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Assessing the Factors Affecting Sustainability and Conservation of Ecotourism Resources: An Empirical Study on Sundarban

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ABSTRACT

Purpose: The key objective of this study is to determine whether the different factors, such as water vehicle movement through Sundarban, Oil spills on the river water, stakeholder associations, deforestation, etc are affecting positively or negatively the sustainability and conservation of ecotourism resources in Sundarban. Apart from this, the motive of the research is also to find out the Eco-tourism practices and conservation of Sundarban for growing sustainability in the tourism industry in this country.

Methodology: The research is exploratory, and a survey research method has been used, involving 70 visitors who have already visited or wish to visit Sundarban. Secondary data has been used in addition to primary data. Direct and indirect sources were used to procure the data. The purposive sampling method was used to collect the data because the researcher obtained data from those who had already experienced or wished to travel to Sundarban. The data has been analyzed by using SPSS (Version 23.) (including linear regression analysis with ANOVA, graphs, chart percentages, etc).

Findings: According to the test results, apart from the Drawback of Government rules and regulations respondents and experts find that the majority of the independent variables, such as (Oil spills on river water, Building Rampal thermal electric plants, Deforestation, Lack of Stakeholders association, Lack of Arranging Seminar or another program to raise awareness, Lack of maintaining sustainable issues, Negligence in conserving ecotourism resources) are affecting sustainability and conservation of eco-tourism resources in Sundarban.

Originality: The research exposes the factors affecting the sustainability and conservation of ecotourism resources in Sundarban and provides some strategic solutions.

Research Limitations: The sample size of those who participated in the research could have been larger.

1. Introduction

The tourist industry is one of the most profitable sectors in Bangladesh (Arif, Islam, & Islam, 2011). Ecotourism has gained recognition as an ecologically and virtually promoted form of

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tourism that, when performed properly, maximizes cultural and ecological advantages while giving visitors an inspiring experience and ecotourism providers more financial benefit (Jen Boulden, Ramon Escudero, et al., 2003). The tourist industry's direct and indirect economic impact on Bangladesh is growing daily. Travel and tourism in Bangladesh contributed 3.0% of the country's GDP in 2019, 2.9% of all jobs, and 0.7% of all exports were impacted by foreign visitors (World Travel & Tourism Council, 2020). Bangladesh is therefore gifted with enormous natural beauty, a heroic historical past, and archaeological treasures, making tourism—especially ecotourism— among the most auspicious industries in the nation. Being one of the tourism industries with the quickest growth, ecotourism offers enormous potential. Although the phrase "ecotourism" was originally used in the early 1990s, it is a relatively new idea in Bangladesh (Situmorang & Mirzanti, 2012). The Oxford English Dictionary states that the term "ecotour" was first used in 1973, and "ecotourism" in 1982. The International Ecotourism Society (TIES) described ecotourism as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (The International Ecotourism Society, 2015).

This is likely the greatest definition of ecotourism. Ecotourism is praised for maintaining and protecting a variety of natural and cultural habitats (Kabir and Bhuiya, 2004). Even though ecotourism is yet comparatively new in Bangladesh, with the right support and guidance, it has an eminent deal of growth possibilities (Khondkar & Anis, 2016). Bangladesh is a "gold mine" for ecotourism goods. The nation boasts a wealth of historical, cultural, and religious treasures that have been preserved and bestowed with natural beauty by Mother Nature (Khan and Han, 2013). There are very few nations in the world with as abundant flora and fauna as Bangladesh. There are a lot of possible ecotourism destinations in Bangladesh (Ahsan, 2008). A popular site for ecotourism is the Sundarbans, which is the world's biggest tidal mangrove forest. Spanning over 10,000 square kilometers, 60% of it is in Bangladesh, while the remaining portion is in India (Roy & Roy, 2015). Despite the Sundarbans' enormous potential as a destination for ecotourism, the loss of natural resources—including land, woods, culture, species, and wildlife—has recently been a common occurrence there (Afroz & Mahmud, 2017).

Because of this, the sustainability or sustainable growth of ecotourism in the Sundarbans has been a top priority for the appropriate authorities. Nevertheless, not much research has been done on this topic up until this point. Prior research has been done on the issues and potential of tourism in Bangladesh (Khanom, Shah, & Chaudhary, 2011; Afroz & Hasanuzzaman, 2012; Afroz & Mahmud, 2017). Furthermore, previous research has either concentrated on a specific ecotourism location in Bangladesh (Choudhury et al., 2004; Hamid & Frank, 1999; Iqball et al., 2010; Islam, Iftekhar, & Islam, 2012; Khan & Han, 2013) or examined the state of tourism in Bangladesh as a whole (Ali & Mohsin, 2008; Ashraful, Chowdhury, & Shahriar, 2012; Hassan & Shahnewaz, 2014; Jahan & Rahman, 2016). In this sense, the study aims to assess how sustainable ecotourism is in the Sundarbans. More precisely, since the environment, tourism progress, and community involvement are crucial components of

ecotourism sustainability (Tsaur, Lin, & Lin, 2006; Ross & Wall, 1999), this study will look into the possible effects of these factors on Sundarbans ecotourism sustainability-related issues.

2. Literature Review

Part of the reason that sustainable mangrove conservation has become a global concern is that community behaviors, knowledge, and awareness are not always cohesive. Thus, the goal of the current study was to measure people's knowledge, attitudes, and perceptions (KAP) toward the preservation of the Sundarban mangrove ecosystem. (Rathnayake, (R. R. M. U. N. B., Bellanthudawa, B. K. A., Pawuluwage, S. M., Arachchige, S. U. K., Nawalage, N. M. S. K., & Tennakoon, A. (2024). Given the significance of the mangrove forest's ecosystems, the United Nations General Assembly designated 2021–2030 as the decade dedicated to ecosystem conservation. The proclamation of ecological conservation could face obstacles due to both natural and man-made factors. For example, the instability of mangrove forest ecosystems may be caused by anthropogenic perturbations, complex biotic regulation, species redundancy, and environmental inconsistency (Iqbal, 2020). Mangrove forest habitats are being destroyed by industrialization, deforestation, unplanned development, and climate change, all of which have drawn a lot of attention. According to empirical research, the annual rate of mangrove deforestation is 1.2%, indicating further ecological degradation shortly (Bernardino et al., 2021).

Understanding the community that lives close to those natural resources has been immensely favorable in recognizing the relationship and quantifying perceptions regarding the conservation of mangrove ecosystems because they are keen observers of changes in the ecosystem (Badola et al., 2012; Quevedo et al., 2021; Wang et al., 2021). Because ecotourism has the potential to preserve biodiversity, enhance economic growth, and raise awareness of sustainability issues, its relevance has been growing. (Abtahee, M., et al., (2023). The biodiversity found in the Sundarbans is increasingly being threatened by oil contamination. Large seagoing transport vessels that travel through the Sundarbans on their way to the seaport in Mongla are the cause of oil contamination (ESCAP, 1988; Scott, 1989). In addition to routinely discharging bilge and ballast water, mechanized boats, fishing trawlers, cargo-carrying ships, and passenger/tourist boats are also accountable for oil spills in rivers (Iftekher, 2004). Furthermore, a significant amount of oil unintentionally spills from the oil-carrying ships. There have been several noteworthy oil spills in the Sundarbans' rivers. The most well-known oil spill incidents were documented in the Shela River in the Sundarbans in 2014, at the Dhangmari Forest Station in 1994, and close to the Jongra Forest Camp in 1990 (Karim, 1994; Bdnews24, 2014).

Oil spills contaminate water, harm the mangrove ecosystem's soil quality, and endanger mangrove trees, seedlings, plankton, soil micro- and macro-organisms, birds, fish, and aquatic animals (Duke, 2016). The most hazardous portion of the oil is the light fraction, which thankfully evaporates or breaks down quickly. Most of the long-term effects on mangroves are brought on by the heavier proportion; these effects include loss of aerial roots,

decreased waste fall, and decreased seedling progress and monstrosity. (Iftekhar, 2004). The accumulation of oil on the leaf surface can clog stomata, impairing vital physiological functions including photosynthesis, respiration, and water metabolism in mangrove plant species (Peng, 2000). When feeding, fish can also directly absorb oil, which taints their tissues. Crude oil contains persistent and carcinogenic aromatic hydrocarbons that have been shown to accumulate at former trophic levels of the food chain and to be physiologically deposited in fish tissue (Rahman et al., 2009; Shigenaka, 2002). To facilitate the import/export of goods and national trade, the Mongla Sea Port was created in 1950.

