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Trend Analysis of Coral Reef Presence in ST. Martin's Island

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Abstract:

Land use is a continuous and ever changing process. Remote sensing and GIS technique supplemented by ground truth data have been used to prepare land use map of St. Martin's Island. The land use map shows the change of coral quantity of the Island. Medium scale Landsat TM, and OLI/TIRS satellite imageries were used for this study. There are different type of land use has identified but coral reef are found around most of the island. The land area used of coral reef decreases 0.81% has found during analysis of land use map. This change has made in a 10 years period.

Keywords - **Remote sensing and GIS, Land use, Coral reef**

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I. Introduction

Ecologists pay considerable attention to the land use change impacts predominantly with respect to its effects on biodiversity and aquatic ecosystems [1]. Coral reefs are the primary marine ecosystem for the island considering biodiversity, value for fisheries, tourism, and shoreline protection. Satellite remote sensing data effectively used to assess the coral reef volume of the island. The GIS technology in conjunction with remote sensing data, can serve as a better tool for the analysis of the island reef resources. GIS results can serve as a test-bed for studying environmental processes or for analyzing the resultant trends or anticipating the possible results of planning decisions [2]. However, the objective of this study is to mapping the land use and analysis the coral reef quantity based on satellite image and intensive field survey. The information generated as a result of this research will be meaningful and will help in formulation of comprehensive and effective conservation and utilization plans for integrated reef resource management. The study shows the process of converting a satellite image into a map. This technique is more economical, efficient and time saving for data coordination. High resolution images provide accurate information about dimensions of physical features regarding coral reef information. But ground survey also required for greater accuracy in deciding land use. The output comes from the maps of land use to assess coral reef with a given level of confidence about the results. Results are not cent percent accurate because of lesser field verifications but still have a number of advantages over the manual land use mapping.

II. Materials and Methods

A.Data collection

Medium scale Landsat TM, and OLI/TIRS satellite imageries were used for this study. The study area, St. Martin Island, is located at the position of Path 135/Row 46 of the Landsat Worldwide Reference System (WRS). For time series analysis two images downloaded from free sources [3]. Downloaded images are Landsat Level 1 Data Products. This type of data are preprocessed

for standard radiometric and geometric correction. Cloud free and good contrast images were selected for the analysis. Images used in the present study are listed in the table

Table 1. List of satellite image

Respective Year	Satellite Sensor	Brand	Spatial Resolution
2007	Landsat 5 TM	2,3,4	30m
2017	Landsat 8 OLI	3,4,5	30m

B. Image Processing and classification

ERDAS Imagine (Version 2014) and Arc Map (Version 10.3) were used for the study. The images were layer stacked using ERDAS Imagine (2014) for further analysis. Both images were subset. For image classification, an unsupervised classification method was principally used. In this method St. Martin's island a small island in the northeast of the Bay of Bengal, about 9 km south of the cox's bazar-teknaf peninsular tip and forming the southernmost part of Bangladesh. It is about 8 km west of the northwest coast of Myanmar at the mouth of the river naf. The island lies between 92°18' and 92°21'e longitudes and 20°34' and

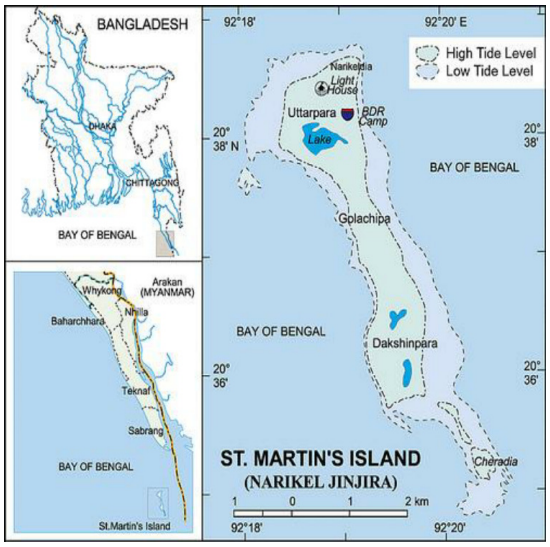

Fig 1. Map of Study Area

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Collected images were in the WGS 84 UTM Zone 46 referencing system.

classification carried through image interpreting software with no direction from the analyst, the

