



Application of Environmental Ethics for Sustainable Development and Conservation of Saint Martin's Island in Bangladesh

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Abstract

St. Martin is a miniature island in the north-eastern part of the Bay of Bengal, which is distinct from the Cox's Bazar-Teknaf peninsula, Bangladesh. Currently there are around 6000 people amidst the majority number of people's primary livelihood sources are fishing, tourism, and agriculture. However, it has become a great tourist's attraction spot in Bangladesh due to its unique landscape. Consequently, its natural environment and ecosystem, especially unique biodiversity is obliterated frequently by virtue of indiscriminate human activities. This problem is triggering due to lack of education and awareness. Contrary, application of environmental ethics can minimize further damages as well as rehabilitate the island anew. Lately, the government and some NGOs have already taken and implemented several steps to protect the island but not fruitful still due to some drawbacks. This study reveals that population control, ecotourism, appropriate zoning system for sustainable development, introducing renewable energy, and spreading education amid mass people can resolve the dispute and resettle. Moreover, involving community people in the management program and initiating cottage industry as substitute of income sources can reduce pressure on island natural resources depletion.

Key words: Biodiversity, Conservation, Environment, Ethics, Sustainable development

Introduction

St. Martin's Island is only 8 km² dumb-bell shaped sedimentary continental island located in the northeast part of the Bay of Bengal and about 9 km far from the Cox's Bazar-Teknaf peninsula tip, and the southernmost part of Bangladesh (Afrin, 2013). Contrary, it is about 8 km west of the northwest coast of Myanmar at the mouth of the Naf River. There is a small connected island that is separated at high tide, called Chera Island. The area of the island itself is about 5.9 km² whereas with the rocky platforms extending into the sea the total area of the island is about 12 km². It was connected to the mainland of the Teknaf peninsula as recently as 6,000-7,000 years ago (Warrick *et al.*, 1993; Chowdhury, 2012). However, the first settlement started just 250 years ago by some Arabian sailors who named the Island -Zajira but later it was renamed St. Martin Island by British. But the real local settlement began on the island in 1880s. Later, it has achieved several local names viz. Narical Gingira, Coral Island, and Daruchini Dwip (Anon, 2008; Khan, 2015; Islam *et al.*, 2002). Currently, there are about 6,000 people amidst approximately 3,700 inhabitants live primarily from fishing while the other staple livelihood sources are tourism, agriculture, and day labour (Thompson and Islam, 2010). Besides, between October and April, the fishermen from neighbouring areas bring their caught fishes to the island's temporal wholesale market. Contrary, chicken, meat and other foods come in island from the mainland and Myanmar. The centre and the south are mainly farmland and temporal huts, most of the permanent structures are around the far north of the island (Islam *et al.*, 2005; Kabir, 2006; Rashid, 1997). Although, it lies within the tropical belt, the climate of the island is heavily

influenced by the subtropical monsoonal climate that prevails over Bangladesh. From October to February the weather is mild with low rainfall. However, the hot season extends from March to May and the monsoon during which the most rains are concentrated extends from June to September. In addition, it is surrounded by sea and further south than Cox's Bazar and hence, the humidity remains relatively high throughout the year (Chowdhury, 2000; Tomascik, 1997; Rahman, 2009).

From 1989-2004, foreigners could merely visit the island but now all are allowed. Therefore, it has become a popular tourist spot in Bangladesh recently. The surrounding coral reef of the island has an extension named Chera Dwip wherein a small bush that is the only green part which adds spares beauty. But people do not live on this part. Contemporarily, the number of tourists has dramatically increased that is causing the deterioration of natural ecosystem of the island though many efforts have already taken to preserve the several endangered species of turtles and coral etc. (Haque, 2009; Hasan, 2000; Hossain, 2013). Pieces of the coral reef are being removed in-order-to be sold to tourists by local people. Nesting turtles are sometimes taken for food, and their hatchlings are often distracted by the twinkling lights along the beach and loud sound of music. But it exists only because of its coral base, so removal of coral risks erosion of the beaches, consequently island has lost roughly 25% of its coral reef in the past seven years. There is quite diverse vegetation because the remaining native species have been supplemented by a considerable

number of cultivated and introduced species. Anyway, the recent floral surveys recorded 260 plant species including 150 herbs, 32 climbers, 25 shrubs and 53 trees, belonging to 58 families (DoZ, 1997). Contrary, there are 9 species of Echinodermata, 187 species of molluscs, 12 species of crabs, 234 species of fish, 27 species of reptile, 4 species amphibian and 19 species of mammals in St. Martin Island. But the island has already heavily used for tourism wherein the form of tourism is both unplanned and unregulated. Therefore, a remarkable percentage of biodiversity has already been lost from the island (MoEF, 2001).

