize the negative impacts of tourism are more closely linked with the ethical and sustainability dimension of tourism. In other words, they proposed to ensure 'ecotourism'. So, in final result, we can say although people have some negative admiration about tourism, but, they are positive in attitude toward ecotourism.

APPENDIX – 2

Notified Protected Areas of the Country are as follows:

i) National Parks :

As on 22/11/10.

Sl. No.	National Parks	Location	Area (ha.)	Established & notification No.
1.	Bhawal National Park	Gazipur	5,022	Ministry of Agriculture No.ii/For-66/81/318 date- 11-5-82
2.	Modhupur National Park	Tangail/ Mymensingh	8,436	Ministry of Agriculture No. ii/For-69/81/967 date- 24-2-82
3.	Ramsagar National Park	Dinajpur	27.75	MoEF(Sha-3)-30/98(1)/347 date 30-4-01
4.	Himchari National Park	Cox's Bazar	1,729	Ministry of Agriculture No. ii/For-63/79/89 date- 15-2-80
5.	Lawachara National Park	Moulavibazar	1,250	MoEF(Sha-3)-7/96/367 date 7-7-1996
6.	Kaptai National Park	Chittagong Hill Tracts	5,464	MoEF(Sha-3)-33/99/769 date 9-9-1999
7.	Nijhum Dweep National Park	Noakhali	16352.23	MoEF(Sha-3)-8/2000/298 date 8-4-2001
8.	Medha Kassapia National Park	Cox's Bazar	395.92	MoEF(Sha-3)-32/2003/356 date 8-8-2008
9.	Satchari National Park	Habigonj	242.91	MoEF(Sha-3)-31/2004/1125 date 15-10-05
10.	Khadeem Nagar National Park	Sylhet	678.80	MoEF(Sha-3)-31/2004/335 date 13-04-06
11.	Baraiyadhala National Park	Chittagong	2933.61	MoEF/For Sha-2-wildlife sanctuary/10/2010/210 date 06-04-10
12.	Kadigar National Park	Mymensing	344.13	MoEF/Ban Sha-2/02/National Park/10/2010/512 date 24-10-10
13.	Shingra National Park	Dinajpur	305.69	MoEF/Ban Sha-2/02/National Park/10/2010/511 date 24-10-10
14.	Nababgong National Park	Dinajpur	517.61	MoEF/Ban Sha-2/02/National Park/10/2010/510 date 24-10-10
15.	Kuakata National Park	Patuakhali	1613.00	MoEF/Ban Sha-2/02/National Park/10/2010/509 date 24-10-10
	Sub-Total		45,312.65	

ii) Wildlife Sanctuaries :

| Sl. No.	Wildlife Sanctuaries	Location	Area (ha.)	Established & notification No.
16.	Rema-kelenga Wildlife Sanctuary	Hobigonj	1795.54	MoEF(Sha-3)-7/96/371 date 7-7-96
17.	Char Kukri-Mukri Wildlife Sanctuary	Bhola	40	Ministry of Agriculture No. ii/For-67/81/883 date- 19-12-81
18.	Sundarban (East) Wildlife Sanctuary	Bagerhat	61226.94	MoEF(Sha-3)-7/96/147 date 6-4-96
19.	Sundarban (West) Wildlife Sanctuary	Satkhira	71502.10	MoEF(Sha-3)-7/96/147 date 6-4-96
20.	Sundarban (South) Wildlife Sanctuary	Khulna	36970.45	MoEF(Sha-3)-7/96/147 date 6-4-96
21.	Pablakhali Wildlife Sanctuary	Chittagong Hill Tracts	42087	Ministry of Agriculture No.xiii/For-1/83/682 date- 20-9-83
22.	Chunati Wildlife Sanctuary	Chittagong	7761	Ministry of Agriculture No.xii/For-1/84/174 date- 18-3-86
23.	Fashiakhali Wildlife Sanctuary	Cox's Bazar	3217	MoEF/Sec-5/Wildlife-2/06/48 date : 11-04-07
24.	Dudh Pukuria-Dhopachari Wildlife Sanctuary	Chittagong	4716.57	MoEF/For Sha-2-wildlife sanctury/11/2010/209 date 06-04-10
25.	Hazarikhil Wildlife Sanctuary	Chittagong	2908.50	MoEF/For Sha-2-wildlife sanctury/11/2010/211 date 06-04-2010
26.	Shangu Wildlife Sanctuary	Bandarban	5760.00	MoEF/For Sha-2-wildlife sanctury/13/2010/212 date 06-04-2010
27.	Teknaf Wildlife Sanctuary	Cox's Bazar	11615	MoEF/For Sha-2/02/Wildlife/15/2009/176 date 24-03-2010
28.	Tengragree Wildlife Sanctuary	Barguna	4048.58	MoEF/Ban Sha-2/02/Wildlife Sanctuary-13 /2010/508 , date 24-03-2010
	Sub-Total		2,23,648.68	
	Grand-Total		2,33,961.33	

