

**ANALYSIS OF ANTHROPOGENIC ACTIVITIES ON PROTECTED
FOREST AREA: A CASE STUDY ON REMA-KALENGA WILDLIFE
SANCTUARY, CHUNARUGHAT, HABIGANJ, SYLHET**



A project thesis submitted to the Faculty of Science and Information Technology at Daffodil International University in Dhaka, Bangladesh, in partial completion of the requirements for the Bachelor of Science in Environmental Science and Disaster Management degree

Course Title: Project Thesis

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January, 2022

DECLARATION

I do hereby declare that the entire work submitted as a thesis entitled ‘**ANALYSIS OF ANTHROPOGENIC ACTIVITIES ON PROTECTED FOREST AREA: A CASE STUDY ON REMA-KALENGA WILDLIFE SANCTUARY, CHUNARUGHAT, HABIGANJ**’ towards the partial fulfillment for the degree of Bachelor in Environmental Science and Disaster Management at the Daffodil International University, is the result of my own investigation and this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.



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CERTIFICATION

This is to certify that the research work presented in this thesis entitled ‘**ANALYSIS OF ANTHROPOGENIC ACTIVITIES ON PROTECTED FOREST AREA: A CASE STUDY ON REMA-KALENGA WILDLIFE SANCTUARY, CHUNARUGHAT, HABIGANJ, SYLHET**’ was carried out by the final year examinee bearing Student ID: 181-30-184, Session: 2018-2022 under my supervision has been accepted as partial fulfillment of the requirement for the degree of Bachelor of Science in Environmental Science and Disaster Management.

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APPROVAL

The thesis entitled ‘ANALYSIS OF ANTHROPOGENIC ACTIVITIES ON PROTECTED FOREST AREA: A CASE STUDY ON REMA-KALENGA WILDLIFE SANCTUARY, CHUNARUGHAT, HABIGANJ, SYLHET’ ‘By Fariha Jesmin ,Student ID: 181-30-184,Session: 2018-2022 submitted in partial fulfillment of the requirement for the degree of Bachelor of Science in Environmental Science has been approved for necessary steps.



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Assistant Professor

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DEDICATION

My loving parents

Dr. Syeda Khaleda Muheb Bithi

Monsur Ahmed

My loving grandparents

Late Habib Mustafa

Late Maksuda Khatun

My respected teachers

Dr. A. B. M. Kamal Pasha, PhD

Dr. Mahfuza Parveen, PhD

Md. Azharul Haque Chowdhury

Md. Sadril Islam Khan

Officials

S. M. Mahmudur Rahman

Sagar Mozumder Shankar

And

Dr. Md. Fokhray Hossain, PhD, Associate Dean and Professor,

Daffodil International University

ACKNOWLEDGMENT

I would like to convey my sincere appreciation to everyone who has shared this portion of my life with me and helped me accomplish my thesis paper over the last four years. Dr. A.B.M Kamal Pasha Sir (Associate Professor and Head) has been a tremendous help to me.

Dr. Mahfuza Parveen Madam (Assistant Professor), has offered support and guidance during my work and throughout my studies at Daffodil International University.

Md. Azharul Haque Chowdhury Sir (Senior Lecturer) for his sincere supervision on this study.

Md. Sadril Islam Khan Sir's (Lecturer) motivation and advice has helped me with my thesis.

I would like to express my thankfulness to Dr. Syeda Khaleda Muheb Bithi and Monsur Ahmed, Shehab Mahmud and Syeda Munsefa Khatun Arzu for their contributions to working in the region as well as their wholehearted support during my thesis research.

S M Mahmudur Rahman, to him, I express my sincere gratitude for his continuous guidance and cooperation.

And Sagar Mozumder Shankar for the support.

ABSTRACT

Rema-Kalenga Wildlife Sanctuary is a protected area with a diverse range of tropical evergreen and semi-evergreen woods that are rich in wildlife.

The Rema Kalenga is Bangladesh's second-largest natural forest, behind the Sundarbans. This dry forest has been declared as a "Reserve Forest" by the government, making it a secure haven for wild creatures. Even though Rema and Kalenga are two independent regions, they are intertwined.

The Rema-kalenga Wildlife Sanctuary offers a variety of study opportunities. Anthropogenic activity studies are limited at the Rema-Kalenga wildlife reserve, though. As a result of a reduced human footprint, environmental health has improved all around the world. There were no Covid-19 symptoms or reports among the residents of the forest region at this time. Because there are fewer people in Covid-19, nature has gotten more beautiful, and biodiversity has increased.

Understanding human behavior is becoming increasingly crucial as our society is influenced by the Covid-19. It's apparent how much the people in this region rely on the forest during this time.

Tree poaching, for example, was recognized as one of several anthropogenic activities. There are a variety of elements that influence human and agricultural practices, as well as how these aspects affect forest biodiversity. These problems are analyzed in this research in a systematic process in order to comprehend this study.

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Chapter 1 – Introduction

1.1. Background

A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values. (IUCN Definition 2008)

Rema-Kalenga Wildlife Sanctuary is a protected area supported mixed tropical evergreen and semi evergreen forests of great biodiversity value. (Shihan and Prodhan, 2014)

After the Sundarbans, the Rema Kalenga is Bangladesh's largest natural forest. The government has designated this dry forest as a 'Reserve Forest,' making it a safe place for wild animals. Despite the fact that Rema and Kalenga are two separate forests, they are interconnected.

For many years, four immigrant communities — tripura, shantal, telugu, and urang – have resided around and inside the sanctuary. Despite their traditional dependency on the forest, these communities are today diversifying and actively participating in the Sanctuary's protection.

1.2. Problem statement

A variety of anthropogenic activities, such as tree poaching, were identified. Marauders arrive in big groups to cut down trees and poach them for profit. It has been observed that people tend to destroy forest trees by scratching them and stabbing them with sharp objects. The snake is native to the forests. Snakes have been seen roving the community, and locals have been known to kill them for the protection of their own and their family's safety.

1.3. Justification of the study

Rema-kalenga Wildlife Sanctuary has a number of research accessible. At the Rema-Kalenga wildlife sanctuary, however, studies of human activity are limited.

The research into the Covid-19 pandemic has been completed. Environmental health has improved across the world as a result of a smaller human footprint. During this time, no Covid-19 symptoms or records were seen among the people of the forest region. Since there have been

less people in Covid-19, nature has become more magnificent and biodiversity has continued to increase.

As our country is affected by the Covid-19, understanding of human behaviors becomes increasingly important. It is noticeable how the people of this area rely on the forest during this period of time.

1.4. Objectives

The objectives of this study are given as follows:

- Identify the primary human activities.
- Determine the impact of agricultural activities on forest diversity.
- Determine the local community's impacts on forest area utilization.
- Identify the impact of human activities on biodiversity (Local community and tourists)

1.5. Structure of the study report

This study is divided into five parts.

Chapter 1 Introduction

This part contains the introduction information about the research project. The context, the problem statement, and the study's goal are briefly discussed. The framework for the analysis is depicted below.

Chapter 2 Literature review

In this chapter, relevant research on main human activities, protected land area, causes and consequences of agricultural activities on forest diversity, local community influences on forest area usage, and impact of human activities on biodiversity have been discussed (Local community and tourists),

Chapter 3 Methodology

This paper provides a comprehensive review of the subject of research as well as the many research methodologies utilized in this research.

Chapter 4 Result and discussion

This part addressed a broad discourse on the study findings in relation to the research goal. This chapter contains structured observations as well as a comprehension of the outcomes.

Chapter 5 Conclusion and Recommendation

The reason for research aims is described in further detail in this section. Some suggestions have been given in an attempt to help future researchers better grasp the pre-existing circumstances in this subject.

Chapter 2 – Literature review

Few reports are available on the Rema-Kalenga protected wildlife sanctuary region. There are numerous reports on human and agricultural activities, as well as how these factors are responded to forest biodiversity. In order to understand the study's background, these concerns are examined in this part in a systematic process.

2.1 Rema-Kalenga Wildlife Sanctuary

After the Sundarbans, the Rema-Kalenga Wildlife Sanctuary is a dry and evergreen forest reserve and the country's second biggest wildlife sanctuary and natural forest. In terms of biodiversity, it is the country's richest forest. It's in the Chunarughat upazila of Sylhet division's Habiganj district. The sanctuary encompasses several hills of different elevations and the low-lying valleys. The highest peak of the hills is about 67 m from the sea level (Rizvi, 1970). The Rema-Kalenga Wildlife Sanctuary was established under the provisions of Article 23(1) of the Bangladesh Wildlife (Preservation) Order of 1973 (Presidents Order No. 23 of 1973), as amended by The Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. The Order bans any type of wildlife slaughter, hunting, or trapping (inside and around a one-mile radius of the sanctuary's outer boundary 2), agricultural operations, people residing or accessing the sanctuary, and habitat damage. The order also forbids the release of any domesticated animals or the entrance of any exotic animals within the sanctuary. However, the government may authorize such operations only in exceptional instances, such as when they are judged required for the development, beautification, or other scientific reasons (Bangladesh Wildlife (Preservation) (Amendment) Act, 1974).



