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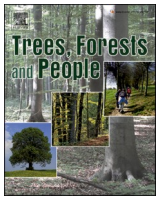

Nature of human–tiger conflict in Indian Sundarban☆

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ABSTRACT

The Sundarban biosphere reserve is the largest mangrove forest in the world, situated partially in India and Bangladesh. This eco-sensitive estuarine delta is designated by UNESCO as a world heritage site. The population density of this estuarine forest region has been relatively low for a long past, but in last few decades it is increasing rapidly, especially after the partition of India. This is creating an immense pressure on forest resources. Mangrove forest area has been converting into arable land, putting all natural animal and local people in a precarious situation. The Sundarban usually is the home of Royal Bengal Tiger, one of the famous endangered species. Due to massive deforestation the habitat of tigers is being destroyed and as a result tigers sometimes attack nearby villagers. The forest dwellers of Sundarban are dependent on the forest resources for their livelihood for which they collect wax, honey, firewood etc. Such human intervention in the forest is changing the composition of core, outer core and buffer forests of Sundarban. This results an increased human–tiger conflict in the study area. The present research work aims to enquire the probable reason of such. Following an intensive study it has been found that, the outer-core of the forest areas are the most vulnerable part of the forest where most of the human–tiger conflicts have been reported and most of the casualties have been identified among the people who are entirely dependent of forest resources for their livelihood.

1. Introduction

Located on the delta of the Ganges, Brahmaputra and Meghna rivers on the Bay of Bengal, the Sundarban mangrove forest is the largest mangrove forest in the world, consisting primarily of halophytic plants. It is intersected by a complex network of tidal waterways, mudflats and small islands of salt-tolerant mangrove forests (UNESCO, W. H. 2023). Its major part (almost 60%) is under the territory of Bangladesh and the rest is located in the South 24 Parganas district of West Bengal State in India. This forest is also known as 'Mangal vegetation', 'intertidal forest', 'tidal forest', and *"Bada Bon"* (Indian-*Bengali* local name) which significantly points to Sundarban mangrove forest. Sundarbans delivers several ecosystem services like natural protection to the fauna and flora, maintaining rich biodiversity, consistent supply of timber, honey, wax materials etc. (WCMC, 2023) It also hosts a wide variety of fish, crabs and other aquatic species. Mangrove forests protect human society from various natural calamities such as cyclones, tsunamis, and tidal surges (Biswas and Biswas, 2019).

The Sundarban is inhabited by The Royal Bengal tigers (*Panthera tigris*), many other large carnivores and other wildlife for a long period. The existence of human habitation close to the core and buffer areas of the forest is a remarkable feature of this study area. But recently conflicts between wildlife and human beings, especially with the Royal Bengal tigers are increasing surprisingly (Chatterjee, 2023). The remarkable growth of the human population in the forest is one of the reasons for this. Such conflict is not only causing a life threat to humans, sometimes tigers are killed by the furious human mob. For more than the last two decades many such incidents have happened in Sundarban and these incidents were uneven throughout the period (Das, 2018). Regarding the conflict between the people of the Sundarban and wildlife, it is seen that people are destroying the forest to build their settlements, which is causing a challenge to the local wildlife including the tigers. This degradation of forests also increases the frequency and severity of various natural calamities like storm surges, cyclones, coastal floods, soil and river bank erosion etc. directly or indirectly. Global warming is also increasing such threats, along with that the threat of illegal hunting and poaching are seriously disrupting natural habitat of the wildlife (Qureshi et al., 2023). In this condition unexpected population growth is

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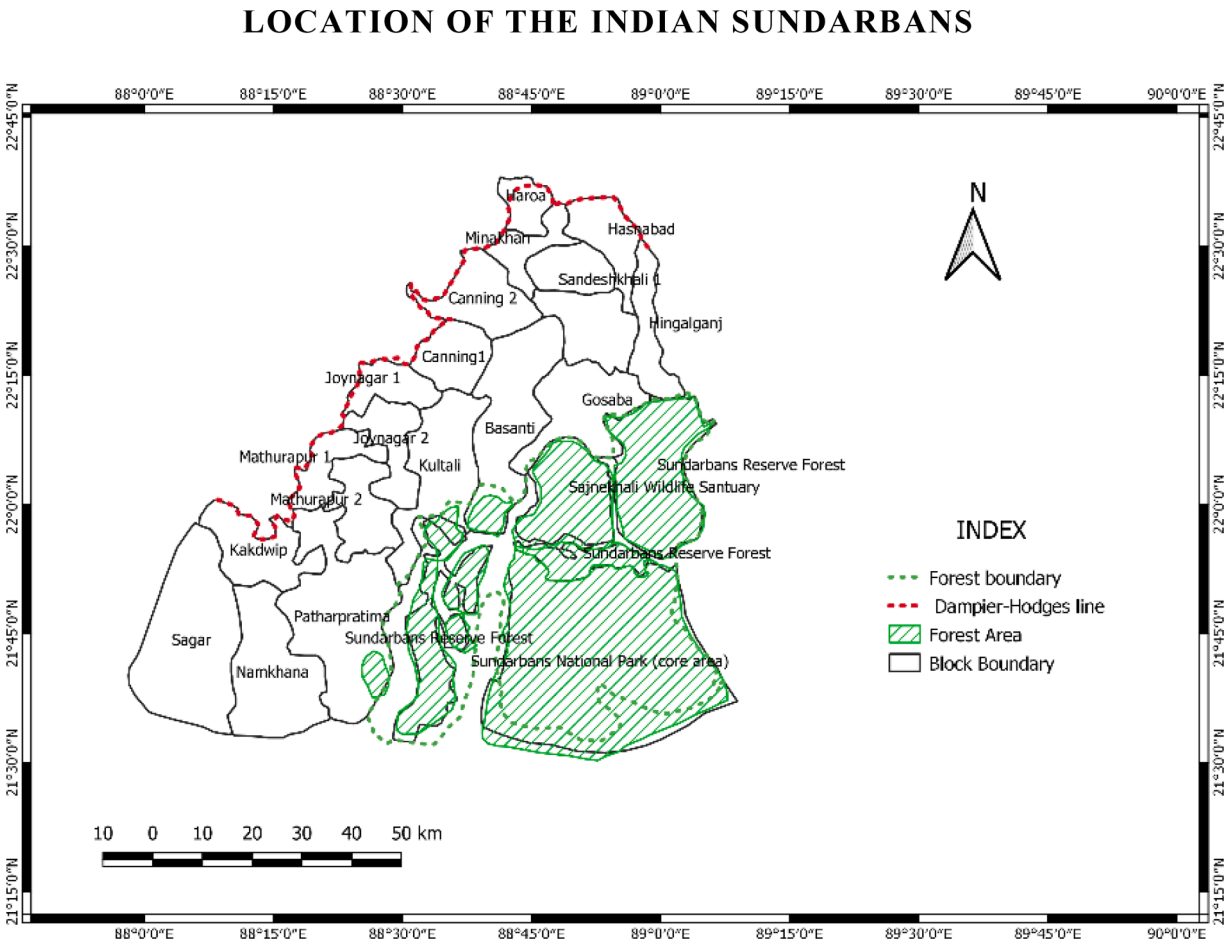