100 ha. = 1 sq. km.

Total protected area = 2,68,961.33 ha.

Total Forest area = 25251 Sq. Km. (2.52 million ha.)
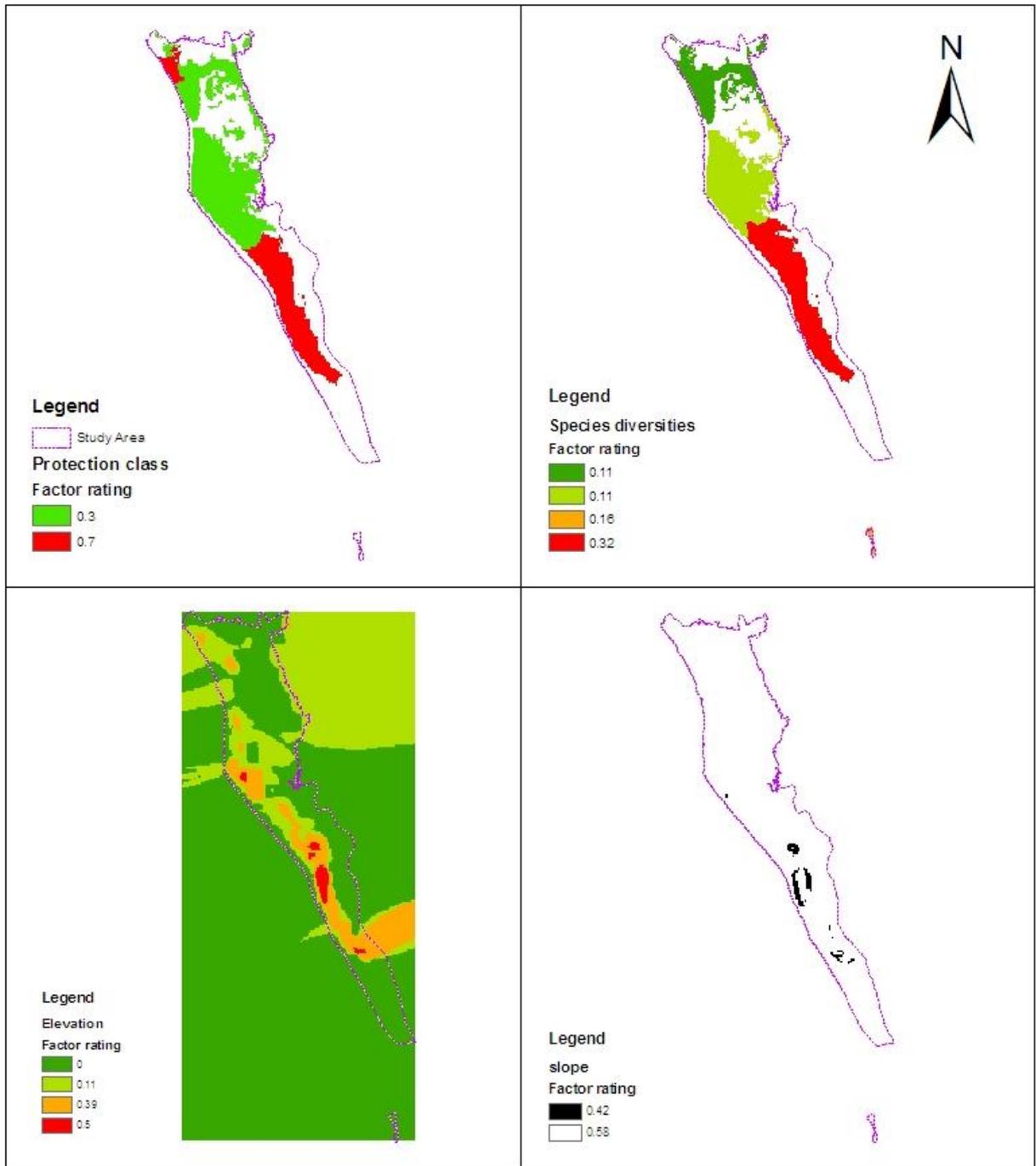
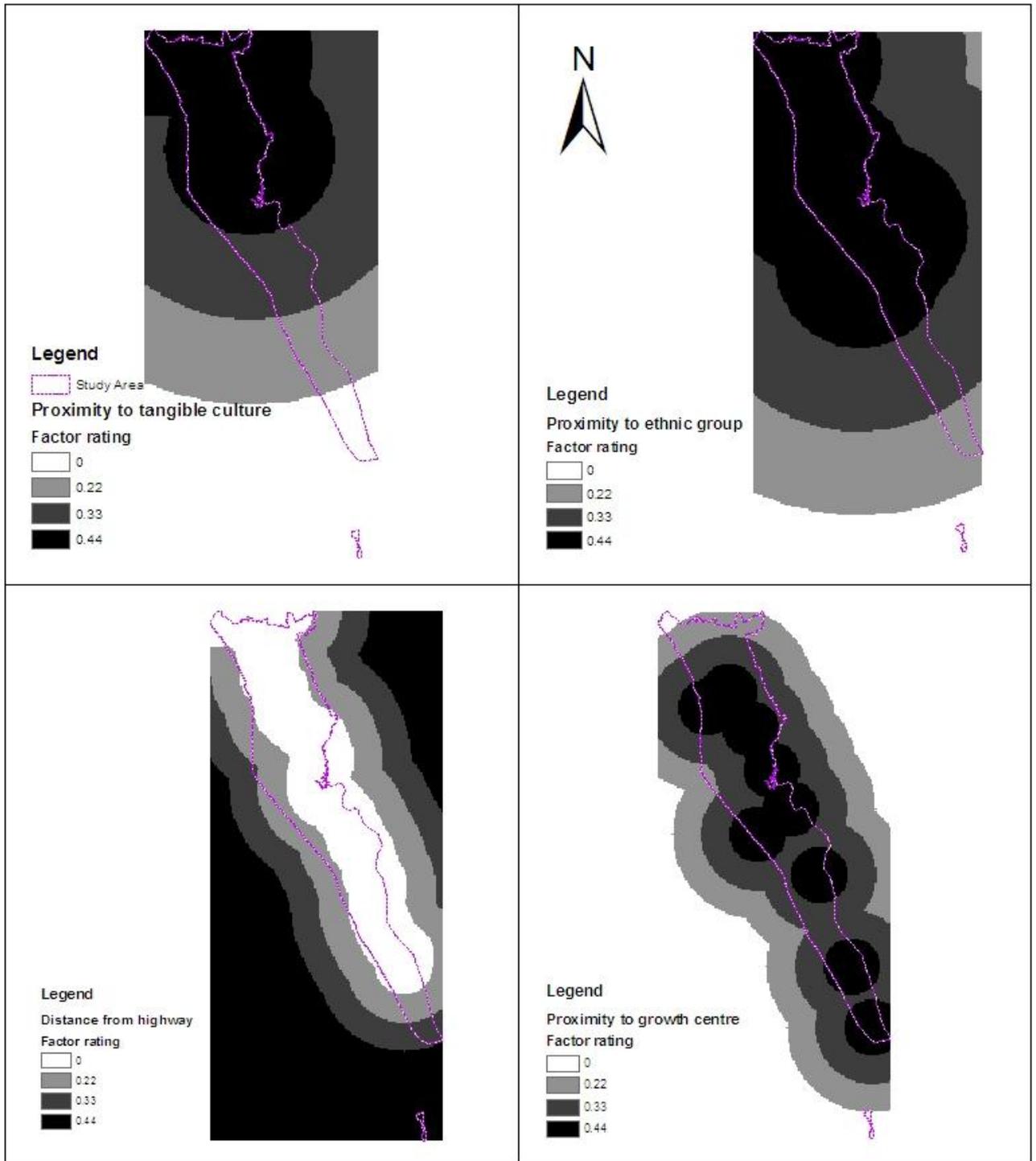Total country area = 147570 Sq. Km.