There is no permanent livelihood sources at St. Martin rather all are seasonal; amid fishing is the prime for most of the inhabitants. But territorial disputes between Myanmar and Bangladesh have created a problem in fishing. Hence, sometimes Bangladeshi fishermen are killed by Burmese Navy forces (BNFs) just off the coast of island (Mollah, 2000; Maruf, 2004; Feeroz, 2009). The only way to reach the island is water transportation from Teaknaf. Without the larger hotels that run on generators, there is no electricity supply since a dangerous hurricane in 1999. The island is covered all about sun, sea and palm trees. November to February is the best tourist season when weather is good but March to July is off-season due to rough weather. The island was

devastated by a cyclone in 1991 but it was untouched by the 2004 tsunami (Rahman, 2009; Brammer *et al.*, 1993), sea level rise is the great threat for the future existence of the island.

Materials and Methods

The whole St. Martin's Island was selected as study area which lies between latitude 20°34' and 20°39'N; and longitude 92°18' and 92°21' E. There are five distinct physiographic areas within the island (details in Fig. 1). Uttar Para is the northern part of the island with a maximum length, along the north-south axis, of 2,134 m, and a maximum width of 1,402 m. Golachipa is a narrow neck of land connecting Uttar Para with Madhya Para. Madhya Para, directly south of Golachipa is 1,524 m long and 518 m wide at its maximum. Dakshin Para, lies next to the south and is 1,929 m long, with an additional narrow tail of 1,890 m towards the southeast, and at its maximum is 975 m wide. Chera Dwip, the southernmost tip of the island and extending south-east from Dakshin Para is a rocky reef that is about 1.8 km long and between 50 m and 300 m wide. Lately, this area has been declared an Ecologically Critical Area (ECA). The island is almost flat with an average height of 2.5 m above Mean Sea Level (MSL), rising to a maximum of 6.5 m high cliffs along the eastern coast (Warrick *et al.*, 1993; Ahmed, 1995).

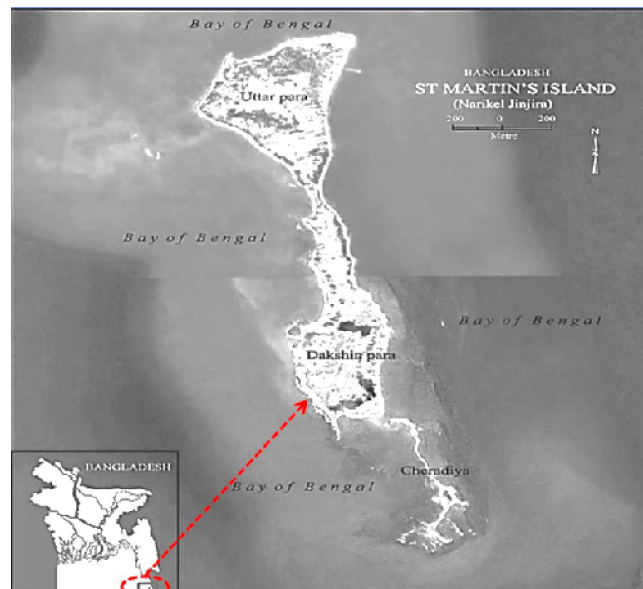


Fig. 1. Geographic location map of St. Martin Island in Bangladesh (Chowdhury, 2012)

Very beginning of conducting this study, we reviewed many literatures from both published and unpublished sources. Based on the gathered knowledge, we designed several semi-structured questionnaires for surveying viz. tourist, shopkeeper, fisherman, household, restaurant/hotel and ship. From all the targeted sources of data, we tried to identify different driver's role on

destruction of island environment and biodiversity as-well-as how environmental ethics can support in sustainable development of St. Martin Island. Then for collecting further information about implemented different management plans by Department of Environment (DoE), Non-Government Organizations (NGOs), and Local Government, a few group meetings were arranged with concerning

persons and administrators. We discussed about local people facing problems, upgrade of their activities and future plans including demands from government.