Situated close to the approach of the Passur River, 131 kilometers upstream from the Fairway Buoy, it is situated in the Bay of Bengal. This river passes through the Sundarbans Forest and serves as a navigation route from the sea to the port. It links the other major rivers in the Sundarbans, such as Baleswar, Bhola, Marjata, Arpangasia, Shibsa, and Jamuna, and splits the Sundarbans into two main sections. Rich in aquatic diversity, the Passur River is well-known for its crocodiles, Gangetic dolphins (Platanista gangetica), Irrawaddy dolphins (Orcaella brevirostris), and hilsa fish (Tenualosa Elisha), among other fish and shrimp species. The government has acquired 1,834 acres of agricultural land in the Rampal Upazila Satmari-Katakhali and Koigordashkathi districts in order to construct the power plant. The remaining areas are public and were cultivated by the landowners for fish and rice, with the remaining 86 acres being kash land. To facilitate ship access for coal-carrying vessels visiting the plant, the government has also undertaken the initiative to dredge ten kilometers of the Poshur River. The operator recommends using imported coal because there isn't enough coal available locally. The Mongla sea port will be used by the Bangladeshi government to transport coal into the Sundarbans. The project's signatories are the Bangladesh Power Development Board and the Indian National Thermal Power Company. The proposed power plant will burn about 4.75 million tons of coal yearly, resulting in the production of about 0.71 million tons of ashes, 0.5 million tons of sludge, and maybe 0.5 million tons of liquid waste (CEGIS 2013)..

In addition, a significant amount of other harmful chemicals and airborne particles, among them carbon dioxide (CO2), a primary cause of global warming, would be released, as per the Union of Concerned Scientists, a US-based organization that studies the kinds and intensities of pollution from coal-fired power plants. The massive amount of garbage generated by burning coal may contaminate the Poshur River's water as well as the groundwater. The government has lately fixed to designate a portion of the Poshur and Andharmanik rivers as dolphin sanctuaries, despite the presence of proper legislation to preserve the environment and wildlife (Sankar 2012). The majority of the effects of coal-fired power plants are opposite and constant. The Sundarbans and the surrounding area's climate, geography, land usage model, air and water attributes, floral and faunal richness, aquatic ecosystems, catch fisheries, and tourism will all be irrevocably impacted by the proposed coal-fired power station. There will be an increase in flooding, river erosion, noise pollution, health concerns, social forestry, farmed fisheries disappearing, and major agricultural damage

in addition to the drop in the groundwater table, noise pollution, and other factors. (Chowdhury, 2017). The overexploitation of the Sundarbans is a result of human demand exceeding supply. The main issues are encroachment and illicit fuel and timber harvesting (Paul et al. 2017).

Illegal forest cutting is primarily caused by the high demand for wood and the unemployment rate in the surrounding areas. Sundarbans are located next to the Khulna newspaper mill, which has long relied on fish, crabs, honey, and medicines; nevertheless, in recent times, substantial exploitation has taken place as a result of increased population squeeze on the Sundarbans (Rahman et al. 2010). The Sundarbans' biodiversity is rapidly vanishing as a result of unlawful encroachment. Endangered and threatened plant species; the Sundarbans' endangered and extinct animal species. Furthermore, the primary sources of income for the locals are fishing and gathering non-timber wood, which places a great deal of strain on the mangrove ecosystem. Additionally, it has been noted that there are fewer fish in perfunctory waters (Mahadevia and Vikas 2012). Moreover, the mangrove environment is seriously threatened by the overabundance of shrimp seed collecting and counterfeit culture in forest regions (Islam and Bhuiyan 2016).

However, the increased movement of seagoing vessels is anticipated to have an impact on the diversity and quantity of this river's aquatic resources. Over the last 15 years (2004–2005 to 2018–2019), the number of ships passing from Mongla port has climbed from 454 to 1283 annually. With the port's modernization, the new Rampal coal-based fired power plant coming online, and the growth of industrial estates in Khulna and the Mongla Export Processing Zone (EPZ), it is anticipated that the number will rise even more in the future. In the southwest of Bangladesh, the number of industrial activities has been steadily rising due to several government investment initiatives, including the building of the Padma Bridge, the Rampal coal-based fired power plant, the renovation of the Mongla port, and other factors. The Mongla Export Processing Zone, the Mongla port area, Jessore, Bagerhat, Kustia, and Khulna are the primary locations for industries. These comprise cottage and small businesses, medium-to-heavy enterprises, and industries centered on natural resources and agriculture (BEZA, 2015). 190 industrial projects had been permitted as of April 2018 in the Environmentally Critical Area (ECA) surrounding Mongla Port, which is 65 kilometers from the World Heritage Site. The ECA that borders the Sundarbans is home to 154 small and cottage businesses, as well as medium-to-heavy industries, businesses based on agriculture, and industries based on natural resources (UNESCO 2019).

About 200 years ago, work on building the Sundarbans'' northern embankments began to shield agricultural areas and human settlements from flooding and tidal inundation. At the regional level, the embankment system influences the vast hydrological network, the tidal prism, and tidal expansion (Pethick and Orford, 2013; Wilson et al., 2017). The Sundarbans' hydrodynamic network, sediment accumulation, and pattern of erosion are thought to have changed as a result of embankments, which could have an impact on how quickly sea levels rise (Hale et al., 2019). The lowest areas behind the embankments have often been

overtopped by the creek bottoms in the Sundarbans. Periodic saline water flooding is caused by the embankments' regular breaches and disturbances as a result of tidal influence, cyclonic storms, and tidal vibrance (Bhattacharya, 1998; Danda, 2007; Hale et al., 2019). More fertile, finer sediment fragments are conveyed into the center of the Sundarbans, while less fertile, fat soil fragments are settled along embankments or at the surface (Hale et al., 2019). In the Sundarbans, there have been 24 documented fire incidents (BFD, 2021). Except for the Wildlife Sanctuary area, Kotka, and Chandpai Rage in 2002, all incidents took place in the northeastern region of the forest area's prohibitions (BFD, 2021).

The number of fire incidents and the impacted areas, however, most likely exceed official records. In the Sundarbans, forest fires can originate from both deliberate and unintentional sources. Careless actions by fishermen, woodcutters, fuelwood collectors, and honey gatherers in the areas are to blame for the unintentional happenings. On the desiccated woodland floor are burned cigarettes and torches used to gather honey. Intentional fires are caused for a variety of reasons, such as unlawfully clearing land for cattle grazing, harvesting fuelwood, fishing, or diverting the attention of forest officials from poaching and wildlife trafficking. Sundarbans under the Sundarbans East Forest Division, which resulted in 34.61 hectares (0.005767% of the Sundarban) of damage. The local aristocracy took great delight in hunting wildlife from the Sundarbans, which was promoted by the government, which even established a reward for hunting tigers (Hunter, 1875). Since wildlife conservation initiatives are enforced, hunting of any kind is now forbidden. Bangladesh's Wildlife (Preservation and Security) Act of 2012 has emerged as a key piece of legislation to protect and manage wild animals. Nevertheless, the poachers continue to hunt deer, tigers, snakes, and birds, and monitor lizards, and other wildlife for both domestic and foreign markets.

According to Samia (2016), tiger parts like skin, teeth, bones, flesh, tongue, claws, fur, and whiskers are highly prized in the international market for use in medicine and society. Using rifles, traps, and bate, locals, "professional" poachers, and pirates are the principal perpetrators of illegal deer hunting. Due to convenient and quick access, poaching is primarily conducted around the Sundarbans' periphery (IUCN, 2012). For the 16 years between 2004 and 2005, there have been 387 deer deaths, killings, and poaching incidents, with an average of 24 per year. Over the course of the last 19 years (from 2001–2002 to 2019–2020), 51 tigers have been killed, poached, or otherwise threatened with death. Bangladesh is currently experiencing a significant crisis with wildlife trafficking because of the enormous demand on the illegal market, especially for tiger bones and skins in China. The Forest Department conducted many seizures and discovered 21,506 live wild animals and birds, including bear and tiger cubs that were documented in the media between 2010 and 2015. While a large number of the items were intended for Southeast Asian nations, some were intended for local sale. International wildlife trafficking makes use of the land borders with Myanmar and India, as well as Shahjalal International Airport (Daily Star, 2015).