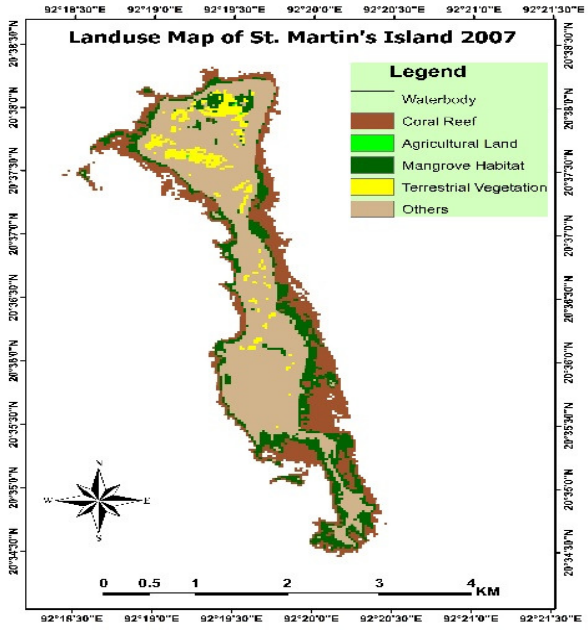
Software separates a large number of unknown pixels in an image based on their reflectance values into classes [4]. In this study 'K Means' algorithm method was used that are available in the ERDAS Imagine (2014) software. The images were primarily classified into 30 classes. Spectral signature of the layer stack images were used to identify the land use classes. Classified images were recoded into 5 thematic classes. Final output was prepared using Arc Map (Version 10.3)

C. Study Area

20°39'n latitudes. The local people call it narikel jinjira. It is almost flat and is 3.6m above the mean sea level. The 9.66 km wide channel between the mainland and the island is much shallower than the open sea southwest of the island. There are reefs from 10-15 km to the west-northwest.

III. Results and Discussion

According to Lea and Curtis [5], accuracy assessment reporting requires the overall classification accuracy above 90% and kappa statistics above 0.9 which were successfully achieved in the present research. The classified Land use map of St. Martin's Island of years 2007 and 2017 is given in Fig. 2. The results show that major decline with respect to area coverage in St. Martin's Island was observed in Terrestrial Vegetation and Coral reef whereas, the area of mangrove habitat and Agriculture land was increased. The comparison of each class of 2007 and 2017 showed that there has been a marked land use and land cover change during the study period of 10 years. GIS was used for the post-classification comparison of the detected change, producing change map for comprehending the spatial pattern of change between years.The classification results for 2007 and 2017 are summarized in Fig 3.



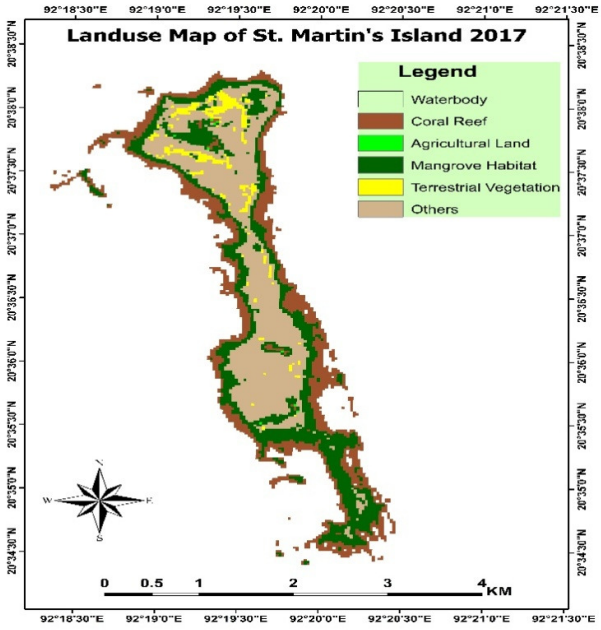
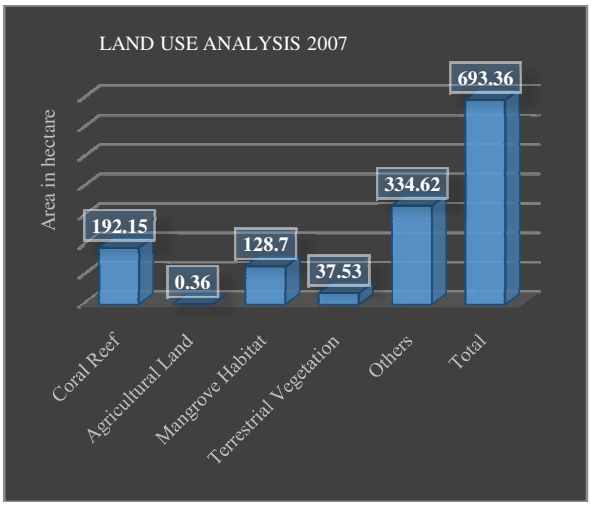