Fig. 1. The Indian part of Sundarban forest, is bounded by the Bay of Bengal in the south, Bangladesh border in the east and various districts of West Bengal State in the western and northern part.
Source: prepared by the authors.

causing immense pressure on forest resources, thus increasing the possibilities of human and animal conflicts. The present paper highlights this scenario in the study area and identifies the geographical distribution of such conflicts along with their reasons.

The world heritage convention was negotiated on how to protect and conserve those eco-sensitive areas of wildlife. It was adopted in 1972. After being notified of this area as a 'world heritage site' by UNESCO, Sundarban is a world heritage site in India where the Royal Bengal Tiger is protected and preserved. In 1987 the National Tiger Conservation Authority (NCTA) launched a project to conserve tigers. Under this project, in and around the Sundarbans, the core area is unembarrassed from various types of anthropogenic interactions and the preservation of the buffer area is given special emphasis; along with that, in this whole area, all types of polluting industrial growth has become strictly prohibited (Basu and Xavier Savarimuthu, 2015). The Royal Bengal Tiger is found in forests across India and the Terai in Nepal. But this is a matter of concern that the various numbers of wildlife are falling constantly. The tiger census reports a total number of 88 tigers in the Indian Sundarban (2018). Different types of natural disasters like cyclones affect the forest and wildlife in the study area adversely. As a result, the tiger moves closer to the village in search of food (Bhattacharya, 2012).

The geographical, biological, political, social, financial, cultural and traditional factors influence the conflict or co-existence between people and wildlife (Ruda et al., 2018). The Sundarban Delta region is facing economic, educational and social backwardness and rapid human population growth leading the area to underdevelopment. According to the 2011 census, approximately 4.37 million people living in the Indian part of Sundarbans. The people of this area are mostly dependent on agriculture due to the absence of any industrial infrastructure. Insufficient irrigation facility has forced the agricultural system to be dependent on seasonal rainfall. The mode of production is also a little primitive in nature. In this condition, people are heavily dependent on the local forest resources. People of the Sundarban continue to live in abject poverty due to overpopulation and a lack of economic and social infrastructure (Mahadevia Ghimire and Vikas, 2012).

Human activities gradually destroy the natural habitat of wildlife, which increases human–wildlife conflict globally (Digun-Aweto et al., 2022). Sundarban is an eco-sensitive zone in India. It's a safeguard zone along the estuarine coastal area, but various types of threats like natural or human activities affect it adversely. Gradual degradation of forest and an increased built-up area near the buffer forest increases the instability of the habitation of wildlife, including the tigers. In such conditions, tigers come close to the nearby villages in search of food very often. Also, human penetration into the jungle in search of forest resources increases the chances of human–tiger interaction. This phenomenon is the major theme of the present research.

The Sundarban is a group of low-lying islands spreading from the South 24 Parganas district of West Bengal, India to Bagerhat district in southern Bangladesh. It is the world's largest deltaic plain, which is a part of the Ganga Brahmaputra Delta (Roy and Dhar, 2021). Out of the total 10,000 sq. km. area of Sundarban, only approximately 4000 sq. km. area is under Indian territory. It is the largest mangrove forest in the world; it is believed that the area was named Sundarban because of its extensive influence of the *Sundari* trees, the mangrove specie that