Local reports also mention the regular trafficking of monitor lizards and geckos from the Sundarbans. Sustainable tourism developments are filling up the requirements of present

travelers and local communities, which also protects and enhances scopes for the future. It is intended to lead to resource management in a certain manner that maintains biological diversity, vital ecological processes, cultural probity, and life support systems while meeting aesthetic, social, and economic needs (WTO, 1997). Ecotourism is considered to have five inferences: nature preservation, minimal impact, sustainability, significant local community engagement, and environmental knowledge (Arsenijevic and Bohanec, 2011). Additionally, by the idea of sustainable ecotourism development, ecotourism can be "sustainable" if improvement satisfies the requirements of current visitors and communities while preserving chances for the future. The preservation of the genuine and the association of local communities at every stage of the system are essential components of ecotourism and should be viewed as environmental protection (preserved areas) (IUCN-The World Conservation Union). The long-term benefits of the development process, which directly contributes to the construction of "sustainable existing" intended areas, can be significant and need a sustained commitment from all parties concerned (Roxana, 2012).

"Visiting fragile, pristine, and typically protected areas is called ecotourism." It promotes veneration for different cultures and human rights while also supporting traveler knowledge, financing environmental reservations, and the political and socioeconomic empowerment of host communities. Ecotourism strives to raise awareness of the environment by investigating ecology and ecosystems, as well as by offering outdoor-themed activities (Martha Honey, 1999). People's ways of thinking are influenced by actively participating in ecology and gaining firsthand knowledge of how ecosystems function, which ultimately increases cognition of preservation and protection (Ecotourism - Sustainable Tourism in National Parks and Protected Areas, 2005). Low-quality edaphic elements at a site are associated with habitat deterioration (Hutchings and Seanger, 1987). When it comes to management interventions, degraded areas in the Sundarbans require extra care because standard prescriptions won't be enough to generate or sustain the expected goods and services. These regions were designated as non-commercial cover (NCC) zones with certain climbers and noncommercial species because it was discovered that they were under stocked and less productive (Siddiqi, 2001). The Sundarbans' degraded areas consist of elevated terrain, depressions, deserted canals, and riverbanks. The northern and northeastern regions of the forest contain comparatively elevated areas.

They are only briefly submerged during the monsoon during the spring tides. In the center and western parts of the Sundarbans, in particular, low-lying areas of standing water show little to no natural mangrove regeneration. There is no mangrove regeneration in sizable regions along the sides of rivers or canals. By evaluating forest cover, one may monitor the decline of a habitat. Using satellite photos taken between 1989 and 2014, the US Geological Survey classified the Sundarbans into three categories: forest, waterbody, and others (bare plains, sandy areas, and marshy areas with dwarf flora). From 1989 to 2014, the percentage of the 'others' type grew, according to this study. To make any trustworthy findings, more research is necessary. The inhabitants of the districts of Satkhira, Bagerhat, and Khulna rely heavily on the Sundarbans for their livelihoods. These folks lack formal education and don't

understand the importance of protecting mangroves. They destroy the forest resources because they don't know how to conserve forests (Rahman et al., 2010), even though Sundarban mangroves are protected by several laws, rules, and policies. Furthermore, the growth of mangroves is impacted by global climate change (Islam et al., 2015). Therefore, rapid action is needed to lessen the impacts of climate change. Nevertheless, the Sundarbans have seen extensive human encroachment, turning forested areas into agricultural land, despite the preservation measures. Such human activity has greatly increased the Sundarbans' stress.

There are three main causes of the disappearance of mangrove forests in Bangladesh: (i) a lack of institutional capacity and knowledgeable authorities and forest security; (ii) inadequate planning and insufficient knowledge of coastal zone management; and (iii) a failure to implement development plans (Rahman et al., (2010). The choice to build a 1320 MW coal-based fired power plant in Rampal, only 14 km from the Sundarbans, is a recent example of poor planning; it violates the regulations governing project execution in an environmentally sensitive zone (Kumar 2016). This facility will burn about 4.75 million tons of coal a year, creating 0.5 million tons of ashes and other wastes (hazardous effluents) accordingly. Furthermore, burning coal is anticipated to release a substantial amount of CO2, CO, SOx, NOx, hydrocarbons, volatile organic compounds (VOC), and other airborne particles (The Daily New Age 2016). Experience has shown that, on average, a coal-fired power plant consumes less moisture from the soil declining groundwater layers: Less fresh water available for farming; worsening surface and groundwater characteristics; fewer croplands, and an increase in shrimp farms decreased river flow Ganges the riverbed ridges in the downstream direction. Elevated salinity of the water Drinking water that is too salinized poses a health risk.

High-salinity surface water is used for irrigation. Aquatic habitat disturbance Navigation and communication disturbance issues with the usage of water in industries, issues with sensitivity to salinity plants, and a rise in the number of fatal diseases. Reduced freshwater flow has only a 33–35% impact on the coastal environment when it comes to coal heat generation (Chowdhury 2012). Cooling water absorbs most of this heat and may release its energy into the neighboring Poshur River (Hance 2013). Additionally, the supply of bituminous coal is in West Bengal, India, via the Sundarbans' rivers and channels. This could negatively impact the forest's healthy ecosystem and heighten the hazard. To save the Sundarbans, the Department of Forests (DoF) attempted to put several conservation strategies into action, such as the strategy for national environmental management, environmental policy, and national conservation strategy. However, logical and scientifically grounded management systems have not yet been created (Rahman et al., 2010; Roya and Gowb 2015). Furthermore, little study has been done so far to determine a successful and long-lasting plan for managing forests (Islam and Wahab 2005).

The existence of water resources in ecotourism implementation generates benefits in terms of both use and visual appeal (Kiper, 2011). Ecotourism promotes sustainable

development, which is a problem in the modern world. This idea has helped several nations secure the regional development of their nations. According to this theory, ecotourism and regional development can both contribute to sustainable development in a given area. An appropriate balance between these dimensions must be achieved to ensure the sustainability of ecotourism enrichment over the extended term (Bhuiyan et al., 2012). The social, economic, and environmental facets of the growth of tourism are referred to as ecotourism development dimensions.

3. Objectives of the Study

The **principal objective** of this study is to explore the factors affecting the sustainability and conservation of ecotourism resources in Sundarban.

The other **specific objectives** are:

a) To gain an understanding of the Sundarban environment, including its floral diversity, fauna, and dangers.

b) To reduce the negative effects of tourism-related risks and to uphold cultural and environmental respect.

c) Providing locals with financial advantages, empowering them, and increasing awareness of the political, environmental, and social conditions of the host nation.

d) Provide some recommendations for the enhancement and modification of ecotourism resources of Sundarban.

a. Implications of the Study

To fully understand the implications of different land management strategies, both private land owners and governmental land managers need to conduct more studies on the sustainability and conservation of ecotourism resources in the Sundarban region. In addition to additional studies, results relating funds from ecotourism to the preservation of natural resources should be more widely disseminated outside of academic circles. This entails devoting time to disseminating research findings through periodicals, newspapers, trade journals, and other popular media outlets in addition to peer-reviewed journals. This way, lawmakers and other decision-makers will be made aware of the need to protect natural resources. Without understanding the connection between ecotourism revenues and natural resource conservation, land managers and public authorities are functionally blind and lack the knowledge needed to make the best decisions that maximize benefits across the triple bottom line. The effect of ecotourism on the foundation of natural resources needs to be regularly monitored (Boon et al., 2002).

Perhaps even more detrimental than the degradation itself is how people perceive their natural resources to be if it discourages visitors and removes the revenue generated by tourism from the area, which would otherwise support the preservation of the natural resources. For this reason, monitoring of both the resources and tourists is necessary. Tourist

satisfaction with ecotourism is negatively impacted by over-tourism, as evidenced by the finding that visitors who thought tourism threatened the rainforest's ecological integrity were also those who had an unsatisfactory experience (Prideaux, McNamara, and Thompson's, 2012). To make sure that the size of ecotourism is acceptable and does not impair the quality of the natural resources or the quality of the tourism experience, earlier research on adequate carrying capacity might be implemented (McCool & Lime, 2001).