Results and Discussion

Population demography and anthropocentrism

Table 1. Population increment status of St. Martin Island (BBS, 2011)

Year	Households	Total population
1996	535	3,700
2000	791	4,766
2005	818	5,726
2012	1100	6000

Population growth rate is comparatively high in island due to early marriage and polygamy culture is still dominant. Therefore, population size is growing up rapidly which is triggering by illegal Rohingya (Muslims) entrance from nearby Myanmar. Moreover, during tourist season, short time stay of tourists within island creates population pressure because of its limited capacity. Contrary, people practice anthropocentrism among themselves which is liable for population growth and consequently, over consumption and depletion of resources cause environmental degradation. Besides, due to lack of education, people cannot understand or realize about the impact of population growth. But spreading education amid mass people and growing non-anthropocentrism amidst them can be helpful for controlling population growth. Moreover, early marriage, polygamy and illegal Rohingya entrance should be stopped immediately otherwise it will become threat for future existence.

Tourism vs biocentrism and eco-centrism

Table 2. Number of tourist visited at St. Martin Island (Khan, 2015;www.parjatan.gov.bd)

Visited Year	Number of Tourists
1996 - 1997	150 - 200
2002-03	62,520,
2003-04	103,488
2005-06	156,736

The island has been a tourist destination for many years ago, especially after the publication of a Bangla film ‘Daruchini Dwip’ covering unique landscape and local culture of island in 2007. But there is no official statistics on the number of tourists visited the island due to absence of systematic monitoring. The 2005-06 tourist figures imply an average of about 750 persons per day over a seven month tourism season, but the numbers of visitors on some days in the peak season must be higher and the number of tourist also depends on some factors.

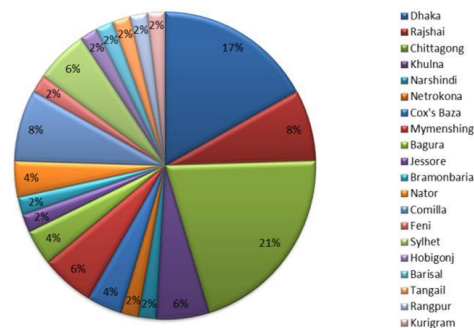


Fig. 2. Origin of the tourists from different parts of Bangladesh

Recent years, St. Martin’s Island has got more popularity as a tourist spot, despite of its location in the southern point of Bangladesh. The island annually attracts thousands of tourists because of its unique beautiful landscapes, clear sea water, and colonies of corals (Islam, 2002). At the same time, it has also an important ecological value as one of the few remaining nesting places in the region for several species of globally threatened marine turtles, along being a wintering site for migratory birds (GoB, 2006; Moudud, 2010). However, the unique flora and fauna of the island have experienced tragic changes over the last two decades. Large numbers of tourists’ entrance can be the cause of destruction. Tourists, who unmindfully or without caring throw away their left-over food scraps and drinks, leave behind synthetic articles or tin containers cause damage to the local environment. Further, untreated sewage is piped directly into the sea, or stored in open ponds, adversely affecting marine and ground water quality (CARDMA, 2010; Hossain, 2010). Hence, the growth of tourism on the island since the 1990s hardly contributes to sustainable economic development but it seriously damages natural resources. However, lack of appropriate knowledge about biocentrism and eco-centrism is redoubling this problem. But if ethical sense can be grown amidst tourists then it can minimize adverse impacts on island environment. However, the number of tourists increases rapidly at present year and our field survey shows that tourists have come from Chittagong (20%), Dhaka (16.36%), Rajshai and Comilla, respectively (7.27%, 7.27%), Khulna, Mymensingh and Sylhet are respectively (5.45%, 5.45%, 5.45%), Cox’s Bazar, Natore and Bagura are respectively (3.63%, 3.63%, 3.63%) and other districts individually contain 1.81% tourists (details in Fig. 2). Considering the current tourist pressures, introducing ecotourism is the best solution for sustainable income including raising awareness about biocentrism and eco-centrism.