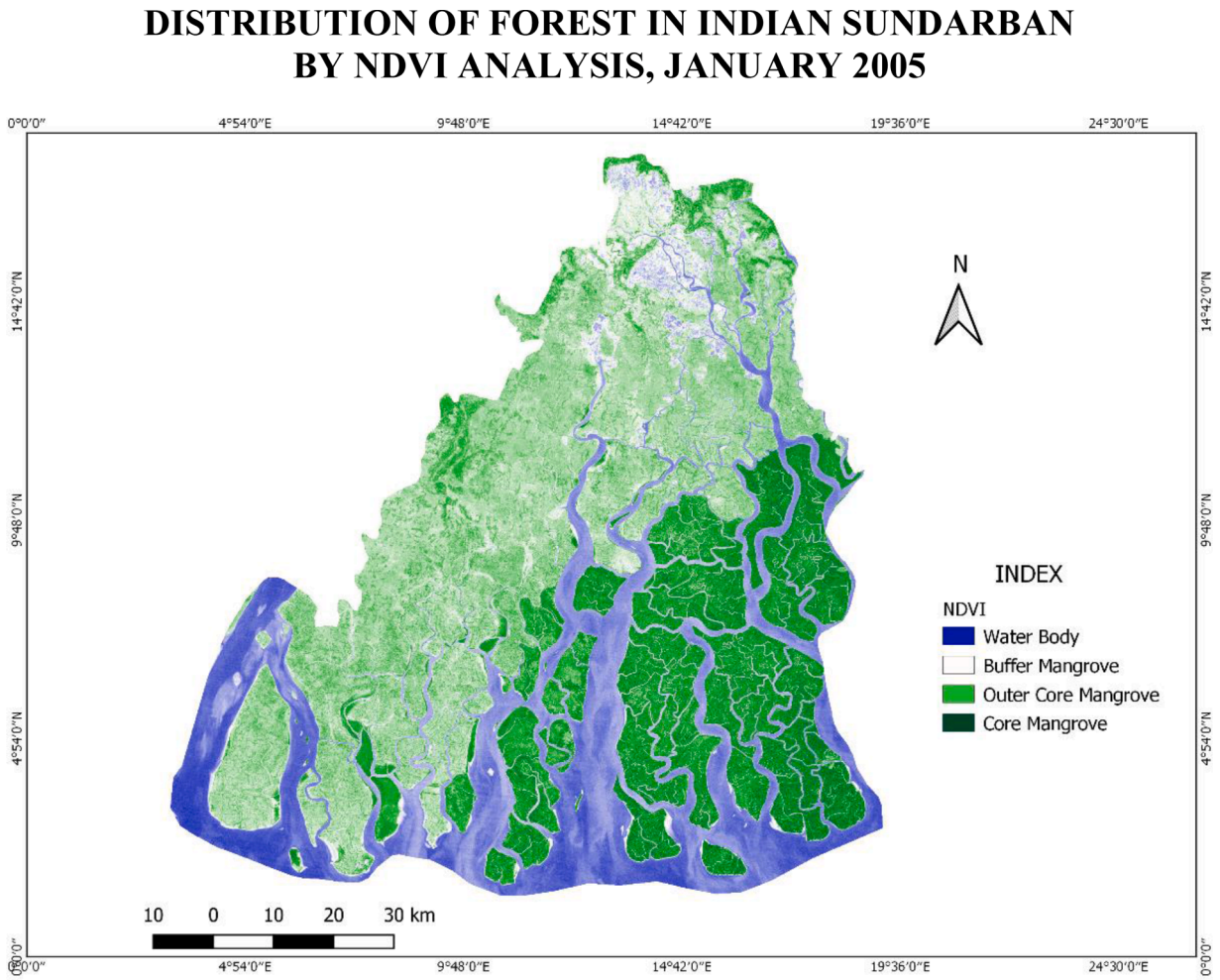

Fig. 2. NDVI map reveals the distribution of different categories of forest as mentioned in the index for 2005.
Data Source: LANDSAT 5.

dominates in the region (Chatterjee, 2018). The formation of Sundarban mudflats and islands that are made by deposited loads of sediments, carried by the Himalayan River and tidal water. The geographical location of the Indian Sundarban has been presented in the location map of the study area (Fig. 1) (Ghosh et al., 2015). The extension of the Indian Sundarban is delineated by the Ichamati-Raimangal River in the east, by the Hugli River in the west, by the Bay of Bengal in the south, and the Dampier-Hodges line drawn in 1829–1830 in the north (Danda et al., 2011). The Indian part of Sundarban was recognized as a Reserve forest by the jurisdiction of the state forest department in 1878. After that, it was designated as a "Protected forest" in the British era under the Forest Act, 1865 (Act VIII of 1865). At that time there was a system of cleaning and converting this protected land to farmland or transferring timber production which had the option of leasing by the Department of Forest. After a long time in 1943, the forest was once again reclassified as a protected forest to protect it from reclamation or conservation. Afterwards, Sundarban got its dignity as a "Reserved forest" due to its unique Ecosystem (Chatterjee, 2018).

1.1. Objectives

The objectives of the present study are as follows:

- To identify the reason for tiger and human conflict in Indian Sundarban.
- To study the human population growth and affected land use pattern in the study area.
- To identify the geographical distribution of human–tiger conflict within the study area.

As the present study is both ways of interaction between human and tiger populations, here both population trends have been enquired. Human population data have been collected from the District Census Handbooks of South and North 24 Parganas. Populations of concerned C D Blocks are analysed for the years 2001 and 2011. As the population of the 2021 census is yet to be published, it has been calculated by the population projection method. According to the Census Report 2011, the population density in the Sundarban region was 110 persons/sq.km on average. There are 19 blocks in the Indian Sundarbans. But these blocks do not have a fairly equal density of population, there is a remarkable variation of human population distribution in these areas (Fig. 5). Few of those like Patharpratima, Basanti, Joynagar I and II, Kakdwip etc. have relatively high population density. Not only that, those blocks are showing a rapid population growth rate too. Here it may be mentioned that all blocks under the study area are exhibiting a rapid population growth rate with a high projected population for 2021. And this poor rural population is significantly dependent on mangrove forest resources (Mohammad Abdullah et al., 2016).

With the increasing human population in the study area, pressure on natural resources is also increasing. Royal Bengal tigers in Sundarbans are one of the unique species in the world because they live in saline