In the absence of an appropriate framework, this study makes an effort to compile pertinent information from other scholars and create its conceptual framework that outlines some of the main sustainability objectives of ecotourism. Although the framework is subsequently implemented in a context-specific setting, the model itself can be helpful to ecotourism operators, government officials, tour operators, local government officials, and community decision-makers, to mention a few, in comprehending the inputs and conceptual connections between ecotourism and sustainable development and potentially even incorporating them into their schemes for developing eco-tourism. Academics interested in ecotourism and sustainable tourism stand to gain a great deal from this work as well. The majority of case studies on ecotourism in the literature are from Southeast Asia, Latin America, and Africa (Weaver and Lawton, 2005). In contrast, South Asian nations—Bangladesh in particular—have found it difficult to encourage ecotourism, much less mass tourism. By examining a region of Bangladesh where ecotourism is only present on a small scale, the research seeks to close a knowledge gap in this regard. Last but not least, the significance of this study lies in the fact that, in contrast to mass tourism, ecotourism is meant to benefit everyone and is a major factor in socioeconomic growth. Therefore, optimizing the advantages of ecologically responsible ecotourism is in Bangladesh's best interest.

b. Research Gap

The study looks at the relationship as a whole between environmental legislation, tourism development, and community involvement. The following are some possible areas for additional research to be looked into:

a) **Long-Term Effect Evaluation**: Even though the study shows relationships between several variables, more research is needed to determine how ecotourism affects the Sundarban’s environment in the long run. Comprehending the temporal fluctuations of these variables and t

b) heir combined impact on conservation endeavors may yield perspectives for sustainable administration.

c) **Local Stakeholder Viewpoints**: The article mainly concentrates on respondents’ quantitative data. Examining the qualitative viewpoints of nearby communities, tour companies, and other stakeholders is an area of unmet research need. Interviews and focus groups could provide insightful information on the potential, problems, and attitudes surrounding sustainable ecotourism.

d) **Tourist Behavior and Awareness**: Examining how visitors behave in the Sundarbans, including how well they follow rules, how they dispose of their trash, and how much they know about conservation efforts, may help determine how successful ecotourism programs are. It is essential to comprehend the reasons behind tourists' actions and how they affect the environment.

e) **Policy Implementation and Enforcement**: Although the study recognizes the significance of environmental policies, more investigation into the details of implementation and enforcement may be necessary. What is the level of enforcement of current policies? Policy suggestions might be influenced by investigating these issues.

f) **Climate Change Resilience**: Considering how susceptible the Sundarbans are to climate change, there is a research gap in determining how resilient ecotourism activities are to shifting environmental circumstances. In the face of changing habitats, harsh weather, and increasing sea levels, how can ecotourism adapt?

g) **Economic Endurance**: While tourism development is included in the report, a more thorough examination of ecotourism's financial sustainability in the Sundarbans is necessary. This involves assessing the production of income, the creation of jobs, and the harmony between the advantages to the economy and the environment.

h) **Community Empowerment**: Although community involvement is emphasized, investigating methods to give local populations more influence over ecotourism-related decision-making could improve sustainability. It is crucial to include communities as active participants as opposed to passive recipients.

In conclusion, filling in these research gaps could lead to a more thorough comprehension of the sustainability of ecotourism in the Sundarbans and help shape efficient conservation and community welfare policies.

4. Methodology of the Study

A survey questionnaire corresponding to each component was created to gather information. Consolidate information using the interviewing process. Through the interview process, data were gathered. Direct questions and Likert scales (a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree) were used to obtain the opinions of respondents.

a. Nature of the study

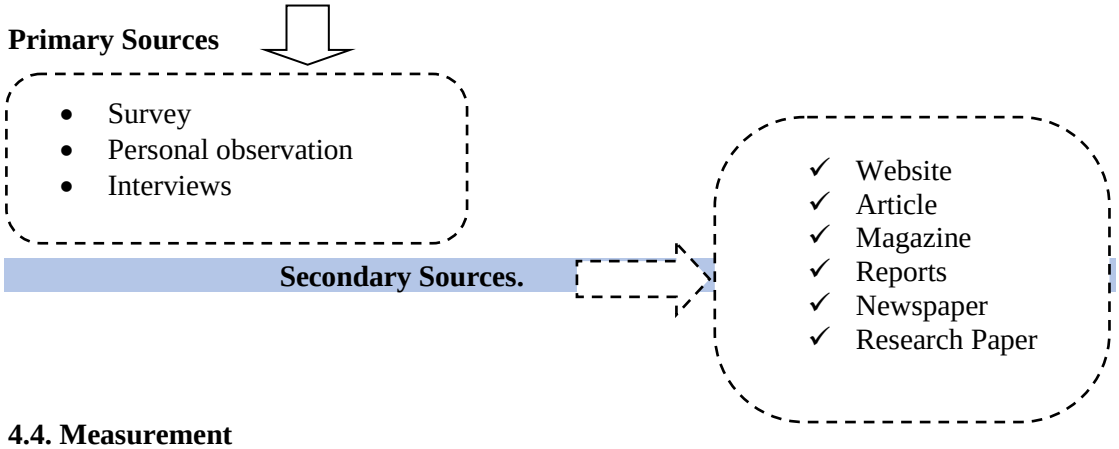
Closed-ended questions were used in this study to elicit replies, which limited the scope of the investigation because the respondents had to select from predetermined options. Additionally, because the replies are easily compared and repeated among subjects, surveys are versatile and have been used with individuals of all ages. They also speed up the process of answering many questions in a short amount of time.

b. Sampling Technique and Sample Size

A study including the entire population is ideal. Nevertheless, this is typically neither practicable nor possible, so one must make do with a sample. To gather primary data, the questionnaire survey method was employed. This study was carried out using the purposive sampling method. The Sample size was **75** but due to an error in 5, the researcher has utilized 70.

c. Fieldwork and Data Collection

Primary and secondary sources have provided data that has been gathered and utilized for the goals of this research project. Secondary data has helped to develop background material so that the reader can better understand the survey results and that the researcher needs to build constructively. Primary data were gathered using two methods. First, visitors to the area participated in a questionnaire survey. Second, authoritative conduct was used when conducting interviews. The study employed two important data sources, "primary sources" and "secondary sources," to compile this research.



4.4. Measurement

The dependent variable of this research is the Sustainability and Conservation of Ecotourism resources in Sundarban and the independent variables are Oil spills on river water, Proper way of conservation, Government rules and regulations, Deforestation, Seminars, Stakeholders association, Rampal thermal electric plant, Maintaining sustainable issues (Tsaur, S. H., et al., 2006). The researcher has utilized linear regression analysis to evaluate the effects of independent variables on dependent variables.

4.5 Data Analysis:

To estimate the association between the variables, linear regression analysis was done by using SPSS (Version 23). More precisely, these analyses are performed to determine which independent variable or variables are most closely associated with the dependent variable and how the independent and dependent variables are related to one another.

4.6 Hypothesis Development

H_1: The oil spill on river water in Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_2: Building the Rampal thermal electric plant beside Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_3: Deforestation in Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_4: Lack of stakeholder association with Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_5: Water vehicle movement through Sundarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