Figure 1 Rema-Kalenga Wildlife Sanctuary Entrance

2.2 Topography of the Sanctuary

The texture of certain soils is yellowish red sandy clay combined with magniferous iron ore particles. The sanctuary's soil ranges from clay to sandy loam, is quite productive, and has a low pH. The hills of Rema-Kalenga are made up mostly of upper tertiary rocks, including siltstones, mudstones and sandstone, which have been locally changed to shales, slates and hills include limestones as well.

FRR and DU (1996) reported two important and valuable habitats: jheels - lowlying areas of forest with an upper canopy 25-30 m high, and in some areas phumdi, found on the forest floor – a mat of soft decomposing organic matter with some grass and herbs overlying water. One artificial lake has been recently created on the edge of the present sanctuary by excavating and damming a natural drainage course (<5 h) (FSP 2000a, FRR and DU 1996).

2.3. Tree bark and leaves: The bark of various trees is often gathered for commercial purposes and used to make mosquito coils. The leaves are used to make medications. Leaves are often used to feed cattle.

2.4 Wildlife Hunting: Hunting is still attempted around, and it's being obtained illegally. Tribal Forest Villagers engage in wildlife hunting. Hunting is, however, strictly prohibited in the sanctuary these days.

2.5 Fuel wood collection: The sanctuary, as well as the remaining portion of the designated forest, are used by the people of the village and those in the surrounding areas to get building materials and fuel wood for their everyday requirements. The forest is used by people in

villages and informal settlements for fuelwood, construction equipment, herbal remedies, handicrafts, raw material, and foodstuff.

2.6 Boundary of the Sanctuary

The Sanctuary is bounded by lands on the majority of its northern and western boundaries, Tea Estate lands on part of its southwestern boundary, India on the southern and eastern boundaries, and Khas lands on a minor piece of its northern boundary.

The Sanctuary is generally bounded on the North by the northern limit of Kalenga Beat area, on the East by the international boundary of India following the lines between boundary monuments Nos. 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, and 1960 in a general south to southwesterly directions, and on the west by the limits of Forest Compartments 2 and 4 of Rema Beat (Rosario, 1997a).

2.7 Biodiversity:

It's a semi-evergreen woodland. Approximately 76 percent of the forest is still in its original state. Only 9% of the forest is covered with plantations. It is home to a diverse range of plants, animals, and birds, as well as. The PA's biodiversity includes 167 bird species, 7 amphibians, 18 reptiles, and 37 mammal species. Mom some of the tree species typically found are Khona *Oroxylum indicum*, Horina *Vitex peduncularis*, Kanak *Schima wallichii*, and Tallya *garjan* *Dipterocarpus turbinatis*. RKWs is home to Bangladesh's only population of the Malayan gigantic squirrel *Ratufa bicolor*, as well as the Particolored Flying Squirrel *Hylopetes alboniger*, which was recently discovered.

2.8 Surrounding Populations:

The forest is surrounded by four ethnic communities (Tripura, Shantal, Telugu, and Urang). Within the sanctuary lies a community inhabited by the Tipra tribe. Other communities, however, can be found on the border between the restricted forest and the animal sanctuary. Near RKWS, a total of 9,330 houses with a population of 23,000 people have been discovered. Long rotational conserved forest, tea estates, transformed agricultural areas, and Khas land are all adjacent land uses. The nearby restricted area of the forest really acts as a buffer for human

strain on the sanctuary. However, the collecting of fuel wood and building materials by neighboring homes poses a danger to biodiversity.

2.10 Co-management in the forest:

Forest and adjacent peoples are scrupulously related. The Rema-Kalenga Wildlife Sanctuary's co-management being analyzed to see how fair capital assets were included in beneficiary selection and how it influenced vegetation cover. Individuals do not place a high value on the forest in terms of resource collection or monetary worth, meaning that the most vulnerable people were underrepresented in the co-management team. The local people's way of life and reliance on the forest, but it does signal a shift in the area's overall circumstances, i.e. local livelihood patterns, forest dependence, and forest conservation. Furthermore, the technique is still in its early stages, and there is still much to be done. Although local people are increasingly more actively involved in decision-making, a more efficient and long-lasting co-management system requires more attention to local needs.

2.11 Anthropogenic Activities:

Rema-Kalenga is overseen by a co-management arrangement, where the local people, government and groups of stakeholders play significant roles to protect forestry as well as forest resources. Though forestry co-management is an effective system of forest restoration, in Rema-Kalenga, it has foundered because of the incompetence of the government as well as other co-management bodies. Authorities concerned and local people often get into disputes over resource ownership and profit made from Rema-Kalenga.

They also ignore or actively injure the forests in order to prevent their rivals from reaping the benefits of Rema-Kalenga. Furthermore, a number of unethical co-management organizations show a bio-colonial mentality by rejecting indigenous peoples' rights and inclusion, which is unethical. In Bangladesh, such insufficiency of co-management is not just seen in unfamiliar or smaller foresteries, but also in large foresteries such as the Sundarbans. From an ethical standpoint, human neglect and animosity toward our forests can be assessed. From an ethical standpoint, nature has the same rights as humans. Because our present capitalist society solely believes in anthropocentric (human-centered) values, humans live at the top of the power hierarchy, with complete control over, consumption of, and capitalization of various levels underneath them. The environment, on either hand, is positioned at the base of the current

power structure due to its exploitability. We, as humans, believe we have a right to all of the resources that nature and the environment have to provide. As a result, mankind have been plundering the environment for ages.

2.12 Capital Assets in Governing Protected Area Co-Management:

Co-management in the Rema-Kalenga Wildlife Sanctuary was evaluated to assess how fairly capital assets were considered in the beneficiary selection, and to what extent it affected vegetation cover. In terms of forest dependency, income, and occupation, the communities in the area were various. The various types of capital assets were strongly related to co-management, with social capital having the biggest effect and human and manufactured capital having no function in co-management governance. Local leaders dominated the other factors when it came to social capital.

2.13 Effects of Land-Related Policies on Deforestation in a Protected Area:

As policies make the transition from net deforestation, conservation measures and different management plans have been established in Bangladesh's protected areas (PAs) to minimize deforestation and incorporate public engagement at many levels. The interaction of land-related policies on deforestation in PAs, on the other hand, is little studied. The total forest area increased in the 1994–2005 period when a plantation program was implemented, and also that many forest areas were replaced with noncommercial agricultural land areas in the 2005–2013 and 2013–2018 periods, when land zoning and co-management programs were implemented under different land-related policies.

Forestland was the most common land cover in RKWS. RKWS had the most forestland in 2005, accounting for 94.42 percent (5885.13 ha) of the total LULC (Land Use / Land Cover) categories given, up from 89.65 percent (5587.90 ha) in 1994. The forest cover then changed dramatically, dropping to 86.68 percent (5402.64 ha) in 2013 and 80.15 percent (4995.78 ha) in 2018. Non-commercial agricultural land declined from 8.16 percent (508.81 ha) in 1994 to roughly 3.79 percent (235.98 ha) in 2005, then rose to 9.94 percent (619.27 ha) and 14.68 percent (915.21 ha) in 2013 and 2018, respectively.

Non-commercial agricultural land declined to 3.79 percent (235.98 ha) in 2005 from 8.16 percent (508.81 ha) in 1994, then grew to 9.94 percent (619.27 ha) and 14.68 percent (915.21

ha) in 2013 and 2018, respectively. Commercial areas saw LULC change as well, rising from 1.22 percent (75.80 ha) in 1994 to 1.88 percent (117.28 ha) and 3.05 percent (189.86 ha) in 2013 and 2018, respectively, before falling to 0.91 percent (56.98 ha) in 2005.

Over the previous 24 years, urbanization has increased. In particular, between 2013 and 2018, cover in this class rose significantly, rising from 1.18 percent (73.40 ha) to 1.66 percent (103.29 ha). In the same way, total water area grew from 0.21 percent (12.98 ha) in 1994–2005 to 0.34 percent (20.90 ha) in 2013 and 0.46 percent (0.46 ha) in 2018. Land use class proportions varied considerably across years (1994, 2005, 2018, and 2013) ($df = 162 = 632.3$, and $p 0.0001$).