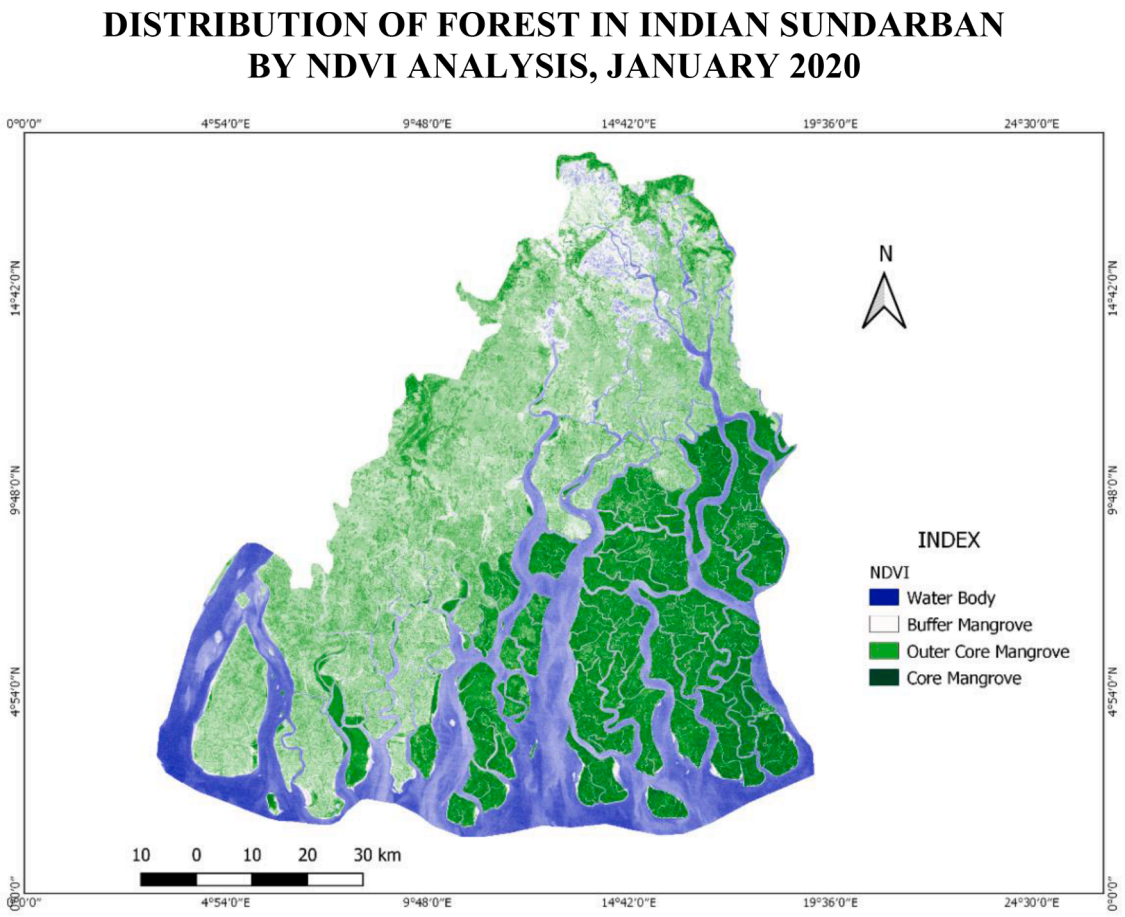

Fig. 3. NDVI map reveals the distribution of different categories of forest as mentioned in the index for 2020.
Data Source: LANDSAT 8.

TABLE 1
Forest cover change matrix in Indian Sundarban, 2005–2020.

Change Matrix (Area in Sq. kilo meter)	New Class NDVI 2020 - Buffer Mangrove	New Class NDVI 2020 - Outer Core Mangrove	New Class NDVI 2020 - Core Mangrove	Change in forest cover 2005–2020 (In%)
Reference NDVI 2005 Buffer Mangrove	–	78.11	7.39	2.15 to 4.32
Reference NDVI 2005 Outer Core Mangrove	116.96	–	481.97	48.18 to 45.49
Reference NDVI 2005 Core Mangrove	10.37	375.31	–	22.33 to 23.51

Data Source: LANDSAT 5, 2005 AND LANDSAT 8, 2020.

mangroves, their behavior is quite different from other tiger communities of the world, they can survive in a variety of adverse conditions. Forest-dependent livelihoods of local people have increased this conflict (Saha et al., 2022). Along with that, a significant portion of natural forest is converted into settlement areas. This phenomenon increases the possibility of human and wildlife conflict. Both human beings and tigers use these regions to collect their food and other life-supporting resources. In some instances, human beings directly attack tigers for self-protection or any other reasons. On the other hand, tigers attack humans, when people enter their territory or tigers come to the nearby villages. Usually, these conflicts result in crop damage, animal slaughter, loss of human lives, etc. Tribal communities living in or near the forest suffer most due to such conflicts, their livelihood becomes ruined and their survival is in jeopardy. This is a big challenge in maintaining a balance between tiger conservation and human population growth. It's a rare condition where people closely live with wild tigers, that is unprotected and terrifying. That fact leads to a pessimistic view of tiger conservation (Naha, 2015). The Sundarban is the region that's the breeding ground of tiger-human conflicts. Many such instances killed more than 3000 people and 1000 tigers, and an estimated massive loss of livestock was observed during the last decades. However, the frequency of casualties has been steadily declining over the past 5 years. Earlier, if a tiger entered a village its condition would turn to a bloody end. All the male members would surround the tiger furiously and kill it. Within 1991 and 2000 the annual frequency of casualties was three villagers and three tigers due to human–tiger clashes in the Indian part of Sundarban (Law, 2015).

2. Materials and methods

2.1. Data source and methodology

To have a broad idea about the present problem in the study area, an extensive literature survey has been conducted covering numerous books, research articles, relevant reports etc. Some valuable information has been collected from the field based interviews and local survey, which are very much helpful in the framing of the present research. Satellite images of the present study area from the sensor Landsat-5 TM and Landsat-8 OLI/TIRS are collected with 30 m spatial resolution to

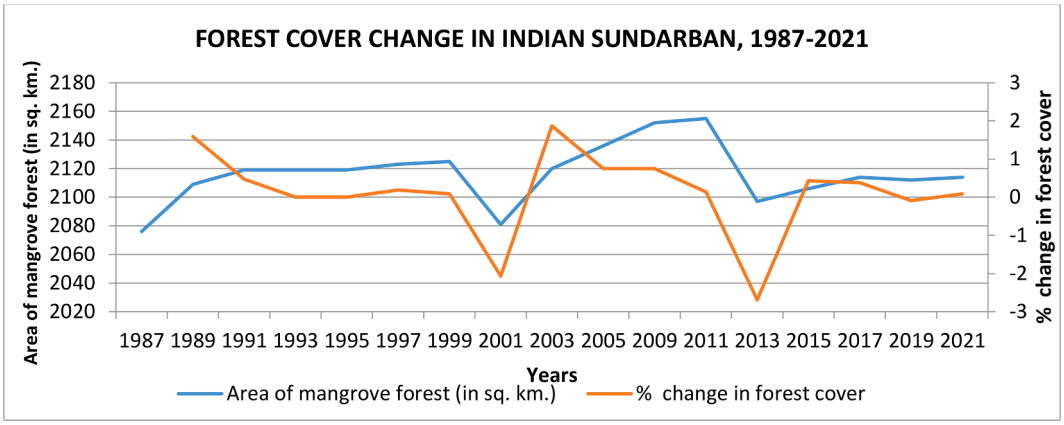

Fig. 4. This graph represents the variation of mangrove forest cover in Indian part of Sundarban since 1987 till date. It is based on the Forest Survey Reports published by Govt. of India in every two years interval.
Source: Forest Survey of India, 1987 to 2021.