Land use change and development vs land ethics and deep ecology

Table 3. Government and public infrastructure in St. Martin Island

Infrastructure	2008	2012	Infrastructure	2008	2012
Hotels	17	42	Light house	1	1
Restaurants	12	32	Naval base	2	1
Government office	1		Village resource centres	2	2
Mosques	2	11	BGB station	1	1
Primary schools	3	3	Police station	1	1
High Schools	1	1	Power plant (damaged)	1	1
Cyclone shelter	2	3	Government guesthouse	1	1
Hospital	1	1	Union council building	1	1

Recently, the island has become a lucrative business spot due to increasing trend of tourism. As a result, developers, political leaders and businessmen are imposing local people to sell their belonging lands to build hotel, restaurant, shopping centre and office. Consequently, agricultural and plantation land has been curtailed due to land use conflicts (Bangladesh Poush, 2006; Molony, 2006) which is liable for the deterioration of natural ecosystem of island day-to-day. The current land

use status is shown in (Fig. 3a). However, the number of infrastructures is also increasing rapidly, especially hotels and restaurants but without any prior planning and indiscriminately (Table 3). In case of infrastructures development, DoE has already introduced some regulations for construction viz. only cottage house building is permitted and in limited area but defective implementation which is liable for unsustainable development and growth.

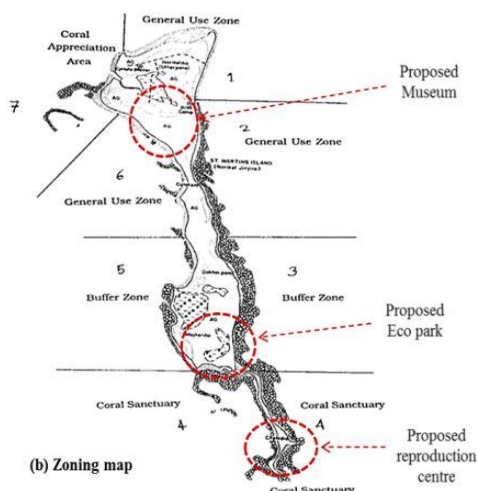
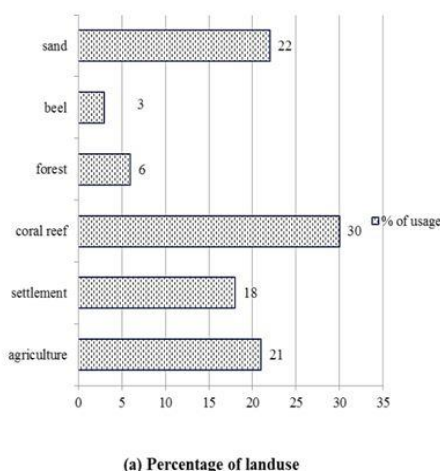


Fig. 3. (a) Current land usage % and (b) Zoning system map for sustainable development (Adopted: Mollah, 2000)

Fig. 3 shows the current land use scenarios of St. Martin Island and zoning system for development including proposed projects. According to land ethics and deep ecology, people should pay attention to protect ecology and give emphasis on non-anthropocentric values which can support to reduce development activities impacts on natural environment. Besides, proper zoning system can avoid impacts on natural environment and ecosystem. So for recreation, regeneration of rare species and revenue collection, we have suggested three zones viz. museum, eco-park and reproduction centre which are showed in Fig. 3 (b). Further, coastal plantation should be enhanced along with limiting local people and tourist movement (NACOM, 2009; Rashid, 2008).

Current status of biodiversity

Biocentrism and animal rights

Once the island was full of flora and fauna (Coral, sea turtle, crabs, algae etc.) that is why it was declared as one of the richest biodiversity hotspot in Bangladesh by IUCN in 2010 (CARDMA, 2010). Coral stone is ecologically very important because their reduction accelerates destruction of island, besides it gained specialty for coral. There are about 66 species of soft and hard coral belonging to 22 genera. The coral coverage in 1997 varied from (2-10) % depending on the location and abundance. Besides, 150 species of marine algae have been identified at island, including 10 economically important species. Marine algae are distributed throughout the rocky intertidal and sub-

tidal zones. Then a total of 234 species of fish have been identified from the site, 89 of which are coral associated fish species and only 16 of which are freshwater fish. Moreover, there are 19 species of mammals and 120 species of birds. Therefore, it was declared as ECA by Bangladesh government but its richest biodiversity has been depleted for frequently enhancing of human movement, collection, landuse change, and disturbances of natural ecosystems (Hasan, 2009; DoZ, 1997).