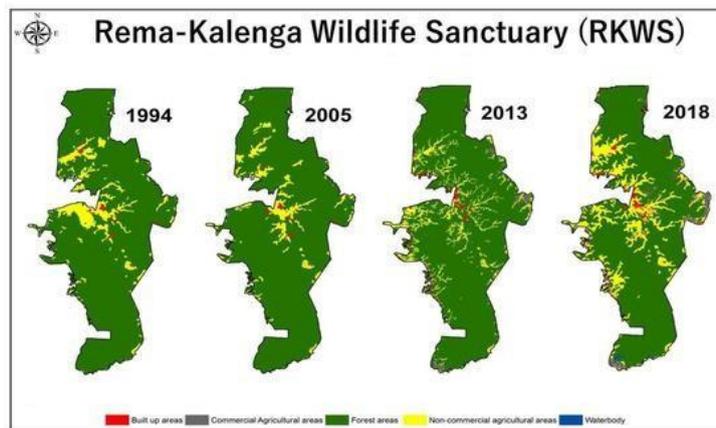


Figure 2 land use land cover changes in 1994, 2005, 2013, and 2018 (*Conservation-01-00014-G004-550*)

Chapter 3 Methodology

3.1 Study area

In Bangladesh, the Rema-Kalenga Wildlife Sanctuary is a protected forest and wildlife sanctuary. This is an evergreen, dry forest. It is situated in the Habiganj district's Chunarughat. In 1982, the Rema-Kalenga Wildlife Sanctuary was established, and in 1996, it was enlarged. As of 2009, the wildlife sanctuary has a total area of 1795.54 hectares. It is located near Srimangal in the Moulvibazar district, close to the Indian state of Tripura's border. The wildlife sanctuary is located 130 kilometers north of Dhaka, Bangladesh's capital. Kalenga, Rema, Chanbari, and Rashidpur are the four ranges and bit of the forest in Habiganj District.

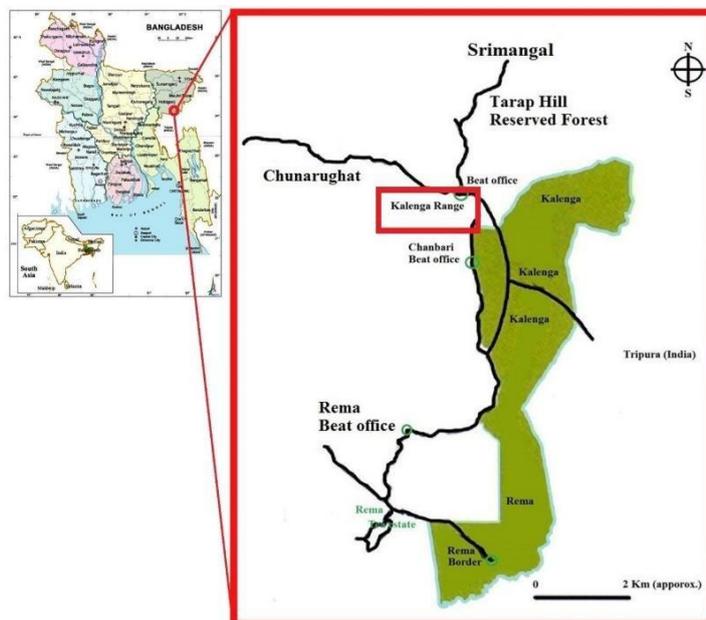


Figure 3 Map of Rema-Kalenga and Study area Marked (Anon n.d.)

3.2 GPS location of Kalenga Range (Study Site):

24.117436906186366, 91.63240613223392: 24°07'02.8"N 91°37'56.7"E

24.185443186825523, 91.62176834184952: 24°11'07.6"N 91°37'18.4"E

3.3 Data Collection and survey location

To begin data collecting, a meeting was held at the Forest Range Office in Kalenga Range with forest officials, members of the Co-management Committee, and local community representatives. The survey's site ranged from the Kalenga range's local market to the surroundings of the forest. Interviewing around 100 and a total of 90 questionnaires were completed throughout the study. A focus group discussion was held at the forest's local market.

3.4 Data Collection techniques of the study

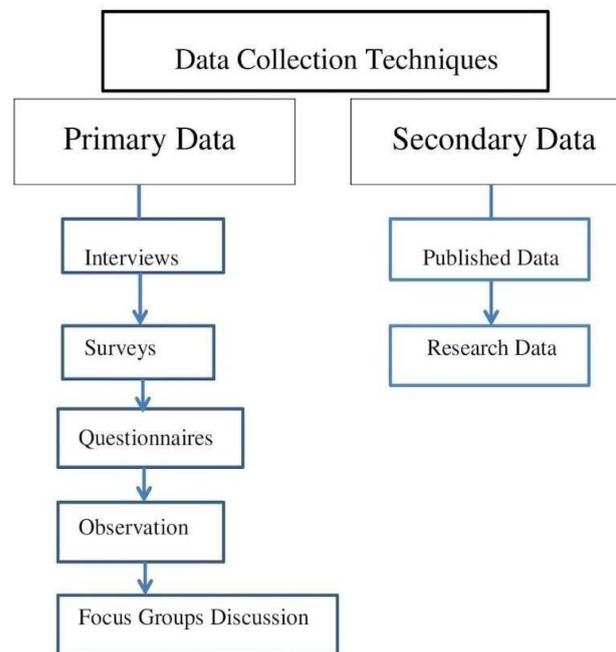


Table 1 Data Collection Techniques of the Study

The research focused mostly on gathering primary data. Interviews, Field surveys, questionnaires, and focus group discussions were used to collect primary data. Secondary data on this topic is very limited and is gathered from several scientific study journals. The framework is given above.

3.4.1 Interviews of the Local people

During the data collection process, around 100 respondents were interviewed. People range in age from 18 to 75 years old. Both male and female participants were included. The majority of them were cultivators who grew rice and lemons. The others are businessmen, the elderly, and individuals who have jobs. Women were housewives who looked after livestock such as cows and goats.

3.4.2 Field Survey

During the field survey, the area was surveyed from the local market to the forest entry and then across the Kalenga Forest Range Office .The survey included cultivated lands, local houses, and trails. For simple navigation, there were monitoring area indicators provided. The majority of the area was utilized for paddy and lemon agriculture during the survey. Bananas were grown by a small group of people.

3.4.3 Questionnaire of the local people

The questionnaire procedure resulted in a total of 90 participants. The ages ranged from 18 to 75 years old. During the questionnaire, women were hesitant and apprehensive, and they did not answer any of the questions properly. Male participants were more numerous and took part in this survey. After arriving, it was found that there were no tourists visiting after the COVID-19 time, therefore the questionnaire does not contain that. As a result, only local residents took part in the survey.

3.4.4. Direct Observation during the survey

The study depended heavily on observation. During the observation, it was found that the vast majority of individuals cultivate the land. They farm and live on the forest land provided by the authorities. They also produce in the backyard of their home. People are also willingly participating as forest guards. They willingly plant trees in the forest. They are always prepared to defend the forest under all circumstances. Some of the people are active in non-governmental organizations.

3.4.5 Focus Group Discussions

Semi-structured face-to-face interviews were conducted. Before beginning the questionnaire surveys, the respondents were given a brief overview of the study goals. People gathered in the markets during the FGD to take part in the discussion. Throughout the procedure, they were really cooperative and helpful. During this period, several questions were asked and information was gathered. Due to shyness, women did not come to the market, hence the participants were all males.

3.5 Methods of the field survey at Rema- Kalenga Wildlife Sanctuary

3.5.1 Initial Steps

A permission was obtained from the Forest Department before beginning the field study in Sylhet. An application was submitted for approval, and when it was granted, a field survey was conducted at Chunarughat, Sylhet. Permission for the field survey takes around 15-20 days to get.