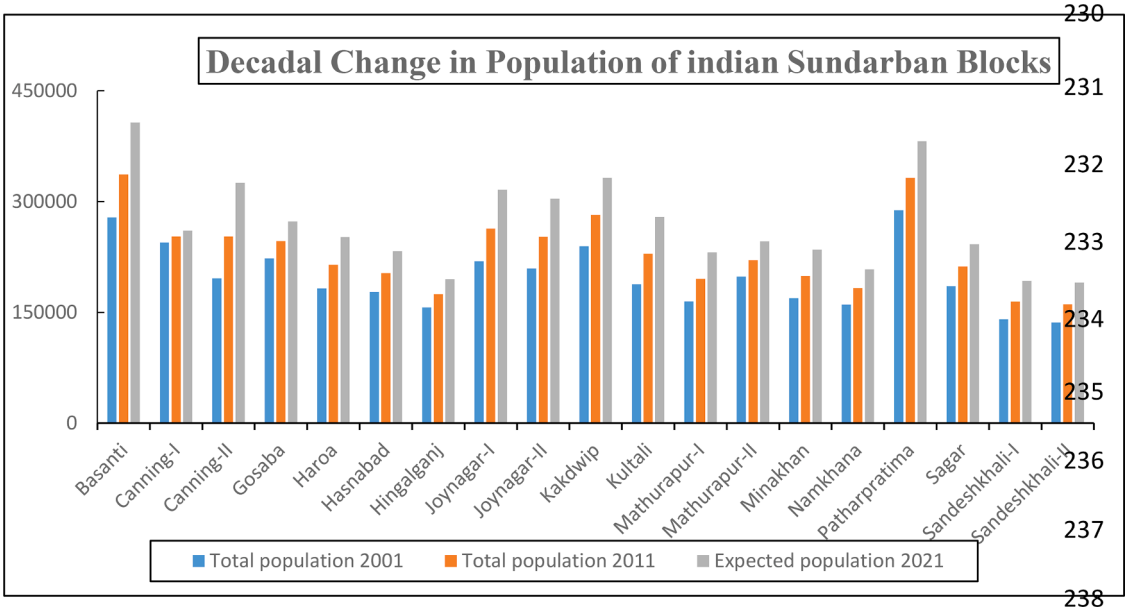

Fig. 5. It shows the decadal change in human population in the blocks under study in Indian Sundarban. It highlights the rapid increase of population in all the blocks.
Data Source: Indian Census records for 2001, 2011.

represent 2005 and 2020 respectively from the portal of USGS Earth Explorer. Some relevant indices have been calculated to analyze the concerned study. Normalized Difference Vegetation Index (NDVI) has been calculated with the following formula to analyze the nature of vegetation distribution in the present study area.

$$\mathbf{NDVI} = (\mathbf{NIR} - \mathbf{RED})/(\mathbf{NIR} + \mathbf{RED})$$

For this, satellite imageries have been used of Landsat 5 TM (acquired date 2005-01-07) and Landsat 8 OLI/TRIS (acquired date 2020-01-01) sensors representing the vegetation cover of 2005 and 2020 respectively with almost zero cloud cover. In Landsat 5 TM band 3 and band 4 represent the RED and NIR reflections respectively. In the case of Landsat 8 OLI/TRIS band 4 and band 5 represent the RED and NIR reflections respectively.

The Normalized Difference built-up Index (NDBI) has been developed to illustrate the nature of urban areas area development in the Indian part of Sundarban with the following formula:

$$\mathbf{NDBI} = (\mathbf{NIR} - -\mathbf{SWIR})/(\mathbf{NIR} + \mathbf{SWIR})$$

In Landsat 5 TM band 4 and band 5 represent the NIR and SWIR reflections respectively. In the case of Landsat 8 OLI/TRIS band 5 and band 6 represent the NIR and SWIR reflections respectively. All necessary image processing has been done with the QGIS software version 3.10.14.

The places of a tiger attack in the area under study have been located using the Google Earth Pro-platform. To analyze the nature of land use and forest cover in the area of tiger attack, buffer areas have been created. At the end, the necessary statistical analysis has been prepared and the future trend of the population has been predicted based on existing population data provided by the census of India. For this purpose, the following formula has been used:

$$P_n = P_0\left(1 + \frac{r}{100}\right)^n$$

Where,

P_n = Population of the projected year; P_o = Population of the base year.

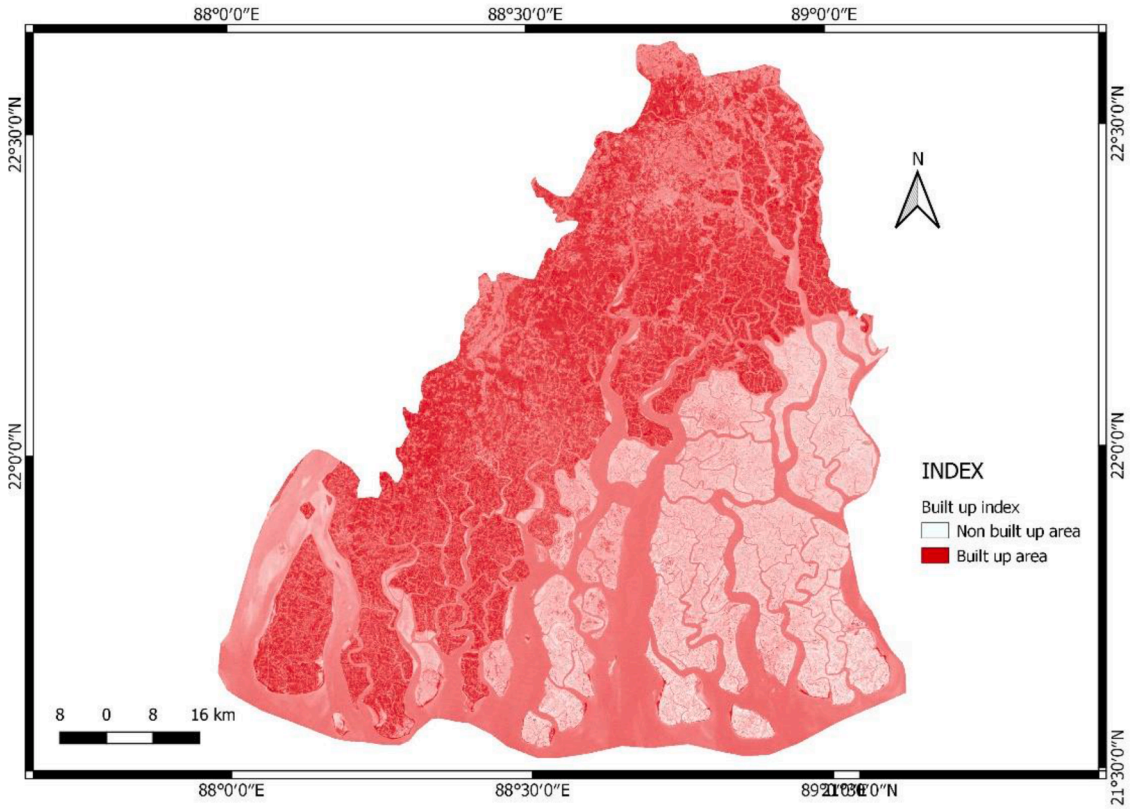

Fig. 6. The NDBI map significantly reveal the intensity of anthropogenic activities in the buffer and outer core of the Indian Sundarban in 2005. Data Source: LANDSAT 5.

r = Average annual growth of population; n = Number of years in the period under consideration.