APPENDIX – 3

Criteria maps using attribute of factor ratings.
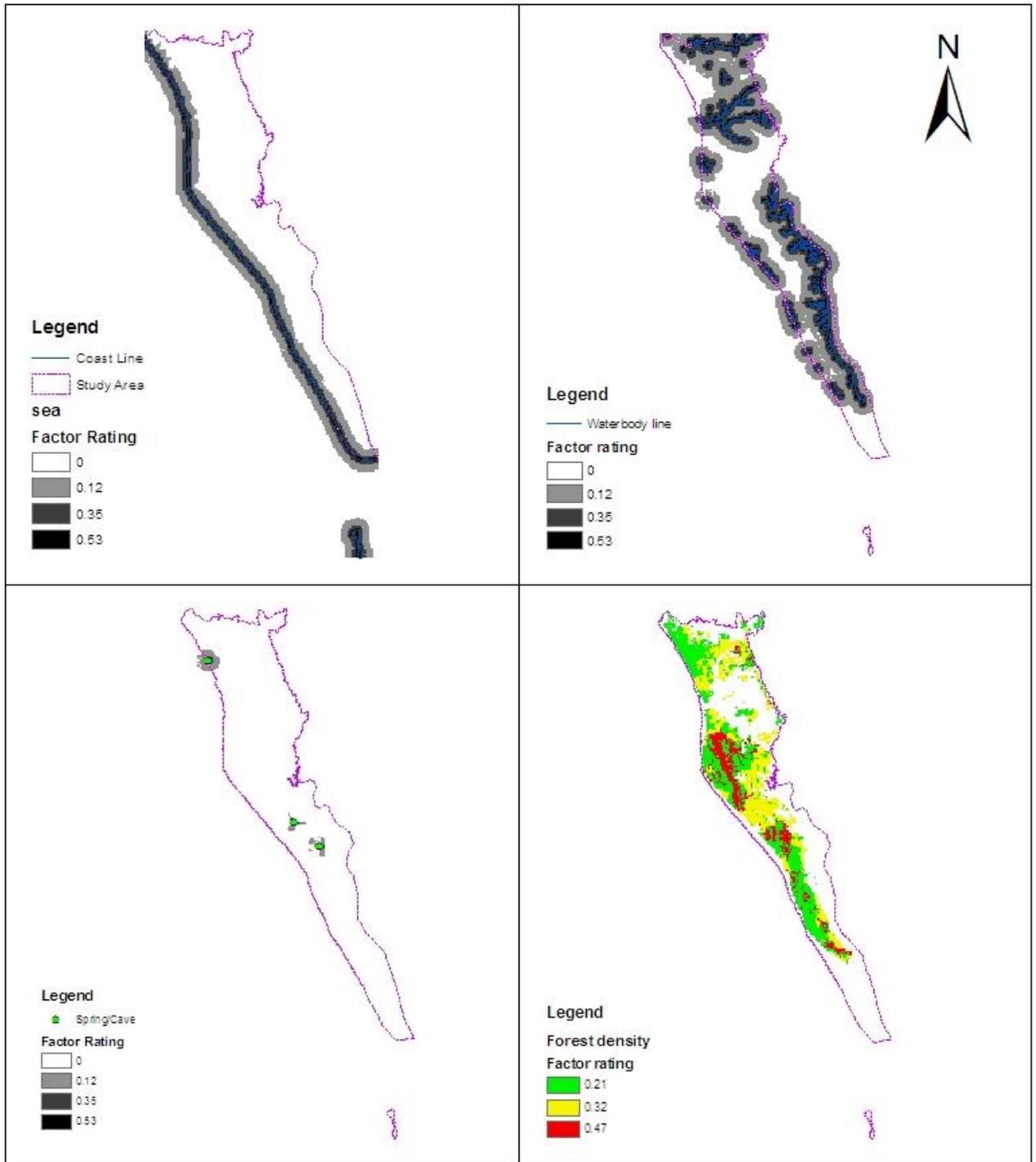
Map-A: Factor rating for criteria on sea, other waterbodies, spring/cave and forest density.

Map-B: Factor rating for criteria on protection class, species diversities, elevation and slope.

Map-C: Factor rating for criteria on proximity to tangible culture and ethnic group, distance from highway and proximity to growth centre.

Map-D: Factor rating for criteria on proximity to existing tourist spots, settlement size and community attitude.