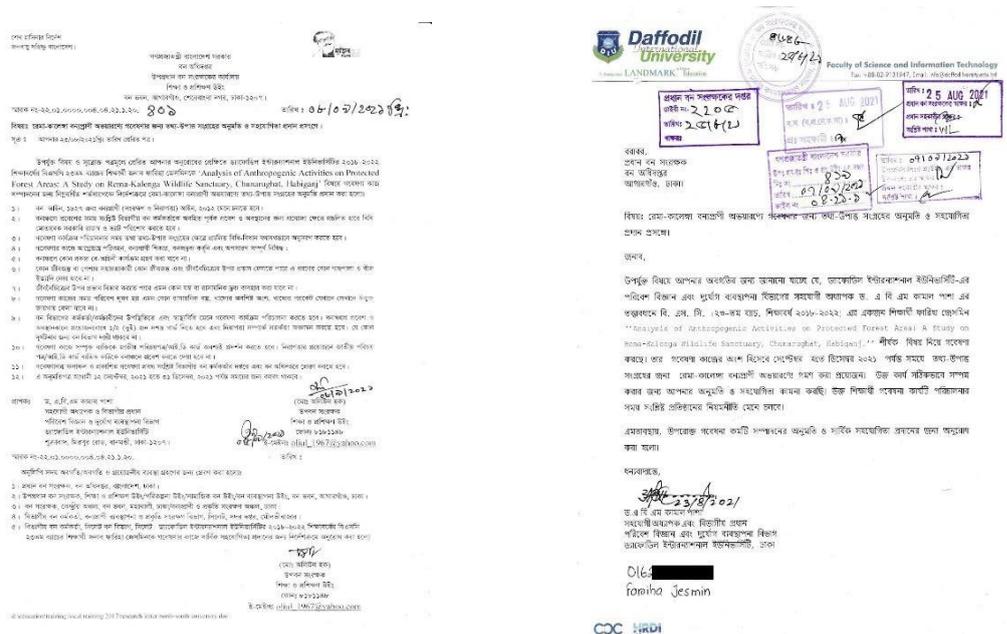


Figure 4 Permission documents from Forest Department

3.5.2 Field visit at Rema-Kalenga ,Chunarughat,Sylhet

The field visit began on September 17th and ended on September 19th. On September 17th, it took around 8 hours to go to Kalenga Range. On that particular date, we went to the local market to get to know the locals. The interview and questionnaire were done from morning to night on the next day, September 18th. The survey included a tour to the forest and interviews with locals in the morning. In the evening, we went to the houses and talked to the residents to learn more about the forest. FGD was undertaken on the local market at night. Interviews and questionnaires were done on the morning of September 19th.



Figure 5 during the field survey at Kalenga Range and with the Range officer

3.5.3 The questionnaire

The following is the questionnaire for the field survey. Questions were also asked outside of the questionnaire since additional information was obtained after interacting with the participants.

Questionnaire

Being a thesis student at Daffodil International University, I am carrying out a research under the title "Analysis of Anthropogenic Activities on Protected Forest Area: A Case Study on Rema-Kalenga Wildlife Sanctuary, Chanarughat, Habiganj"

I require your kind cooperation in order to complete this thesis. You will remain firmly anonymous throughout and all information will be kept strictly secure. Your information will only be used for this thesis.

Personal Information

Name(Optional):
Age:
Are you a local or tourists?:
If local, since when have you been living in Rema-Kalenga?:

Q1: What are the main sources of income for people in Rema-Kalenga?

Q2: Do you know that Rema-Kalenga is a protected area?

- YES
- NO

Q3: What are your thoughts on the anthropogenic activities occurring in the Rema-Kalenga Wildlife Sanctuary?

Q4: Do you consider that locals/tourists have an influence on the wildlife sanctuary's ecosystem? If 'Yes,' please explain why.

Q5: Do you suspect that anthropogenic activities on Rema-Kalenga are causing extinction of species of flora and fauna?

- YES
- NO

Q6: What changes have you seen in this forest since you've lived here?

- Behavioral changes in animals
- Illegal activities are on the rise
- Forest area is reducing as a result of agricultural activities
- All
- None

Q7: What kinds of agricultural or economic activities take place in forests?

Q8: What was the most common species of fauna you used to notice in this area which you no longer observe?

Q9: What was the most common species of flora you used to notice in this area which you no longer observe?

Q10: Do you suppose wildlife is relocating due to human disturbance?

Q11: What are your thoughts on unauthorized tree cutting inside the forest?

Q12: Do you think that people should not be permitted to live on protected land?

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Figure 6 Questionnaire for the survey

3.5.4 Focus Group Discussion with the local people

This study relied heavily on focus group discussions. During this process, brief and extended discussions with Kalenga Range residents discussed anthropogenic activities, the forest's social and economic values, and forest conservation.



Figure 7 FGD at local market of Kalenga Range

They talked about how forests are used in their daily lives. In addition to traditional forest uses such as harvesting honey, wood products, and bamboo and cane for handicrafts and weaving, these villagers and outsiders graze large herds of cattle and buffaloes in cultivated regions after the fields have been abandoned, as well as in swampy lowlands.



Figure 8 FGD at local market of Kalenga Range with Range officer of Kalegna Range

3.5.5 Analyses of the livelihood

The Sustainable Livelihoods Framework (SLF) was carried out to analyze local livelihood patterns through systematic interviews and focus groups discussions.

The livelihoods framework is a tool to improve our understanding of livelihoods, particularly the livelihoods of the poor. It was developed over a period of several months by the Sustainable Rural Livelihoods Advisory Committee, building on earlier work by the Institute of Development Studies (amongst others).

Chapter 4: Result and Discussion

This chapter shows the analysis findings and outcomes in a variety of formats and parameters. By analyzing the data and outcomes acquired, the study aims are also answered.

4.1. Study Findings

The findings of the study are explained in this article. Current anthropological operations on the Kalenga Range are described, as well as the challenges and solutions to negative concerns such as tree cutting, illegal tree cutting, animal hunting, and management team duties.

4.1.1 Forest Dependency

A shortage of assets for clearing land and establishing protective fences hampered agricultural productivity. Households were also afraid to invest in agriculture because of the potential concerns involved with predator attacks and livestock feeding. While agricultural improvements were seen as viable options for decreasing forest dependency, a landscape strategy to conservation in the region will be required to ensure the long-term viability of all livelihoods and minimize overall impacts on forest resources. The amount of fuelwood and grasses they collected, as well as the sources from which they collected it, were used to determine forest dependency.

4.1.2 Capital Source

On the Kalenga Range, an estimated 600-648 families reside, with 90% of them being poor or very poor. Agriculture is the principal source of income for residents both inside and outside the sanctuary, although forest resource collecting is typically a secondary source of income. The cost of feeding a cow on commercial feed (without grass) was used as a standard for evaluating the value of grasses taken from the forest, while the volume of fuel wood collected each week per family and its local market value were evaluated.



Figure 11 Agricultural land and farmer at Kalenga Range

4.1.3 Anthropogenic Activities on Kalenga Range:

People's engagement in protected areas across the world has been based on a vision of human emancipation, development, and welfare that includes the whole variety of accessible natural resources. Direct revenue from environmental preservation, livelihood diversification, and security of access to provided resources, and the maintenance of ecosystem functions such as watersheds protection are some of the benefits of protected areas for local populations. The people of the village were impoverished and reliant on the sanctuary for their livelihood. They used to make a living by harvesting unsustainable resources or unlawfully cutting down trees, prolonging the rate of deforestation.

During the survey, it was found out that the majority of respondents claim that anthropogenic activities have approximately less influence on forest biodiversity. They have no negative impact on the forest ecosystem. Rather, they preserve the forest against illegal activity and, if necessary, plant more trees.

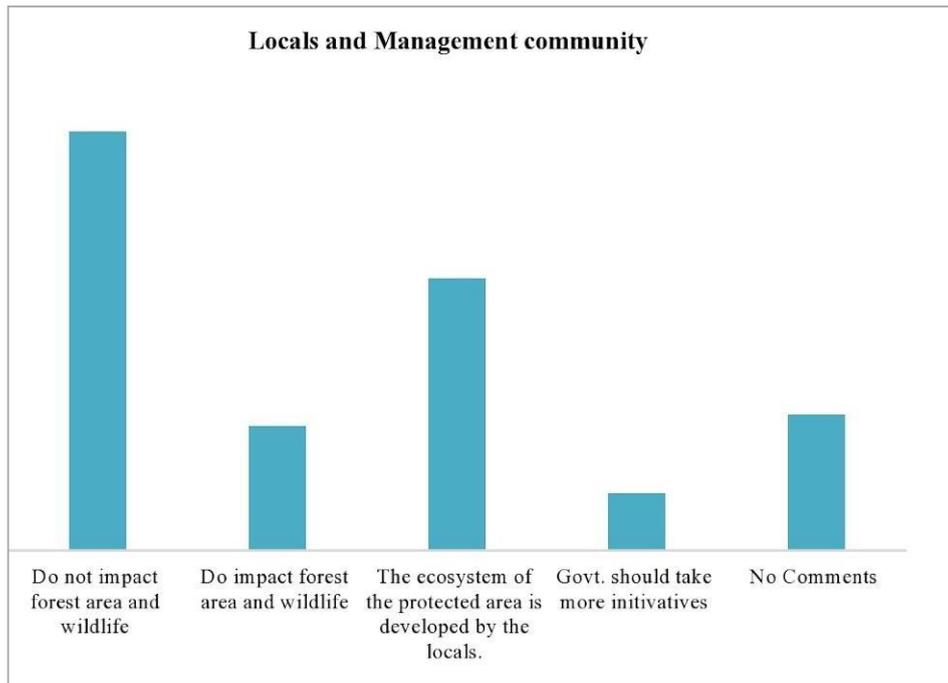


Table 2 Locals and management on anthropogenic Activities on Kalenga Range

The sanctuary's effective management appears to be based on the community's impactful improvement in different socio-cultural dimensions. The establishment of community-based administrations has clearly indicated that local institutional arrangements, such as social norms and social conventions, meant to induce cooperative solutions, may assist solve collective action issues and improve natural resource usage and management effectiveness.