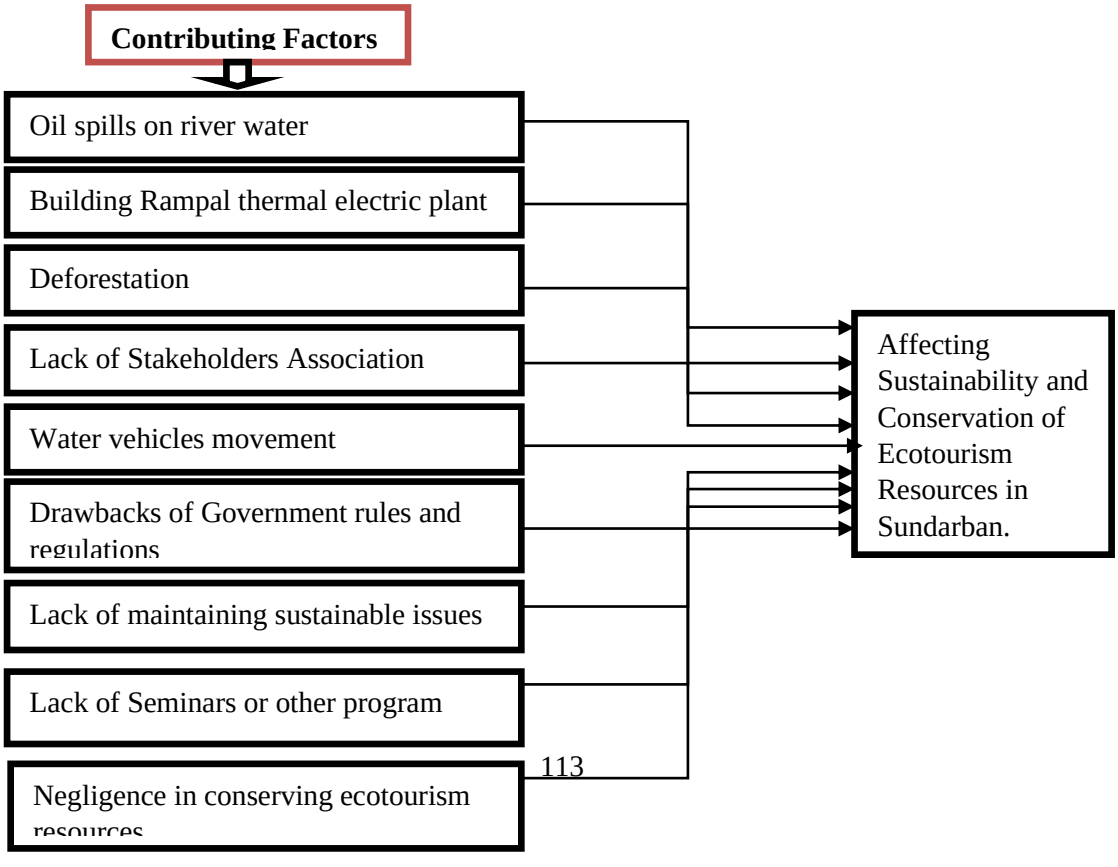
H_6: The drawback of Government rules and regulations in Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban

H_7: The lack of sustainable issues in Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_8: Lack of seminars or another program to raise awareness about Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

H_9: Negligence in conserving ecotourism resources in Sudarban has a significant influence on the sustainability and conservation of ecotourism resources in Sundarban.

4.7 Figure 1. Conceptual Framework



Source: (Conceptual Framework Developed by Researcher)

5. Overview of Eco-Tourism Concept

5.1 Eco-tourism

Ecotourism indicates a visit to naturalistic areas that preserve the environment and resources for future generations and ensure community health in the immediate area. The fact that so many diverse parties are trying to define "Ecotourism" has made it a challenging endeavor. The range of meanings is due to people's propensity to identify belongings in terms that are advantageous to the local community. However, several useful definitions are currently popular. According to The International Ecotourism Society, ecotourism is defined as "responsible travel to natural areas that improves the welfare of local people and conserves the environment." Traveling to peaceful, pristine natural environments is known as ecotourism, the concept and guiding principles of ecotourism established by the International Ecotourism Society (TIES) in 1990. They state that ecotourism is "Responsible travel to natural areas that conserves the environment and improves the well-being of local people." (TIES, 1990).

5.2 The Principles for Sustainable Ecotourism.

Using resources sustainably	Natural, social, and cultural resource protection and sustainable use are essential, and doing so will benefit businesses in the long run by Utilizing resources wisely.
Reducing over consumption and waste	Reducing waste and excessive consumption lowers tourism expenditures and lowers the cost of repairing long-term environmental damage.
Maintaining Biodiversity	Long-term sustainable tourism depends on preserving and maintaining ecological, social, and cultural variety, which also provides a solid foundation for the sector.
Amalgamating tourism into planning	The tourist industry's long-term outlook is enhanced by tourist development that is integrated into regional and national strategic planning frameworks and that carries out environmental impact assessments.
Nourishing Local economies	A variety of local financial actions are supported by tourism that protect these economies and prevent environmental harm by taking into account environmental costs and values.
Congaing local communities	The quality of the tourism project, the environment, and local people all gain from their full involvement in the tourism sector.
Consulting stakeholders and the public	If local organizations and institutions and the tourism sector are to cooperate and overcome any potential conflicts of interest, consultation between them is crucial.
Training Staff	The quality of the tourism offering is enhanced by staff recruitment and education that incorporates sustainable tourism into work exercises.
Marketing tourism	Customer happiness is increased, and reverence for the environmental, social, and cultural contexts of destinations is increased by marketing

responsibility	that gives visitors complete and responsible information.
Undertaking research	The industry must do a current study, observing efficient data collection and analysis to help solve issues and benefit travelers, the industry, and businesses.

Source: (Muriithi, J. K., & Ireri, P. 2024)

5.3 Three sustainable systems for the growth of ecotourism

A: Sustainable environmental goals of ecotourism.	✓ Encourages the preservation of the environment (impact assessment, environmental planning, building materials and techniques, aesthetic effects, water supply, air quality, and waste management). ✓ Minimization of litter, storm water drainage, wastewater, water conservation, energy efficiency in buildings, energy efficiency in transportation, and minimal impact on wildlife) offers environmental education, raises public awareness of environmental issues, and encourages positive attitudes and behaviors toward the natural world. Invites donations to support the preservation of the area's natural resources and air quality.
B: Sustainable socio-cultural objectives of ecotourism.	✓ Encourages locals to participate actively; encourages local ownership; empowers locals—for example, by boosting their self-esteem and confidence. ✓ Enhances local community equilibrium by fostering intercultural appreciation and communication between host communities and tourists.
C: Sustainable tourism goals in terms of the economy.	✓ Encourages the growth of other connected industries and contributes to the long-term economic prosperity of the community by creating long-term jobs for locals. ✓ Improves the community's infrastructure and keeps profits in the area. ✓ Proper allocation of earnings. ✓ Finances the creation and upkeep of protected areas. Encourages consumption and production.

Source: The International Ecotourism Society, 1991

5.4 Ecotourism Guidelines for Responsible Travelers

The guidelines below are meant to help responsible tourists.

a) Prepare for your trip
b) Respect local traditions and etiquette
c) Avoid ostentatious displays of wealth:
d) Be flexible in your expectations
e) Conserve resources
f) Practice environmental minimum impact

g) Choosing a tour operator or guide
h) Support local economies
i) Bridging cultural gaps
j) Continued ecotourism

(Source: Medina, L. K. (2005).

5.5 Positive Impacts of Ecotourism in Sundarban

Advantages of Sundarban Ecotourism Conservation Funding: Park upkeep, animal welfare, and conservation programs are funded in part by the money raised by ecotourism. This contributes to maintaining the ecosystem's fragile equilibrium in the Sundarbans.

- **Decreased Dependency on Unsustainable Practices**: Communities are less likely to turn to unsustainable fishing or woodcutting when tourism offers alternate revenue streams, therefore safeguarding the environment.
- **Increasing Awareness**: By introducing tourists to the distinctive treasures of the Sundarbans, ecotourism promotes environmental awareness and respect for conservation initiatives. This translates into supporting sustainable activities and acting responsibly when traveling.
- **Habitat Restoration**: To maintain the resilience and overall health of the Sundarbans ecosystem, ecotourism projects frequently entail the replanting of mangroves and other restoration efforts.
- **Economic Empowerment**: The Sundarban ecotourism and eco-village resort employs locals as tour guides, boat drivers, homestay providers, and artists. These raise living standards and promote financial independence.
- **Cultural Preservation**: Sundarban ecotourism encourages customs and knowledge about the Sundarban's environment. This promotes pride in the distinctive way of life of the local communities and aids in the preservation of their cultural heritage.
- **Better Services and Infrastructure**: The money generated by tourism can go toward developing the local community's infrastructure, including its sanitization, medical facilities, and educational opportunities.
- **Empowering Women**: Increasing gender equality and elevating women's social standing in communities are achieved by the active participation of women in income-generating ecotourism projects.
- **Appropriate Development**: Suitable development of ecotourism packages that involve locals in planning and decision-making to increase local participation.
- **Diversity:** Diversification of ecotourism offerings, such as trail treks and stays in rural boats, etc.

Source: Afroz, N., & Mahmud, M. S. (2017).