However, application of ethical concept like animal liberation or right, biocentrism, and eco-centrism can support to protect and enhance biodiversity growth or equivalence in the island. Justification of social, economic and ecological value of biodiversity can awaken such an attitude among community people and tourists which will be beneficial to conserve and protect biodiversity. Contrary, reproduction centre and reserved areas should be introduced as-well-as some human activities must be banned suchlike coral, fish, crabs, sea turtle, and algae etc. collection from nearby area and surrounding beach. All of these biodiversity have a great ecological value for sustainability of the island though currently they are in great threat (World Bank, 2000; NACOM, 2009).

Present status of energy and communication: social consumption ethics

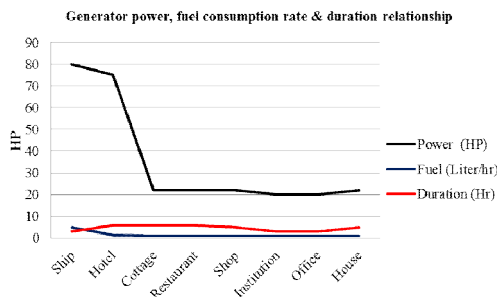


Fig. 4. Energy consumption rate and duration relationship by different engines

St. Martin is fully distinct from mainland and hence, only one communication way is water transport system between island and mainland. There are two gates for boarding into ships or launches suchlike Teknaf (long distance but currently used) and Shah Fari Dwip (short distance). Anyhow, they use diesel as fuel in transports, generators, motors; and kerosene for lamps (Fig. 4). Before 1991, there was one power plant by using diesel which was completely destroyed by cyclone and now a remarkable number of families use solar panel for energy (fossil fuel for cook). Later, one wind power plant was constructed in 2006 but it didn't work properly due to some mistakes. Being separated from mainland, all fuels are collected from Teknaf which is very costly (Islam, 2005; Ullah, 2013).

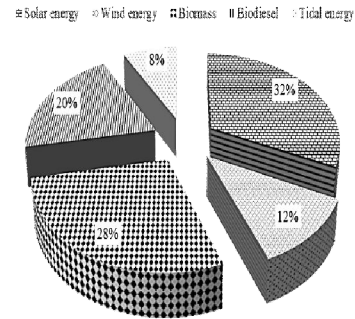


Fig. 5. Probability of renewable energy production from different sources at St. Martin

St. Martin Island is distinct from mainland, so it is difficult to supply electricity from national grid. Hence, alternate source of energy is required to meet the demand of electricity. There are some feasibilities of electricity from renewable sources and finds that the best option is wind-solar-biomass hybrid system where there is no subsidy, only the need to purchase coconut palm feedstock (Ullah, 2013). Renewable energy could be an effective alternative to fulfil the electricity demand in the island. The probability of renewable energy production from different sources at island is shown in (Fig. 5). Besides, awakening conscious amid local people about social consumption ethics can minimize wastage of energy and increase efficiency. Providing training and loan for using renewable energy can encourage to rapid use of alternate energy at island.

Current water status and ethical consumption

Drinking water is a big problem in island due to salinity intrusion in ground water level. Their main water sources are deep tubewell and dug well for drinking and household usage purposes. In the summer season, sea water level fluctuate which occur salinity intrusion into the mainland water bodies and all tubewells and dug well water become saline (Thompson and Islam, 2010; Chowdhury, 2000). Moreover, they harvest rain water for domestic usage and washing motives. But fresh and drinking water supply is a great problem for island inhabitants because the whole island is covered with saline sea water. Therefore, the only reliable drinking water source is rain water harvesting by constructing new wetlands and artificial lagoons as well as protecting existing ones. Contrary, sea water supply for drinking and household purposes by local government applying desalinization technology is better option because sea water is unlimited in quantity. Besides, ethical consumption of water should be ensured by creating awareness among mass people to reduce wastage of water and increasing efficiency. It is remarkable that currently huge amount of water is wasted every day.