4.2 Economic Activities

Villagers on the inside grow rice in nearby irrigated agriculture fields, produce vegetables and fruit in domestic yards, and keep a small herd of livestock. Certain people run their own businesses. Rice agriculture is practiced by the vast majority of the population. Some people are working as tourist guides. Qualified people are also associated with non-governmental organizations while others work as day laborers.

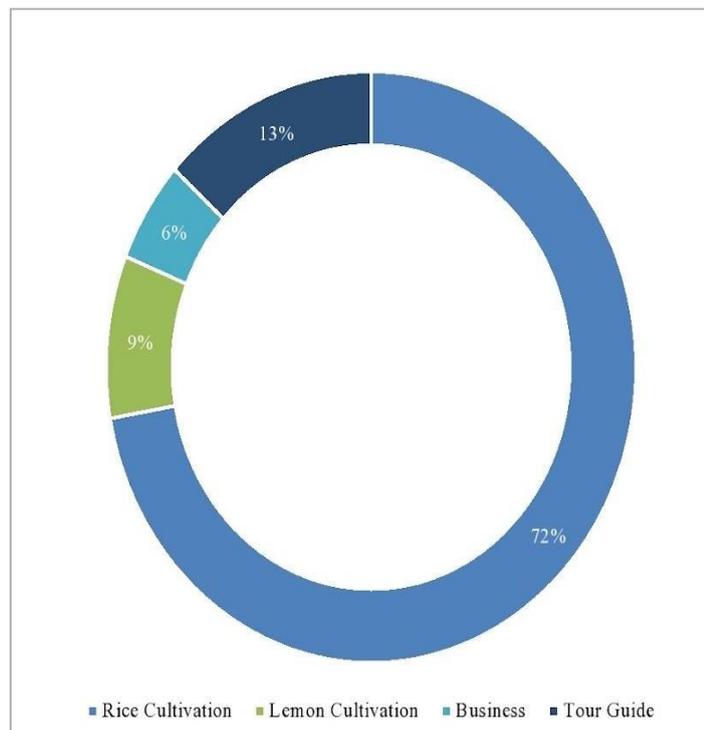


Table 3 Types of economic activities take place in forests

4.3 Exploitation of resources

4.3.1 Illegal tree cutting: Illegal logging is a widespread problem, according to reports. Illegal loggers from Indian land penetrate the sanctuary's forest near the sanctuary's eastern and southeastern borders. Some local fellers also access the sanctuary through nearby khas property and the Tea Garden, float logs down the Kalenga Chara, and then leave. Smuggled across the sanctuary area are illegally chopped trees. Authorities and locals said that tree cutting was a frequent incident in Rema-Kalenga in previous years, but that it has significantly decreased as a result of the government's actions.

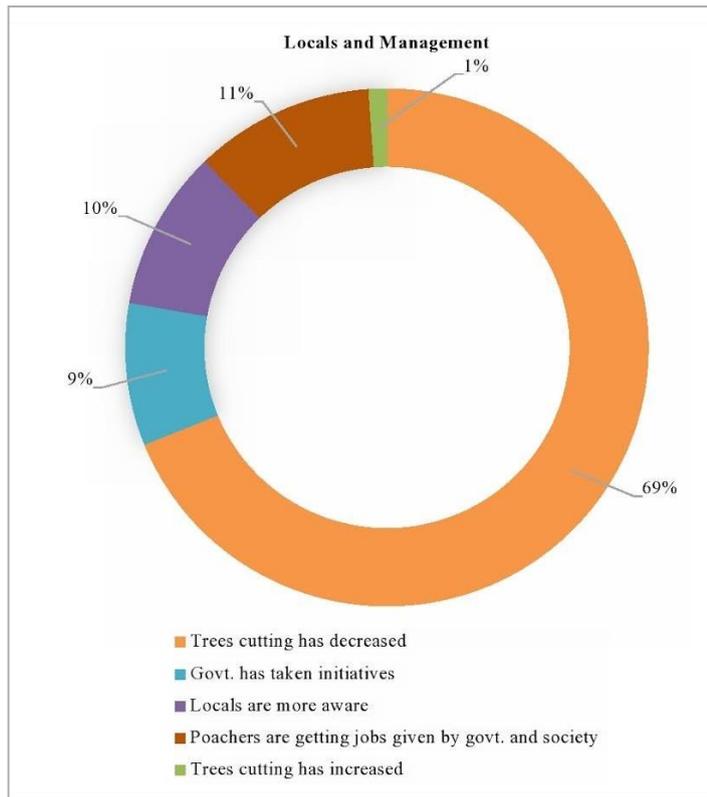


Table 4 Locals and managements thoughts on unauthorized tree cutting inside the forest

4.4 Uses of Lands in Rema-Kalenga Wildlife Sanctuary

The Rema-Kalenga Wildlife Sanctuary is mostly covered with natural forest. People claim that the natural forest is enormous and deep on its own, with a large wildlife habitat, and that locals do not harm nature. Following that, the lands are used for plantations. Local residents grow trees by covering the costs themselves. Lands are used in large quantities for farming, while lands are granted for forest preservation so that poachers do not destroy the woods. Paddy fields are the most plentiful. There are also streams and a lake. Since protected areas have been shown to be crucial for conservation, their implementation confronts difficulties due to anthropogenic influences, including the problem about how to integrate rural development with protecting the natural environment.

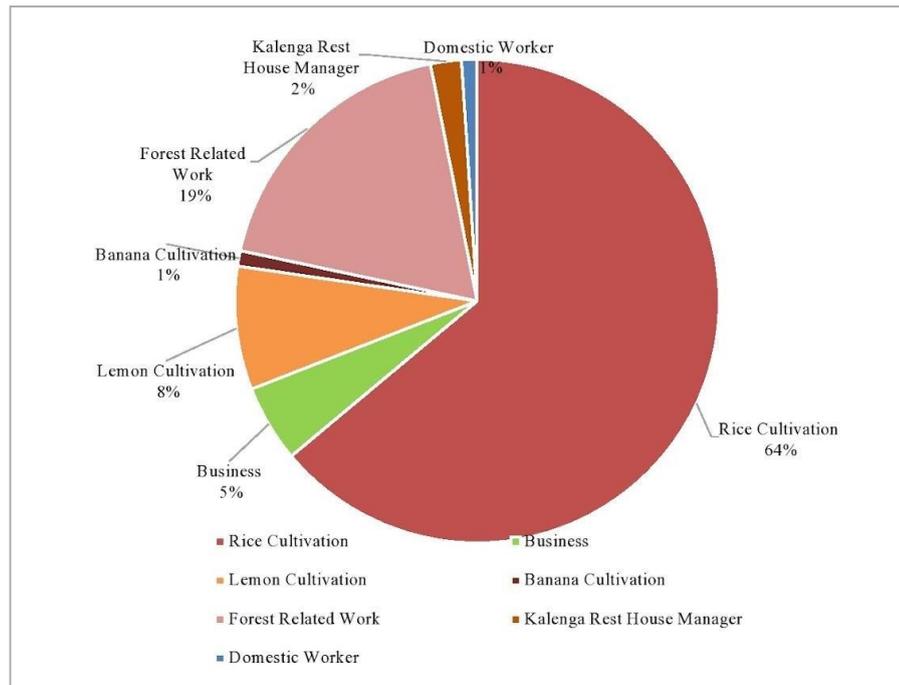


Table 5 Types of uses of Lands in Kalenga Range

4.5 Development of Ecotourism

Tourism use of PAs basically involves the travel for the discovery and learning about wild environments. Tourism is viewed in many industrial nations as an environmentally friendly way to revitalize distressed rural communities and economies. A similar view is gaining momentum in developing countries like Bangladesh where PAs are becoming more popular destinations for wildlife tourists of national and international origin.

Bangladesh is exploring the ecotourism opportunities. According to the analysis of the data, males account for the majority of tourists, with the youngest visitors being under age of 35. The majority of the tourists appeared educated, and many of them were students. Since they were professional, the majority of tourists opted to take vacations. Visitors who came with a group of companions were enhanced. As per the discussion, Rema-Kalenga is a wonderful tourist destination. The forest inhabitants rely heavily on tourism since it is a significant source of income for them. Several people work as tour guides among the locals.