5.6 SWOT Analysis of Sundarban as an Ecotourism Destination

A SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of ecotourism in Sundarban has been conducted, taking into consideration background information on the area as well as the views of visitors, tour operators, forest officials, and locals. The following themes surfaced after each enterprise''s strengths, weaknesses, opportunities, and threats were analyzed:

SWOT analysis of Sundarban

Strengths:	**Weaknesses:**
☑ Sundarban is a well-known tourist site with a range of natural attractions, including the Royal Bengal Tiger, mangrove vegetation, estuarine crocodiles, and other birds. ☑ The locals are adamant about the necessity of ecotourism in this area. ☑ The Sundarbans are a World Heritage Site and Biosphere Reserve. ☑ A sizable influx of both domestic and foreign visitors to this location. ☑ The distinct culture of the community. ☑ Pre-existing infrastructure for tourism.	☑ Climate Vulnerability: The ecosystem is at risk from cyclones, saline intrusion, and rising sea levels. ☑ Human-Induced Pressures: The delicate equilibrium is impacted by pollution, habitat destruction, and overfishing. ☑ Limited Infrastructure: Effective conservation efforts are hampered by obstacles in the development of infrastructure.
Opportunities:	**Threats:**
☑ Appropriate development of ecotourism packages that increase local participation by incorporating them in planning and decision-making. ☑ Diversifying ecotourism offerings such as country boat stays, trail walks, etc., will enable the local community to keep the majority of the money made from tourists ☑ Ecotourism: While raising awareness of environmental issues, sustainable ecotourism can also bring in money. ☑ Research and Education: There are chances for both scientific research and	☑ Extremely impoverished landless people are migrating to Kolkata in quest of employment. ☑ Possible adverse effects on the ecosystem, such as harm to mangrove vegetation from an increase in salinity and extinction of species as a result of tiger shrimp farming, could exist. ☑ Sewage pollution, where waste is dumped into rivers. ☑ An increase in mass tourism has increased biotic pressure. ☑ This delicate environment is being negatively impacted by improper

environmental education in the Sundarbans.	management. ☑ Visitors' discontentment following their visit to this location.

Source: (Bhattacharya, M, 2011)

5.7 Floral Diversity and Threats

One can observe 64 different plant species in the Sundarbans' mangrove environment, including Aegiceras corniculatum. Other often occurring plants and trees in the park are Sundari (Heritiera fomes), Garjan (Rhizophora spp.), Passur (Xylocarpus mekongensis), Dhundal (also known as cannonball mangrove, Xylocarpus granatum), and Goran (Ceriops decandra). Additionally, because of tidal influences, they can tolerate estuary environments and saline inundation. The yellow blooms of Khalsi, the crab-like red flowers of Kankra, and the flaming red leaves of Genwa all bloom in April and May.

Table 1: **Different Plant Species**

Group of Organisms	No. **o**f Species	Group of Organisms	No. **o**f Species
Flowering Plants		Monogenera	1
Pteridophytes	105	Trematoda	21
(Ferns & Fern allies)		Cestoda	13
Algae	150	Nemathelminthes	6
Lichens	32	Acanthocephala	68
Vertebrates	445	Nemertinea	3
Chondrichthyes	22	Rotifera	2
Osteichthyes (Fishes)	154	Mollusca	4
Amphibians	8	Sipuncula	143
Reptiles	58	Echiura	2
Birds	163	Annelida	3
Mammals	40	Polychaeta	78
Phylum-		Oligochaeta	69
Sarcomastigophora	45	Hirudinea	6
Aplicom plexa	24	Arthropoda	3
Myxozoa	4	Crustacea	476
Ciliophora	31	Insecta	240
		Arachnida	201
Invertebrates	1	Merostomata	33
Porifera		Entoprocta	2
Cnidaria	33	Bryozoa	1

Ctenophora	2	Brachiopoda	3
Platyhelminthes	41	Chaetognatha	1
		Echinodermata	4
		Hemichordata	20

Source: (Gopal & Chauhan, 2014**)**

6. Data Analysis

The research design used for the study is exploratory in nature. For data analysis, the researcher used computer-based techniques such as linear regression analysis with ANOVA, and the result will be presented through percentages, diagrams, graphs, and charts. The Demographic data has been analyzed by SPSS (Version 23). These presentations are very easy to understand.

Table 2. Description of the Socio-Demographic profile of the respondents

Traits	Sub-Criteria	Frequency	Percentage
Gender	Male	44	62.00
	Female	26	26.00
Occupation	Student	43	61.43
	Teacher	4	05.71
	Businessman	8	11.43
	Farmer	7	10.00
	Housewife	8	11.43
Age	Under 20	19	27.14
	20-30	29	41.43
	30-39	7	10.00
	40-49	12	17.14
	50+	3	04.29
Annual Income	0-5000	26	37.14
	6000-15000	29	41.43
	16000-40000	5	14.00
	41000-60000	8	11.43
	60000+	3	04.29
Visiting Experience	Yes	49	70.00
	No	21	30.00
Learned about Sundarban	Travel Agency	11	15.71
	Magazine	6	8.57
	Friends	35	50.00
	Guidebook	14	20.00

	Other	4	05.71
Travel arrangement	Independent way	8	11.43
	Travel agent	5	07.14
	Group Travel	38	54.28
	Relative	10	14.28
	Other ways.	9	12.86

6.1 Analysis of the Socio-Demographic Profile of the respondents:

Table 6 shows the number of genders in our research. Out of 70 samples, 44 (62.86%) were male respondents, and 26 (37.14%) were female respondents. The table also shows the number of respondents to our research in different occupations. Out of 70 samples, 43 (61.43%) respondents were students, 08 (5.71%) respondents were teachers, 8 (11.43%) respondents were businessmen, 07 (10%) respondents were farmers, 8 (11.43%) respondents were housewives were female respondents. The above table also shows the number of respondents of our research of different ages. Out of 70 respondents, 19 respondents were under 20 years which is (27.14%) of total respondents, 29 respondents were 20-30 years which is (41.43%) of total respondents; 7 respondents were between 30-39 years which is (10%) of total respondents, 12 respondents were between 40-49 years which is (17.14%) of total respondents; 3 respondents were 50+ years age which is (4.29%) of total respondents. The research also shows the number of respondents and their annual income level. Out of 70 respondents, 26 (37.14%) respondent's annual incomes were 0-5000 Taka, 29 (41.43%) respondent's annual incomes were 6000-15000 Taka; 5 (14%) respondent's annual incomes were 16000-40000 Taka; 8 respondent's annual income was 41000-60000 Taka (11.43%); and 3 (4.29%) respondent's annual income was 60000+ Taka. The number of respondents visiting experienced Out of 70 samples, 49 (70%) respondents have visiting experience and 21 (30%) respondents have no visiting experience. The study also provided the number of respondents who learned about Sundarban from different sources. Out of 70 respondents, 14 (20%) are from guidebooks; 11 (71%), are from travel agencies; 6 (8.57%) respondents are from magazines; 35 (50%) respondents are from friends; and 4 respondents are from others. The above table shows the number of respondents' travel arrangements. Out of 70 respondents, 8 (11.43%) were through independent means, and 5 respondents were through independent travel agents. 38 (54.28%) respondents were through group Travel; 10 (14.28%) respondents were through relatives; and the rest of the 9 (12.86%) respondents were through other means.

7. Regression analysis:

Independent variables affect the dependent variable. Additionally, factors are functioning together to determine the influence on sustainability and conservation of ecotourism resources in Sndarban. The term multiple regression analysis is a handful for it.

Table: 3 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.993[a]	.987	.985	.059
a. Predictors: constant, Oil spills on river water, Proper way of conservation, Government rules and regulations, Deforestation, Seminar, Stakeholder association, Rampal thermal electric plant, Maintaining sustainable issues.				

According to the model summary Table 3 the dependent variable is Sustainability and Conservation and the independent variables are Oil spills on river water, Proper way of conservation, Government rules and regulations, Deforestation, Seminars, Stakeholders association, Rampal thermal electric plant, Maintaining sustainable issues. And the value of R^2 is 0.987 which means that 98.7% of the respondent's feedback has been explained by independent variables.