Present status of agriculture and social ethical consumption

The whole area of island is not fertile, only the centre and the south parts are suitable for cultivation because other areas soils are either infertile or un-stabilized. In the rainy season rice grows and in the winter different varieties of vegetables are grown. Among all plants, coconut is the dominant species in the island including betel nut, and they earn a lot of money by selling coconut along with timber of coconut tree is used for construction of house. Besides, they cannot grow sufficient crops to meet their daily demand within limited land due to dearth of fertilizers, pesticides, and modern technology. Hence, they need to buy food from mainland with high price including transport cost. Wherein, application of social ethical consumption theory for agricultural production and consuming foods is the best option for the island. Further, spreading Daoism and Confucianism theories amid mass people can reduce wastage of foods and confirm sustainable production that can meet current demands along preserving for future. However, only one-third lands of the island are cultivable whereas they grow rice in the rainy season and vegetables in the winter season. So, government should supply food within standard price and monitor it regularly. Similarly, people should minimize wastage of foods during production, processing and consumptions. Currently, they use chemical pesticides and fertilizers which are costly and environmentally harmful but they can use organic soil nutrients, fertilizers and compost products (using food waste, leaves, animal manure, and human nightsoil etc.) for high production of agricultural crops without putting negative impacts on environment. Rice and fish are the staple food for the island inhabitants same as mainland people of Bangladesh. In case of fish, they don't need to think about it because surrounding sea is abundance with fishes. But excessive collection of fishes from nearby sea is very harmful for the existence of island due to reduction of biodiversity, soil erosion, disturbance of reproduction and ecological services. Further, there is another big problem that sometimes Myanmar Navy Forces shot fishermen which is threat for catching fishes to meet their daily food demand (Feeroz, 2009; Maruf, 2004).

Livelihood sources and ecotourism

The income sources of island inhabitants are not so wide like mainland rather slightly restricted. The main sources for livelihood of island people are fishing, tourism business, farming, service, and day labour (Fig. 6) but seasonal (Afrin *et al.*, 2013). The secondary sources are driving van, coconut sale, vegetable cultivation, and poultry farming. But the primary sources of livelihood being seasonal, they suffer more during off-season and waste time through idle activities. Contrary, most of the people

are poor and so they have to live through hardship during off-season. Therefore, their current crying demand is sustainable income sources for better and secured life. Both government and international organizations should come forward to resolve their problems by initiating substitute income sources and supplying financial support.

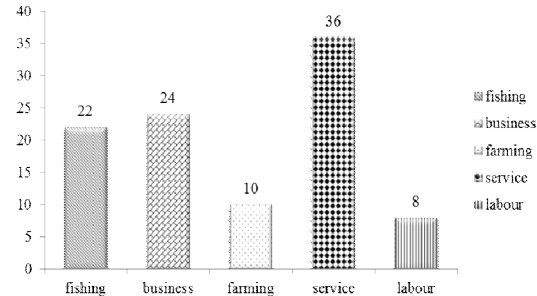


Fig. 6. Percentage of people involved in different occupations for earning livelihood

Anyway, the sustainable livelihood source for the island people is ecotourism according to growing up trends of business and significance of environmental conservation. Besides, Fig.7 shows the current use pattern of income sources and dependency of livelihood. It is stark clear that a major part of livelihood comes from tourism and its related business. Contrary, ecotourism can provide both sustainable income and converse natural environment including ecosystem because it engages community people benefits and ensures their involvement in management programs. Therefore, initiating ecotourism and small cottage industry can be the sustainable substitute income source for Island inhabitants.