Apart from that, tiger population in the study area also is considered. The tiger census is done quadrennially (every four years) by the National Tiger Conservation Authority (NTCA) with technical help from the Wildlife Institute of India (WII).

2.2. Limitations of the study

The collection of tiger attack data is the main constraint in the present study. There are no official updated records of such incidents. All information on the tiger attack has been collected through primary survey. Their location and period may vary a little from the given ones.

3. Results

3.1. Forest cover change

The Tiger human conflict is closely associated with the nature of forest cover in the study area. Hence, for the present study initially, it has been analysed with the help of the Normalized Difference Vegetation Index (NDVI) for the years 2005 and 2020 (Figs. 2 and 3).

In the present study area between 2005 and 2020, the buffer mangrove has increased from 2.15% to 4.32%; the outer core mangrove decreased from 48.18% to 45.49% and the core jungle has increased from 22.33% to 23.51% (Table 1).

According to the data provided by the Forest Survey of India regarding the mangrove forest in West Bengal, the mangrove forest is largely seen in the districts of North 24 Parganas and South 24 Parganas. In 2021 the area of mangrove forest was 2114 sq. km. Considering the fluctuating nature of mangrove forest area in the present study area from 1987 to 2021 shows that, the area of mangrove forest was much higher from 2005 to 2011 but has been declining sharply in 2013 (Fig. 4). Subsequently, it increased slightly and in 2019 it declined marginally in West Bengal. For a better understanding of changing forest cover, the percentage change in forest cover has also been calculated. It shows a negative change in forest cover for the year 1999. 2011 and 2017. Fir rest of the years the figures are positive.

3.2. Human population change

The rapidly growing human population is primarily dependent on the natural resources of the Sundarban forest. That makes the region economically backward (Yadav, 2006). Major factors of such backwardness are as follows:

- Lack of major industries and employment.
- Absence of necessary irrigation facility.
- Insufficient transport and communication facilities.
- Absence of electricity in most of the islands.
- Lack of various social amenities like health, education, sanitation etc.

In these circumstances, increased pressure on surrounding natural resources and expansion of built-up areas are a few commonly found features in the area. To enquire about that issue, the Normal Difference Built-up Index (NDBI) maps have been prepared for the years 2005 and 2020. Those represent the difference between build-up areas with the

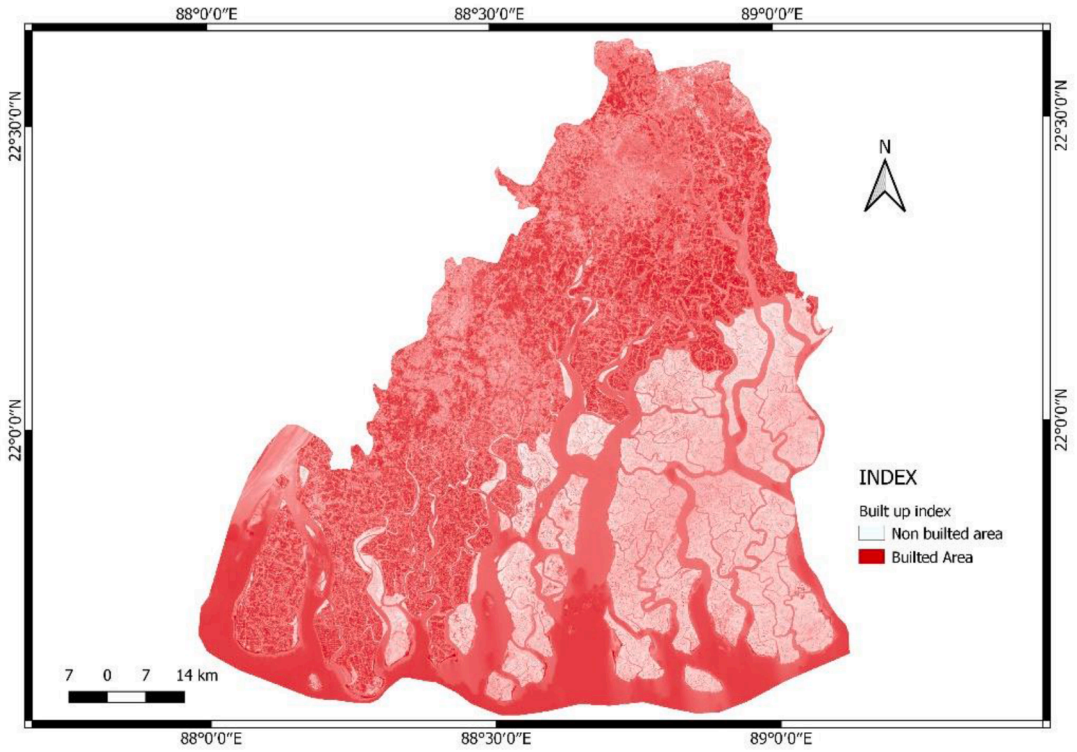

Fig. 7. The NDBI map significantly reveal the intensity of anthropogenic activities in the buffer and outer core of the Indian Sundarban in 2020.
Source: LANDSAT 8.

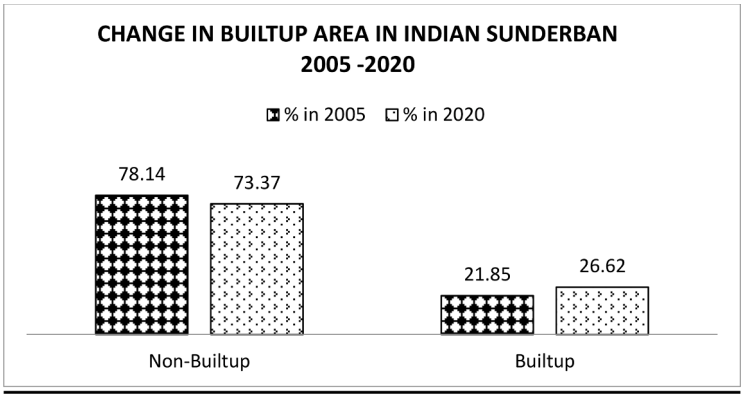

Fig. 8. The comparative study of built up and non-built up areas in the study area from the NDBI maps of 2005 and 2020 reveals a rise in built up area and decline in non-built up area. This condition is a threat to the natural habitat of wild lives, further increasing the probability of human–tiger conflict.
Data Source: LANDSAT 5, 2005 and LANDSAT 8, 2020.