Fig 2. . Land use map of St. Martin's Island



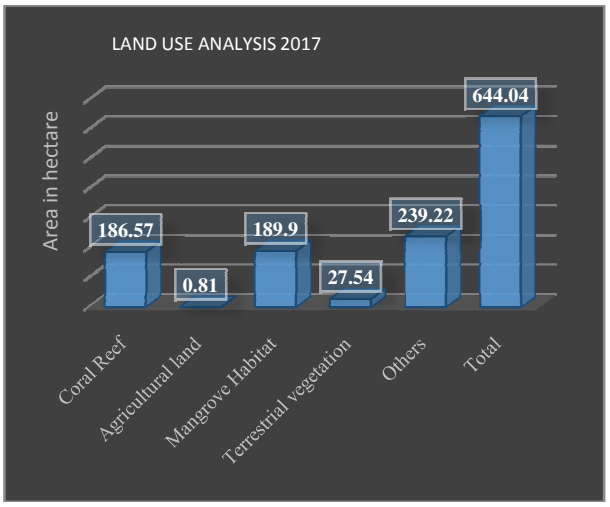


Fig 3. Land use Analysis of St. Martin's Island

Moreover, the change in the total area of Island wasalso observed. Classification indicates that the total area covered 693.36 hectare in 2007 but area reduced to 644.04 hectare in 2017.The percentage decrease in total landarea was 7.11%. The assessment shows that, Coral reef area found 192.15 hectarein 2007 constituting about 27.71% of the total area but it was reduced to 186.57 hectare in 2017 covering 26.9% of the total land of the island. Thus, approximately 0.81% of the coral reef area diminished in 10 years.

A. Potential Threats to Coral and Associated Resources

The main threat to future viability of coral communities comes from direct extraction of coral colonies. It has also been estimated that about 30,000 coral colonies are collected annually and current extraction activities remove about 24% of the existing population from the extractable areas. Coral removal has continued since so reasonably assume that the current status of coral at the site is very poor, and surveys of corals are an urgent priority [6]. The following are the key environmental (natural and anthropogenic) concerns in St. Martin's Island which pose threats to environment and resource degradation.

Anthropogenic Threats

Overexploitation of renewable marine and coastal resources (e.g. rocky reef fisheries, coral and shell extraction, removal of coastal vegetation). Large scale removal of key-stone species from intertidal subtidal habitats (I.e. corals, cucumbers and molluscs). Destructive fishing practices, mainly the use of rock weighted gill nets over the inshore boulder reefs. Increased water turbidity and sedimentation from agricultural practices, deforestation and urbanization, Waste disposal, particularly fish offals from large number of fish dry farms. Tourists activities (e.g. collection of sample specimens other destructive activities).

Natural Threats

Cyclonic storms and tidal surge probably cause serious damage to coral communities by shifting and overturning substrate boulders. Silts coming with Naaf discharge causing turbidity problems on the east coast of the island. Resuspension of sediments also help to increase water turbidity and directly impeding the coral development and survival. Increased discharge of freshwater flood water from Naaf River during rainy season causes salinity to fall to a suboptimal level [7].

IV. Conclusion and Recommendation

Based on the results obtained by employment of GIS and RS applications to achieve the specific research objectives, it is concluded that the coral reef quantity in the study area have changed significantly in 10 years.The haphazard expansion of Settlement, Agriculture and Tourist activities in the island was main reason of coral reef area reduction due to lack of proper management and land use planning to land development in the study area.By far the most serious threat to the future viability (ecological and economical) of coral resources of St. Martin's Island is over exploitation. This is serious issue throughout the tropical regions where local communities depend heavily on coral reef resources for their survival and economic well-being. However, coral viewing using glass-bottom boat has been suggested. Development of small scale community based ecotourism, to satisfy national demand for new travel destinations, is a viable option

on island that needs to be promoted. Development of community based ecotourism will not only benefit local conservation efforts through community participation but will also expose tourists to new experiences [8].

A. Recommendation

Strengthen socioeconomic monitoring of reef resources to provide adequate information for coral reef management. Identify and develop alternative livelihoods for those dependent on reef resources. Sustainable and long-term funding to protect and habitat conservation activities of coral reef resources. Promote awareness, education and publicity on the protection of biodiversity of the island. A complete resource inventory of the island need to be taken and very detailed maps with quantity of the whole reef system are to depict. Nations around the globe should perform more to restrict fishing, cut pollution and fight to control emissions of different greenhouse gases like CO2, SO2 to protect corals.

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