Current status of environmental pollution

Engineering strategies and ethics

St Martin's includes a cluster of islands. Scientists say that island is getting smaller every year instead of growing geologically as it should be. The increasing cyclones and erosion of coral reef are held responsible threats. Besides, sea turtles die in huge numbers which is an indication that all is not well. Hence, biodiversity loss is a great environmental impact now. Contrary, pollution is not so serious problem currently but during tourist season population pressure rise up and their activities intensify pollution such as water, soil, solid waste, air and sound. Air pollution is not significant but water, solid waste and sound pollution are noticed during tourist season remarkably. Oil spills, heavy metal, sewage from hotel or restaurant, and chemicals from fertilizer runoff lead to water pollution mainly. Contrary, there is one solid waste collection system and make open fire to dispose wastes but recyclable ones are shifted to mainland (Teknaf). However, solid waste is a potential source of biomass energy and composting products. Though pollution is not a big

factor now but there is probability of being more polluted someday and the island may disappear from the world map in near future. Contrary, application of appropriate engineering strategies, ethical concepts and justification of moral standing as well as value judgement during implementing development project and any economic activities can minimize impacts on natural ecosystem, environment and biodiversity (Ali and Ahmed, 2000; Hossain, 2010).

However, creating awareness amid local people and tourists is the best option for minimizing biodiversity loss and environmental degradation. Besides, appropriate policy adaptation and implementation for controlling fuel consumption emission, development project, and artificial light and music sound on the beach area of island can facilitate to protect island from being disappeared. Finally, follow up appropriate zone system for development projects viz. establishment of government office, resort, recreation spot, and other infrastructures can avoid unexpected impacts on Island (NACOM, 2009).

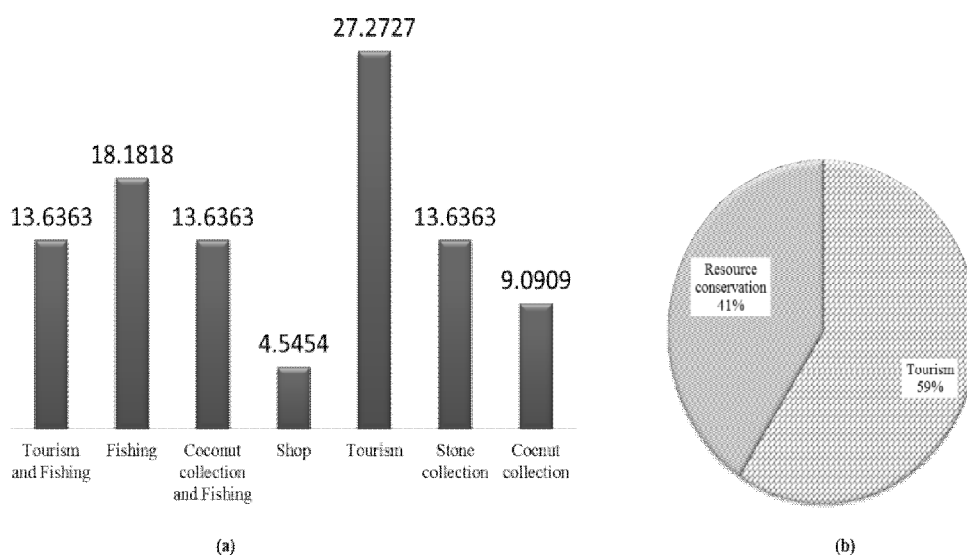


Fig. 7. (a) Use pattern of income sources and (b) dependency of livelihood at St. Martin

Climate change and future of St. Martin Island

The island land height is almost similar to mean sea level. Due to global warming sea level is rising up gradually, which will affect island someday. Therefore, the water level of the Bay of Bengal is fluctuating and submerging surrounding landmass of island wherein sometimes it is also observed that new land is formed in other side. So the impact of global climate change is a great threat for the future long term existence of Island (Feeroz, 2009; Rahman, 2009; Warricket *al.*, 1993; Maruf, 2004; Brammeret *al.*, 1993).

Conclusions

From last decade, St. Martin Island has become a great tourist attraction spot in Bangladesh. Lately, it has turned as a fast economic growing spot due to tourism business. Consequently, the natural environment and ecosystem is continuously deteriorating at an alarming rate. Therefore, government and local authority have already adopted some policy and plans but defective implementation hereto. Moreover, lack of awareness among local people and tourist is a great

barrier to implement all the planned policies and laws. However, introducing and practicing environmental ethics concepts viz. non-anthropocentrism, biocentrism, ecocentrism, Rolston's seven values, social judgement, land ethics, deep ecology, Confucianism and Daoism can minimize adverse impacts and conserve natural ecosystem. Therefore, we consider the application of environmental ethics is the best tool for managing this historical unique Island. But local community people involvement in management programs and their benefits must be confirmed.

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