Table 2
Land cover land use change data.

Elements	2005	2020	Percentage of change
Water	24,99,755	24,65,747	−1.36
Forest	23,78,896	23,09,276	−2.93
Settlement	14,54,434	18,41,760	+26.63
Arable land	18,55,086	13,61,939	−26.58
Vacant land	6,31,056	8,50,073	+34.71

Data Source: LANDSAT 5 and LANDSAT 8 Images.

help of satellite image band SWIR and NIR and build-up areas and bare soil reflect more SWIR than NIR. Its detailed methodology has been illustrated in the methodology part. Here the negative value indicates the non-built-up area and a positive value indicates the high concentration of built-up area. (Figs. 6 and 7).

Comparison of built-up area in the study area shows that non-built-up area has decreased from 78.14% to 73.37% between 2005 and 2020 (Fig. 8), whereas built-up area has increased from 21.85% to 26.62% during the same time span under study. This signifies the pressure of increased human population on the forest.

After a detailed analysis of human population growth and its

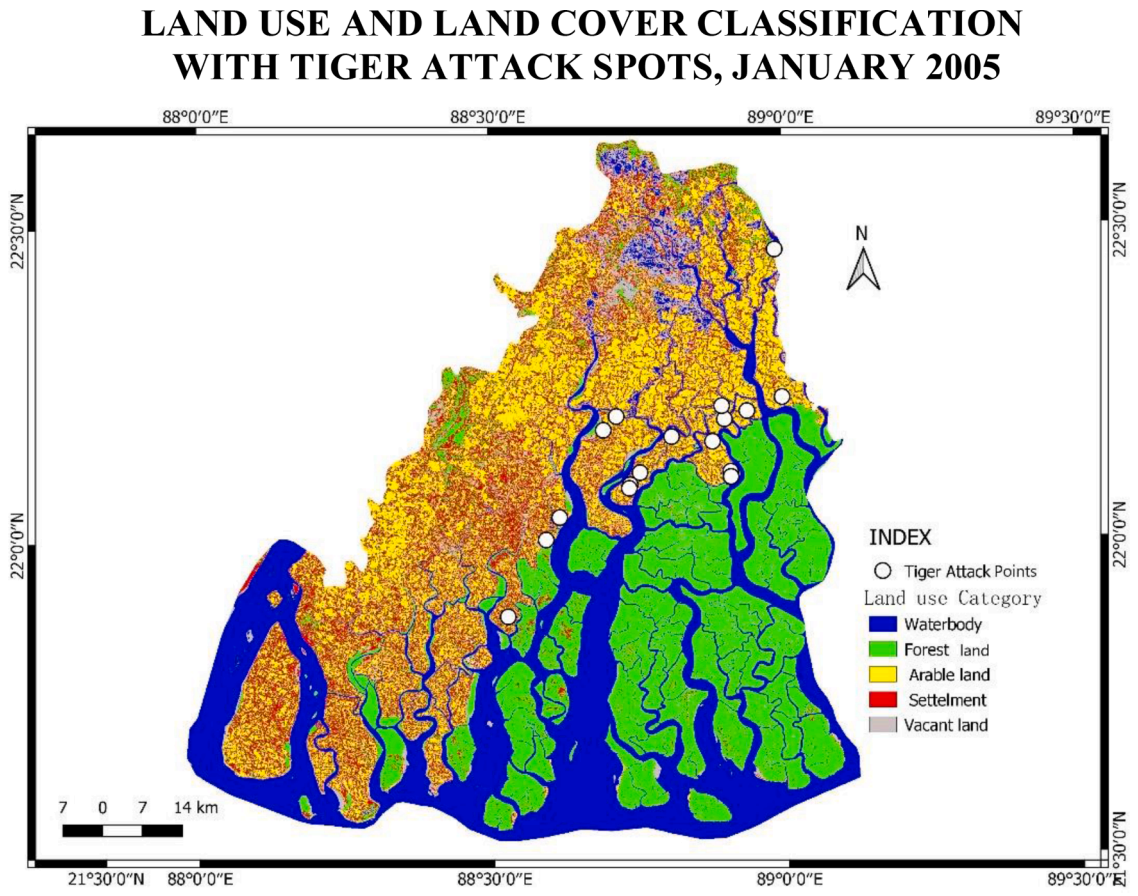

Fig. 9. Reported locations of human–tiger conflicts are demonstrated on the 2005 land use map of the study area to identify the risk areas of tiger attack. Data Source: LANDSAT 5.

influence on the forest, the nature of tiger population growth has also been analysed. To understand the proper reason for human and tiger conflict, both aspects have to be examined with proper care. The census is done quadrennially (every four years) by the National Tiger Conservation Authority (NTCA) with technical help from the Wildlife Institute of India (WII). It has been found that the first census of tigers was conducted in the year of 2006. NTCA in collaboration with the State Forest Departments, Conservation NGOs and coordinated by the Wildlife Institute of India (WII), has conducted a National assessment for the "Status of Tigers, Co-predators, Prey and their Habitat". The tiger population in Indian Sundarban does not remain stable at all times. The figures for the tiger population in the successive years of 2010, 2014, 2018, and 2020 were 70, 76, 88, and 96 respectively (Jhala et al., 2020). With this increasing nature of tiger population, it is obvious that its visit probability in or around human habitation has increased gradually.

3.3. Nature of tiger and human conflicts in the study area

From the land use change analysis between 2005 and 2020 land use and land cover map, it is understood that the area under human settlement has increased significantly (26.58%), whereas the area dedicated to agriculture, and forest has decreased. At the same time, vacant or barren land in the study area has increased a lot. Loss of arable land in the last decade is the main reason behind it (Table 2). After considering the geographical locations of the man and tiger conflict in the Indian Sundarban (Figs. 9 and 10), it is quite clear that such conflict areas are found near the forest boundary in most cases. Such an outer buffer location of the forest is a favourable place where both the tigers come sometimes in search of a few cattle residing in the human settlement and people also visit those places quite regularly in search of forest products.