Table: 4 ANOVA

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	15.631	5	1.954	62.622	.000[b]
	Residual	.212	64	.003		
	Total	15.843	69			
a. Dependent Variable: Sustainability and Conservation						
b. Predictors: (Constant), Oil spill on river water, Proper way of conservation, Government rules and regulation, Deforestation, Seminar, Stakeholders association, Rampal thermal electric plant, Maintaining sustainable issues.						

The ANOVA **Table 4** below indicates that the P-value (0.000) is less than 0.05. Thus, with 95% confidence, the alternative hypothesis is accepted. This also suggests that the model is important and shows how the Sundarbans' sustainability and preservation of their ecotourism resources can be greatly explained by the oil spill on river water, proper way of conservation, government rules and regulations, deforestation, seminar, stakeholders' association, Rampal thermal electric plant, maintaining sustainable issues can significantly explain sustainability and conservation of ecotourism resources in Sundarban.

Table: 5 Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.034	.072		19.467	.000
Oil spill on river water	.018	.015	.024	1.195	.237
Rampal thermal electric plant	.229	.052	.234	4.431	.000

Deforestation	.029	.019	.036	4.506	.000
Stakeholders' association	.229	.052	.234	4.301	.000
Government rules and regulations	.016	.013	.023	1.192	.231
Seminar	.229	.052	.234	4.430	.000
Maintaining sustainable issues	.229	.052	.234	4.421	.000
The proper way of conservation	.018	.015	.024	10.195	.011
a. Dependent Variable: Sustainability and Conservation					

According to Table 5, the Regression analysis has been done where the sig value of, Proper way of conservation, Deforestation, Seminar, Stakeholders association, Rampal thermal electric plant, and Maintaining sustainable issues are 0.000 which is P<0.05. So, the alternative hypothesis is accepted apart from the P- value (0.237 & 0.231, where P>0.05) of Oil spills on river water and Government rules and regulations. Hence, oil spills on river water and Government rules and regulations in Sudarban have less significant influence on affecting the sustainability and conservation of ecotourism resources. The model is significant at a 1% level. T's crucial values are listed in the Appendix. The total number of observations in the sample less the total number of population samples is the number of degrees of freedom, expressed in textual terms *n-2*=70-2=68.

At last, the study shows that the majority of the factors are negatively affecting the sustainability and conservation of ecotourism resources in Sundarban. My questionnaire is prepared to show that factors are affecting negatively. Most of the respondents agreed that factors are affecting negatively ecotourism resources in Sundarban.

7.1 Assessing Hypothesis

The hypothesis was tested through linear regression analysis with ANOVA using SPSS (Version 23) to assess whether the factors are affecting sustainability and conservation of ecotourism resources in Sundarban. To generate meaningful statistical results, the sub-groups were combined to form groups of at least 70 respondents, as age, occupation, household income, and education level groupings have disproportionate sample sizes. The results (see Tables 7-8) show that apart from the Oil spills on river water and the Drawback of Government rules and regulations the factors are affecting the sustainability and conservation of tourism resources in Sundarban.

Table: 6 Test of Hypothesis

Factors	**P Value**	**Analysis**	**Result**	**Statement of Hypothesis**
Oil spills on river water	.237	0.237>0.05	Ha1 **Rejected**	Oil spills on river water have little influence on Sustainability and conservation of ecotourism resources in Sundarban.

Building Rampal thermal electric plant	.000	0.000≤0.05	Ha2 Accepted	Building the Rampal thermal electric plant has a great influence on the Sustainability and conservation of ecotourism resources in Sundarban.
Deforestation	.000	0.000≤0.05	Ha3 Accepted	Deforestation has a significant influence on Sustainability and conservation of ecotourism resources in Sundarban.
Lack of Stakeholders Association	.000	0.000≤0.05	Ha4 Accepted	The lack of stakeholder association has a significant influence on the Sustainability and conservation of ecotourism resources in Sundarban.
Drawbacks of Government rules and regulations	.238	.231>0.05	**Ha5 Rejected**	The drawback of Government rules and regulations has little influence on the Sustainability and conservation of ecotourism resources in Sundarban.
Lack of Arranging Seminar or other program to raise awareness	.000	0.000≤0.05	Ha6 Accepted	The lack of Arranging Seminars or other programs to raise awareness has a significant influence on the Sustainability and conservation of ecotourism resources in Sundarban.
Lack of maintaining sustainable issues	.000	0.000≤0.05	Ha7 Accepted	The lack of sustainable issues has a significant influence on the Sustainability and conservation of ecotourism resources in Sundarban.
Negligence in conserving ecotourism resources	.011	0.000≤0.05	Ha8 Accepted	Negligence in conserving ecotourism resources has a significant influence on Sustainability and conservation of ecotourism resources in Sundarban.

7.2 Discussion:

The research found a negative relationship between sustainability and conservation of ecotourism resources in Sundarban and independent variables which were also found in different previous studies i.e., (Chowdhury's, 2017); and Paul et al., (2017). So, the sustainability and conservation of ecotourism resources in Sundarban are greatly affected by Oil spills on river water, Proper way of conservation, Government rules, and regulations,

Deforestation, seminars, Stakeholder associations, Rampal thermal electric plant, and Maintaining sustainability issues. As a result, the study's conclusions support earlier claims made by other investigations. However, because of several important limitations, the study's conclusions should be applied with caution. The study lays the groundwork for consequences for current literature and practice in this area. However, by performing comparable studies in various circumstances, researchers in the future will be able to expand on the study's arguments.

8. Findings that need to be solved

The biotic pressure from the surrounding environment and natural or human-induced changes in the higher catchments are contributing factors to the problems facing the mangrove ecosystem. The following is an outline of them.

- ✓ Decreased sweet water flow into the Sundarban Mangrove system.
- ✓ The expansion of land usage beyond forestry into mangrove forests.
- ✓ Tigers are invading villages along the Sundarbans' western border.
- ✓ The need for little wood and firewood for domestic use
- ✓ Tigers, spotted deer, wild boar, sea turtles, horseshoe crabs, etc. are all targets of poaching.
- ✓ Prawn seedlings collected uncontrollably.
- ✓ Unrestricted fishing within reserve forest waters.
- ✓ Constantly stepping on the shores of rivers and creeks by fishermen and prawn seed gatherers.
- ✓ Chemical contamination resulting from hydrocarbons and marine paints.

8.1 Recommendations

Several recent natural disasters, such as Ampan and Bulbul, have seriously harmed both the Sundarbans' population and the region itself. Additionally, poaching, haphazard use of natural resources, tree-cutting, and inadequate wildlife care are some of the ways that locals and visitors are endangering the Sundarbans. In light of these circumstances, stringent environmental protection laws, norms, and policies should be developed and effectively communicated to all relevant parties (such as residents and visitors). These strategies have the potential to significantly increase the sustainability and conservation of ecotourism resources in the Sundarbans. Bangladesh's tourist business and ecotourism would both grow quickly if the hospitality sector became a professional one. The world's top ecotourism destinations can be found in Bangladesh's natural areas, but lawmakers need to establish some kind of

structure. Some suggestions are included below for the growth of Bangladesh's ecotourism industry:

- To formulate a policy for promoting ecotourism in Sundarban.
- To establish environment-friendly water vehicle routes in the forest and to establish the sign and light of signal in the forest.
- To set the limit for each of the ships.
- To provide safe and pure drinking water.
- To provide medical facilities for tourist ships.
- To ensure the availability of a tourist guide who has enough knowledge about ecotourism principles.
- To engage the local people in saving forests.
- To raise awareness among tourists and local people about waste management.
- Strict Government rules and regulations should be implemented to protect Sundarban.
- To save the environment of the Sundarban and the wildlife.
- Arranging seminars and workshops for preserving ecotourism resources.

8.2: Further Research Direction

In case of further research, the researcher should select the respondents from the peak season and off-peak season to find out the diversified responses from the respondents. The researcher also should find out other factors that are also affecting ecotourism resources sustainability and conservation.