Since the research was conducted during the COVID-19 outbreak, it was found that the number of tourists has dropped significantly since the breakout of COVID-19. The number of tourists used to be 30-35 per day before the COVID-19. It has dropped to 5/10 in the month since

COVID-19. The locals' and tour guide's financial situations have been affected as a result of this.

4.6 Tourists influence on the wildlife sanctuary's ecosystem:

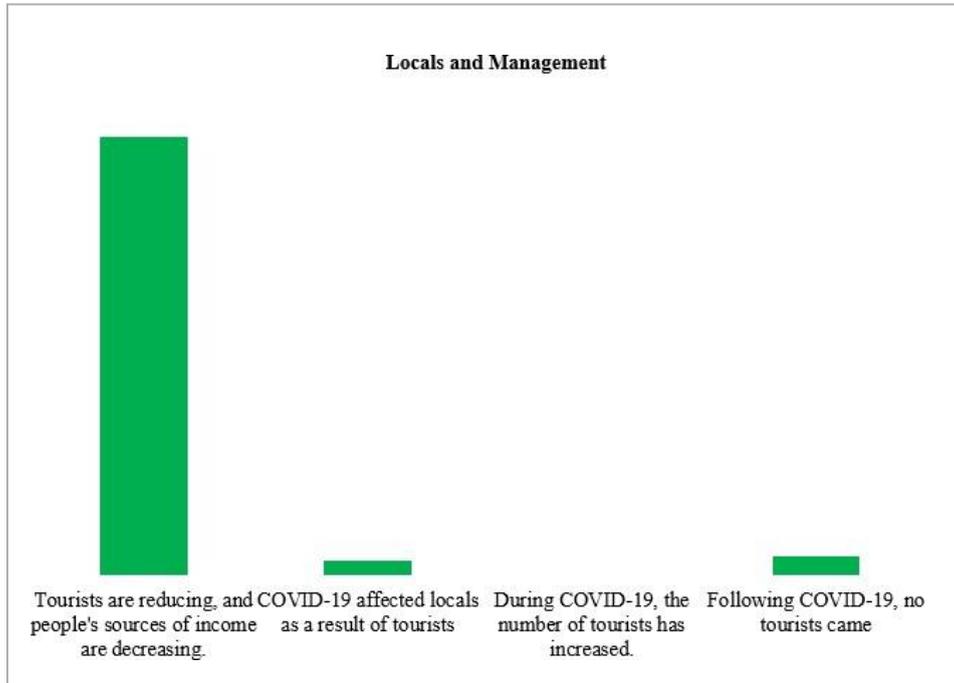


Table 6 COVID-19 effect on tourism in the forest

Tourists are crucial for the forest and the inhabitants, according to the locals and management. As of now, there has been no evidence of tourists disturbing the animals in any manner. Tourists help both the people and the tourist guides. Tourists also pay an entrance charge and stay in resorts and rest homes, providing economic advantages to the locals. The vast majority of respondents stated that they do not harm animals and are quite affectionate to nature. One disadvantage is that they often trash the surrounding. These had to be cleaned up by the locals.

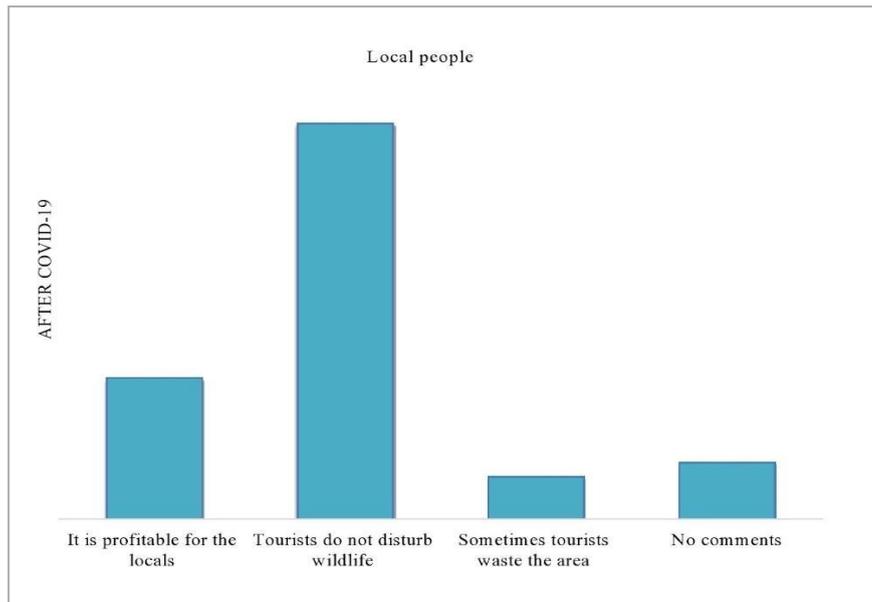


Table 7 Tourists influences on Sanctuary

4.7 Wildlife relocating due to human disturbance in Kalenga Range

Locals think that if there is any disturbance, wildlife will relocate. There has never been a circumstance when wildlife has been forced to relocate due to human disturbance. They say that certain animals have become extinct, but that this is not due to human interference. They are quite concerned about the animals. If they come to the living area, they are even fed. They also agreed to prohibit monkeys from agricultural areas since they damage it. It does not, however, result in their relocation to other locations. Tourists do not make any noise or create any disturbance to the animals. This is strictly enforced by the locals and management. Locals claim that tourists are quite kind to the animals.

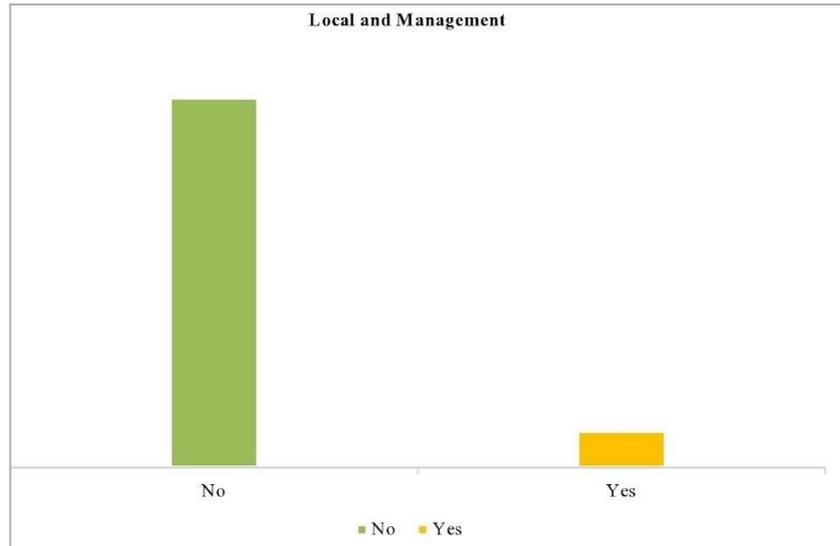


Table 8 Local and Management on wildlife relocating due to human disturbance

4.8 Poaching of trees

Wildlife is a source of wealth in many regions, whether as forest products for local or even worldwide markets, or through illegal trading of animal parts and endangered species. Many formerly protected places have now become crucial sanctuaries for once-widely-distributed species. Wildlife poaching and trafficking are responsible for the extinction of many species, and trafficking has become more systematic and commercialized in recent years than it has ever been. Capturing valuable resources is one way to gain fortune and power. Some wildlife poaching is undoubtedly influenced by poverty and a lack of economic opportunities.



Figure 12 Illegal trees are stored for auction by the government

It was nothing uncommon in the Kalenga Range; as a protected area, this forest had been subjected to criminal activity for a long time. For a long time, people have been poaching trees and selling them at a high price. When poachers attacked the area for tree cutting, locals and authorities said it was difficult to resist them since the number of poachers was more than the number of locals and officials. As a result, the majority of them were able to roam freely. Poachers used to have weapons and would fire them at officials. As a result, the number of tree cuts increased.

Due to continual observation and counseling, the government has been able to reduce the incidence of poaching on the Kalenga Range in recent years with the support of local people. It took a long time, but poachers have now established a method to make a living other than doing illegal activities. Poaching of illegal trees and wildlife has decreased in recent years, and the government has taken control of the problem.

The trees in the above image have been taken from poachers' hands, and the poachers are under legal monitoring. The trees are for the auction and are labeled with case numbers. It will be utilized lawfully because it has already been chopped down.

4.9 Attacks on Fauna:

The forest region was home to a wide variety of flora. Because most of the fauna inhabit deep forest, there was a limitation of them in the local area. During this period, snakes, red monkeys, and birds were seen. The inhabitants of the area are incredibly friendly and courteous. The locals are very considerate and polite to animals, and they will even feed them if they are hungry. One downside has been observed: snakes are killed if they come close to children or houses.