8.2 Conclusion

The study shows the independent variables apart from oil spills on river water and government regulations and rules are affecting the sustainability and conservation of ecotourism resources in Sundarban negatively. The goal of this study is to develop a framework for comprehending the key elements influencing the sustainability and conservation of ecotourism resources at Sundarbans. The present study aims to enhance our current comprehension of the complex relationships among the following: oil spill on river water; appropriate conservation methods; government regulations and rules; deforestation; seminars; stakeholder associations; Rampal thermal electric plant; maintaining sustainable issues; and their combined effects on the preservation and sustainability of ecotourism resources in the Sundarbans. Furthermore, a more diversified sample, stronger analytical techniques, and other factors that impact the sustainability of ecotourism in the Sundarbans could all be used to overcome the shortcomings of this study in future research. However,

from the perspective of the sustainability and protection of tourist resources in Sundarbans, this study explores those elements aside from oil spills on river water and government rules and regulations. Thus, to preserve the Sundarbans' sustainability, related policies are crucial. So far, it raises hopes that the appropriate authorities are taking action by passing laws and supporting programs to raise public awareness of the Sundarbans. The study's findings, according to the authors, may support such attempts.

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Disclosure statement

There is no conflict of interest declared by the writer.

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Ethical statement

Hereby, I, G. M Selim Ahmed (Author consciously assure that the manuscript titled "Assessing the Factors Affecting Sustainability and Conservation of Ecotourism Resources: An Empirical Study on Sundarban" fulfilled the following:

1) The content presented here is the writers' unique creation, never before published.

2) No other publications are currently considering publishing the paper.

3) The study accurately and thoroughly presents the writers' investigation and analysis.

4) The findings are suitably positioned within the framework of earlier and ongoing studies.

5) Every reference used is correctly cited and disclosed and text that is copied rigorously needs to be marked as such with quote marks and appropriate citations.

6) The author will accept public responsibility for the paper's content, having directly and actively contributed to a significant portion of its creation.

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Appendix:

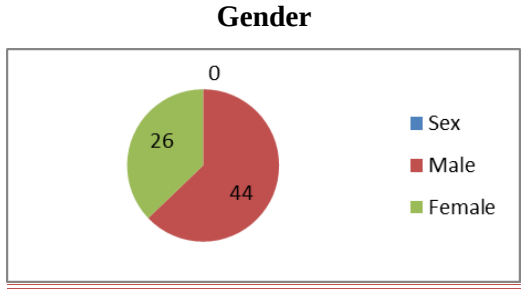

Figure 1: The number of respondents who participated in our research

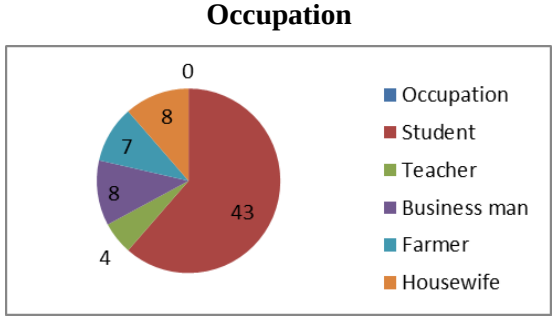

Figure 2: The number of respondents to our research in different occupations

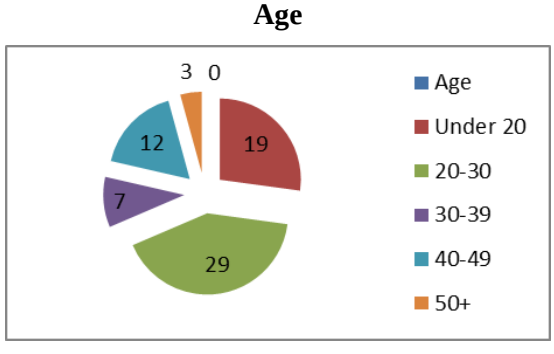

Figure 3: the number of respondents of our research in different ages

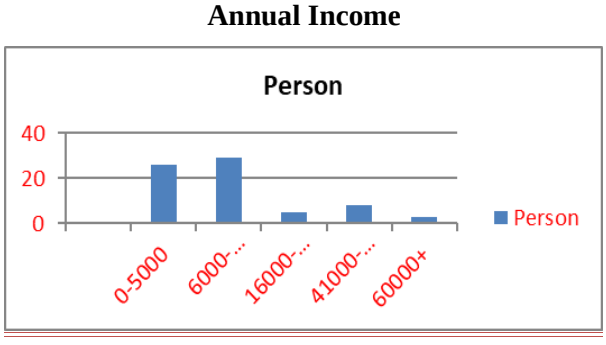

Figure 4: The number of respondents and their annual income level

Visiting Experience

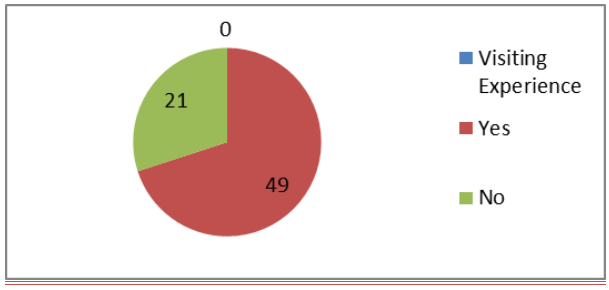

Figure 5: The number of respondents visiting experience

Learned about Sundarban

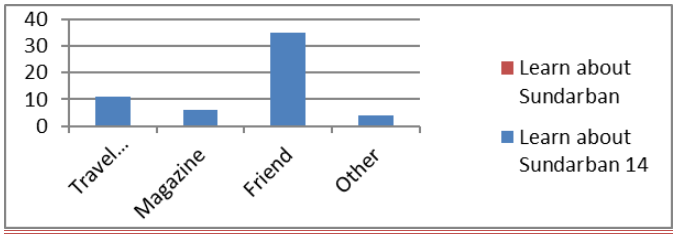

Figure 6: the number of respondents who learned about Sundarbans from different sources

Travel Arrangement

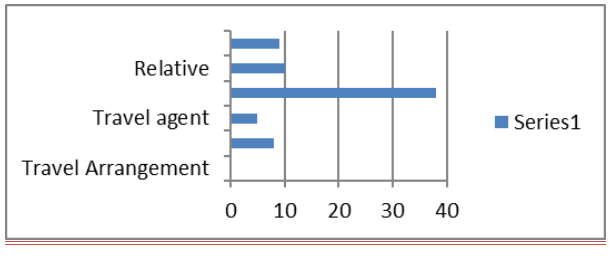

Figure 7: The number of respondent's Travel arrangement way

Perception about Major attractions in Sundarban

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unattractive	1	1.4	1.4	1.4
	Unattractive	1	1.4	1.4	2.9
	Neither attractive nor Unattractive	1	1.4	1.4	4.3
	Attractive	19	27.1	27.5	31.9
	Very attractive	47	67.1	68.1	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

Table 1. Wilderness /Remoteness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unattractive	1	1.4	1.4	1.4
	Neither attractive nor Unattractive	1	1.4	1.4	2.9
	Attractive	23	32.9	32.9	35.7
	Very attractive	45	64.3	64.3	100.0
	Total	70	100.0	100.0	

Table 2. Wildlife Viewing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unattractive	1	1.4	1.4	1.4
	Neither attractive nor Unattractive	1	1.4	1.4	2.9
	Attractive	23	32.9	33.3	36.2
	Very attractive	44	62.9	63.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

Table 3. Flora and Fauna

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unattractive	2	2.9	2.9	2.9
	Unattractive	3	4.3	4.3	7.2
	Neither attractive nor Unattractive	3	4.3	4.3	11.6
	Attractive	18	25.7	26.1	37.7
	Very attractive	43	61.4	62.3	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

Table 4. Local Peoples Culture Village life

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unattractive	1	1.4	1.4	1.4
	Unattractive	3	4.3	4.3	5.8
	Neither attractive nor Unattractive	2	2.9	2.9	8.7
	Attractive	19	27.1	27.5	36.2
	Very attractive	44	62.9	63.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

Table 5. Opportunities for Meeting Local People

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unattractive	9	12.9	13.0	13.0
	Unattractive	20	28.6	29.0	42.0
	Neither attractive nor Unattractive	11	15.7	15.9	58.0
	Attractive	6	8.6	8.7	66.7
	Very attractive	23	32.9	33.3	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		

Table 6. Guest Lodges

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Unattractive	2	2.9	2.9	2.9
	Unattractive	3	4.3	4.3	7.2
	Neither attractive nor Unattractive	3	4.3	4.3	11.6
	Attractive	17	24.3	24.6	36.2
	Very attractive	44	62.9	63.8	100.0
	Total	69	98.6	100.0	
Missing	System	1	1.4		
Total		70	100.0		