Figure 13 A woman killing a snake at the forest

4.10 Rema-Kalenga as a Protected Land Area

Locals were interviewed about the protected land area throughout the survey. The majority of people are aware of the protected land area, based on surveys. There were a few people who were unfamiliar with the concept of a protected land area. They were addressed whether they recognized it was a protected land area when they relocated here. Yes was the majority response.

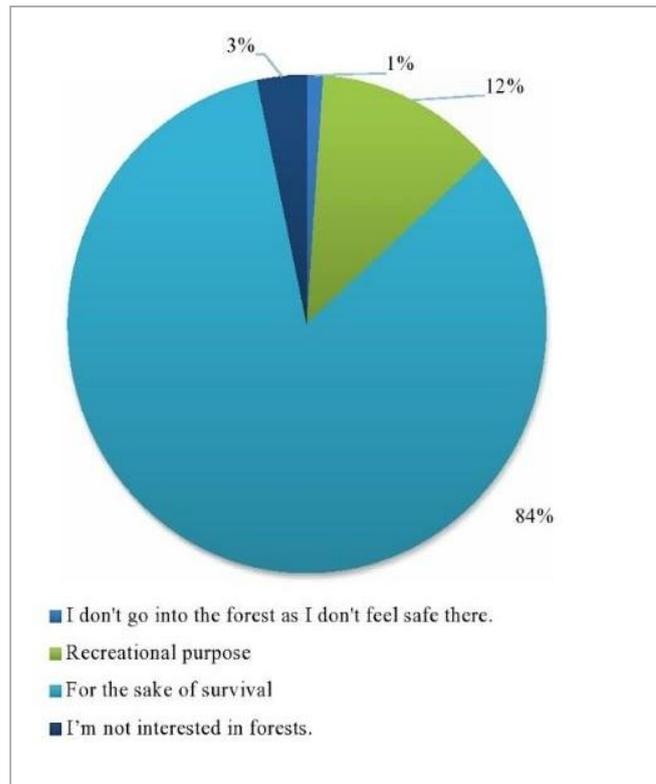


Table 9 Locals purposes when they enter the forest

4.11 Natural Resource-based on Kalenga Range

In the research region, the informants mentioned three types of land ownership: homestead areas, individuals owned agricultural lands, and agricultural lands held from the Forest Department. The Forest Department granted unoccupied plain areas within the sanctuary to local communities to enhance higher agriculture production as an aspect of its attempts to decrease dependence on protected areas.

4.12 Flora and Fauna in Kalenga Range

Historically, Bangladesh forests are highly vulnerable to anthropogenic disturbances and climate change. Since liberation (1971) majority of the state forests have been declared as protected areas (PAs) in the form of wildlife sanctuaries and national parks to conserve the natural forests.

4.16 Permission on living on Protected Land Area According to the forest guard of Kalenga Range, the number of individuals living in the forest is growing day by day. Based

The richness of uncommon species is abundant in the Rema-Kalenga Sanctuary. The lists of flora and fauna in Rema-Kalenga given below:

Flora	Fauna
Haritaki	Owl
Chikrashi	Hyenas
Banamala	Monkey
Chamkathal	Deer
Teak	Squirrel
Gandharai	Kite bird
Awal	Maasranga
Lojipata	Tuntuni
Bosok pata	Bhimraj
Medicinal plant	Hanuman
Neur	Tia
Black Fig	Moyna
Chapalish	Mongoose
Kodom	Snail
Neem	Snake

Table 10 Lists of Flora and Fauna

4.12.1 Behavior of Fauna before and After COVID-19

During the study, residents reported observing changes in their behavior. It was obvious that the number of individuals present before COVID-19 was higher than after COVID-19. As a result, wildlife animals used to spend the most of their time inside the forest. However, they were formerly visible to travelers. They began to emerge in the local areas after COVID-19, due to a decrease in the number of people present. If food is provided, they become quite calm and less aggressive. According to locals, however, there have been minor changes in animal behavior.

on this, it was done a survey to see if people were permitted to live in the protected area. A large number of people should not be permitted to reside in the forest region, according to the majority of the public. The administration, on the other hand, feels that people should be allowed to live since it protects the forest from illegal activities by allowing locals to work together to maintain it. However, as the family grew rapidly, it became a source of concern for them. In comparison to a few years ago, the number of families has risen.

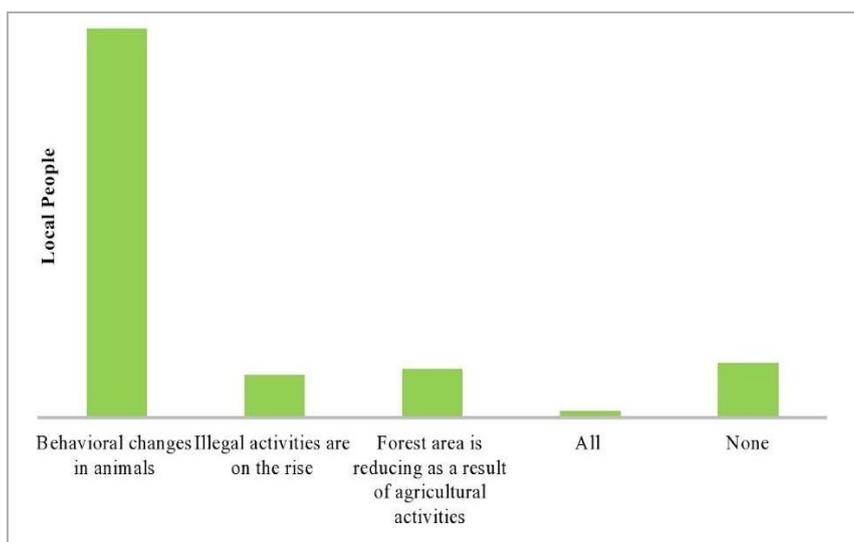


Table 11 Behavior Changes in Flora and Fauna

4.13 The vulture culture

The number of vultures in the county has already fallen, as is widely known. Locals knew that RKWS had been cultivating and feeding the vultures in order for them to survive. In order for them to live, they are fed cow meat. Vultures have been surviving in the RKWS as a result, but in smaller numbers.

4.14 Fauna- nearly extinct and extinct in Kalenga Range

According to the locals, a number of species of animals have become extinct or are on the verge of becoming extinct. The environment, such as a shortage of food, human disturbance, poaching, and other factors, play a role in the extinction of these species. Poaching and killing for the sake of bones or skin are the most common reasons. The elderly people mentioned about tiger they used to see and had been attacked by multiple times, but the tiger is no longer visible in this forest. Younger and middle-aged people discussed the matter about the decrease of hyenas and deer encounters compared to 10 to 15 years earlier.

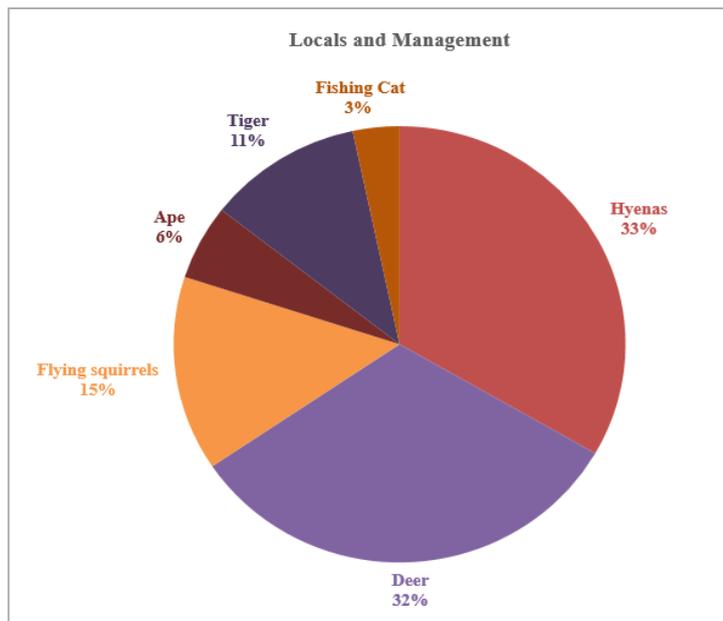


Table 12 Fauna nearly extinct and extinct in Kalenga Range

4.14 Flora nearly extinct and extinct in Kalenga Range

Plant extinction is most apparent and frequent in the forest. For many years, poachers have chopped down a large number of trees in the forest. It has been going on for years, and the government and local people have had no control over it since the number of poachers used to be higher than the administration and local people. For a long time, poachers were constantly attacking the forest. They used to regularly chop down trees and poach them. The government has recently taken control of this issue, and the number of trees chopped down has decreased. As a result of this, numerous tree types have become extinct, and many flora have become extinct. The government and locals have taken the initiative to replant these trees.

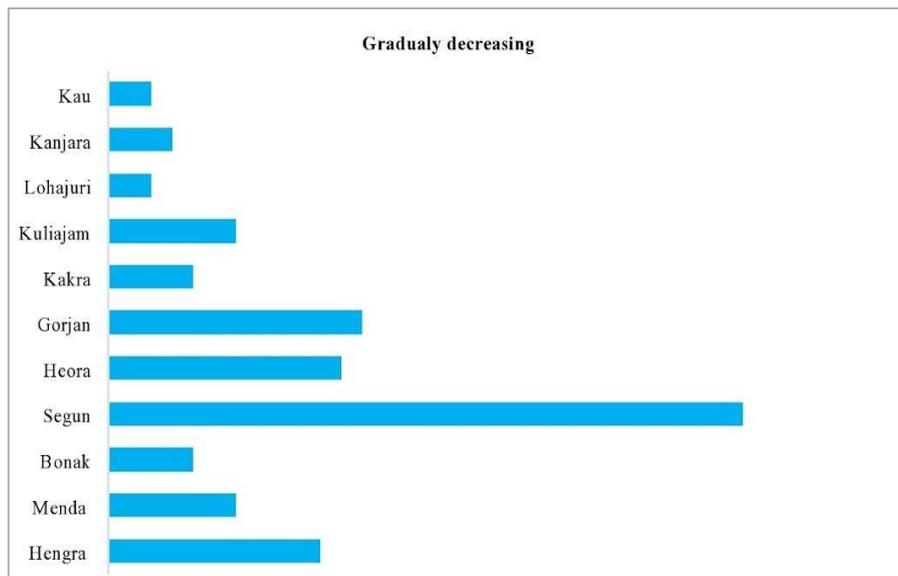


Table 13 Flora gradually decreasing in the forest

4.15 Anthropogenic activities on Kalenga range on extinction of species of flora and fauna

During the survey, no major anthropogenic activities that might lead to the extinction of flora and wildlife were observed. However, there have been certain human-caused actions. Such as:

- Illegal Tree cutting down poachers
- Agricultural Activities
- Ousting monkeys from agricultural land.
- Using pesticides in agricultural land.
- Increasing agricultural land in the forest.
- Killing of snakes if they come to the local areas.
- Planting invasive plants by different NGOs.
- Construction of rest houses.

The locals claim to engage in no substantial anthropogenic activity. According to the survey taken, the majority of people agreed not to endanger the forest in any way. Few people agreed that certain actions are gradually degrading the forest.

Locals, however, think that the number of people living on the protected land area should be reduced for the forest's welfare.

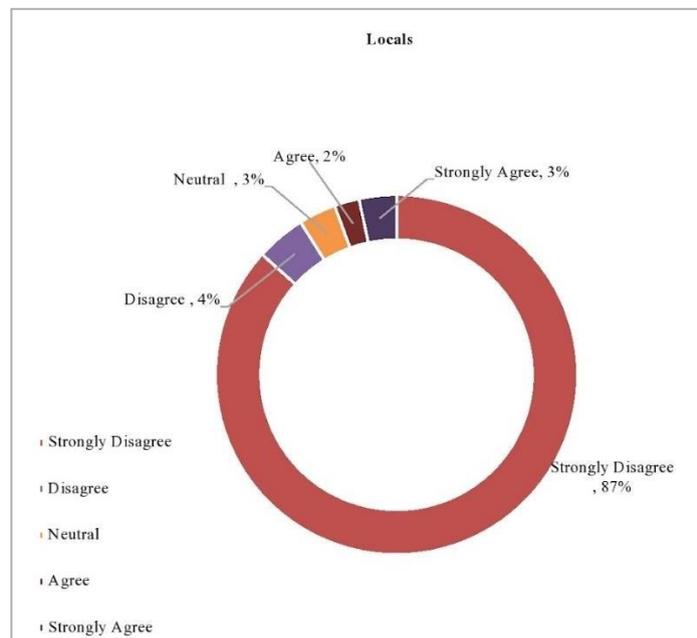


Table 14 Locals vote on people should not be permitted to live on protected land

417 COVID-19 impact on the forest environment

The research was conducted during the COVID-19 crisis. During the survey, it was reported that COVID-19 had no impact on the Rema-Kalenga Wildlife Sanctuary. Surprisingly, no cases of COVID-19 were found. In comparison to the urban area, the people were considerably healthier. People were not wearing masks or taking precautions since visitors had not visited the region since the COVID-19. The only effect that COVID-19 has had is on the economy. Tourists contributed significantly to the area's economic development. Tourists had not visited because of the pandemic, and many people's economic situations

had deteriorated as a result. Many people have lost their employment at NGOs where they previously worked. They are relying on agricultural activities to support themselves.

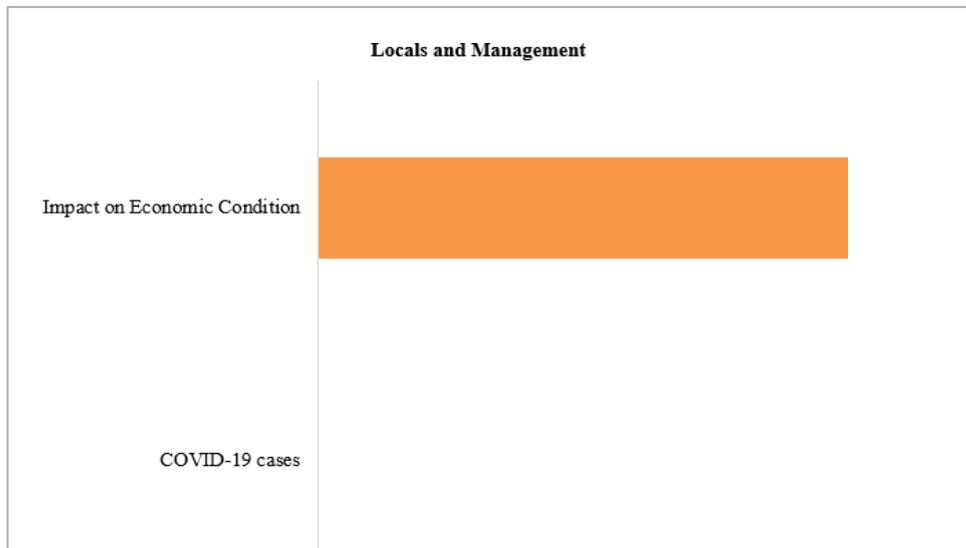


Table 15 COVID-19 impact on the Kalenga forest environment

Chapter 5 – Conclusion and Recommendation

This study's last chapter summarizes all of the study's findings from the literature review, data collecting, data analysis, results, and comments. Here we have attempted to clarify the research's overall goals in this section. Guidelines for researchers are also provided to help them better understand the future analyses. There are two parts to this chapter.

5.1 Recommendations

This part was divided into two parts for better understanding of the reader.

a. Study Limitations:

1. The Kalenga Range's road is too poor, making the journey extremely challenging.
2. From the town to the forest region, only CNGs are accessible.
3. Traveling with fewer people is risky.
4. The forest is too dense, and fauna such as snakes, monkeys, and wild caterpillars prowl the area.
5. The language of Sylhet might be difficult to decipher at times.
6. In many areas, gaining access is quite difficult. It is quite difficult to utilize a drone for aerial surveillance due to the presence of certain national or government facilities nearby.

b. Study outcomes or understandings:

1. Rema-Kalenga is recognized as one of Bangladesh's largest forests. Though the administration claims that illegal tree cutting has decreased in recent years, the administration should focus more on eliminating it totally.
2. To keep illegal activities in the forest under control, the number of administrations should be expanded.
3. The amount of agricultural land available should be restricted.
4. Non-governmental organizations (NGOs) should not be permitted to plant invasive species in forest areas.

c. For future study:

1. Locals and government officials are extremely knowledgeable and friendly. They can assist in the collection of data for future research.
2. To monitor the continual changes in the forest and to safeguard the forest, more research on anthropogenic activities should be conducted.

So from the beginning to the end of the report, these are the key points of this study's recommendations.

5.2 Conclusion

This study found that co-management has improved local community livelihood options, biodiversity conservation, and forest management. Another significant change in forest management has resulted from the co-management approach: the local community has a stronger voice and is more involved in forest management choices. However, the most outspoken members are frequently from the community's upper crust. According to the findings, the local community has a generally positive view toward co-management, particularly in terms of improving forest biodiversity, improved forest management, and forest protection from illegal activities.

Tourism may be promoted as a tool for wildlife and forest conservation and sustainable development, and from a community viewpoint, it is intended to deliver advantages that will increase community support for natural resources conservation. This study's findings indicated no negative perceptions about tourist development at RKWS, however views toward tourism may alter in the future as tourism grows.

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Appendix – I: Photograph