To enquire about the nature of forest cover in and around the tiger attack spots, a 5-km circular buffer area analysis has been done (Figs. 11 and 12). There it is revealed that 62% of the surrounding area of tiger attack consists of the outer core mangrove forest. 18% area is under the core mangrove jungle, whereas 17% is covered by water bodies and only 3% is under buffer mangrove forest. This distribution of forest categories around the tiger attack spots indicates that people reach the outer core and core area of the Sundarban frequently, which is a natural habitat of tigers. This practice of entering the core forest without proper training and protection is increasing the risk of casualties of people due to tiger attacks.

4. Discussion

The nature of man and tiger conflict in the Indian part of Sundarban for the last few years reveals that some blocks like Gosaba, Kultali, Patharpratima, Basanti etc. frequently face such problems (Table 3). Such conditions are again worsened by the impact of devastating tropical cyclones like Amphan cyclone in 2020 and Yass in 2021 by destroying the natural habitat of tigers and other animals. It has been noticed that, as an impact of these cyclones, conditions for human and tiger conflict become more favourable in the study area. Shrieking habitable land, lack of safe drinking water, crunched natural resources etc. are collectively creating a crisis for both human beings and wild life to survive. Hence, both of them cross the niche border with each other and develop more suitable conditions for conflict. In such circumstances, the probability of a tiger attack increases for the food search.

At the same time, rapid human population growth in the Sundarban region and the nature of land use and land cover change is worsening the situation. People are destroying forests for food on the one hand and

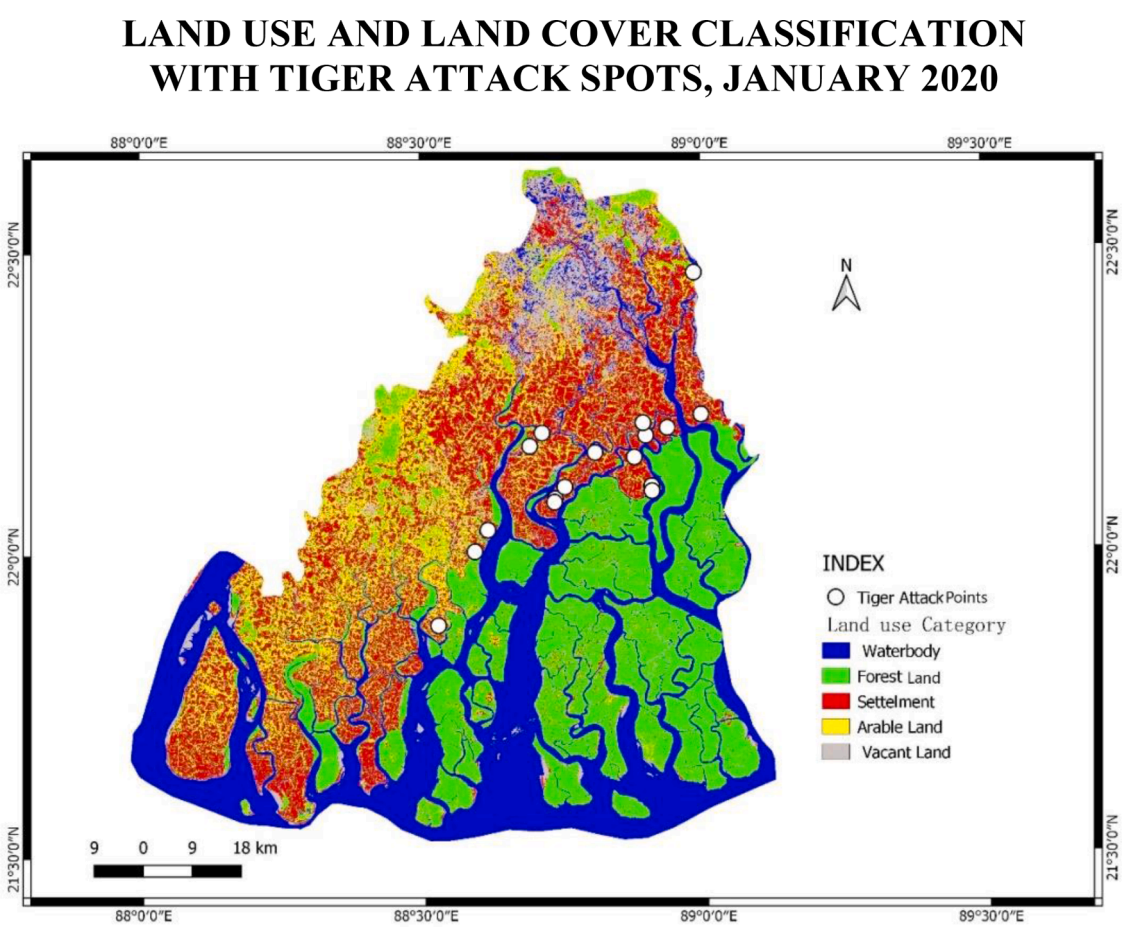

Fig. 10. Reported locations of human–tiger conflicts are demonstrated on the 2020 land use map of the study area to identify the risk areas of tiger attack. Data Source: LANDSAT 8.

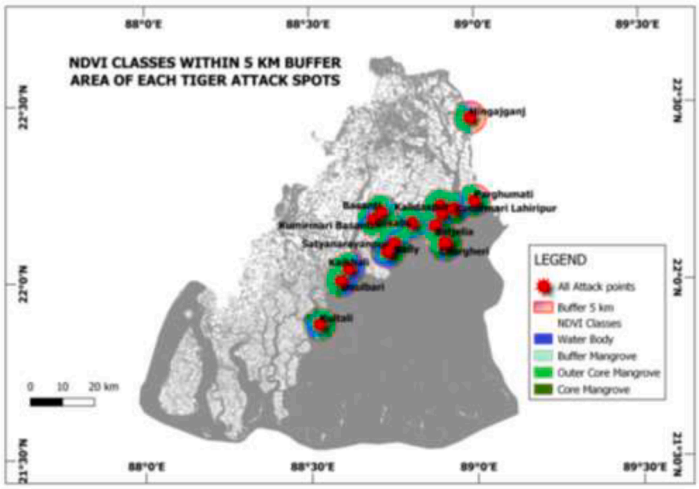

Fig. 11. For an in depth analysis of the favourable environmental condition for human–tiger conflict, forest types within the 5 km buffer area have been developed. Data Source: LANDSAT 8.

increasing dependence on forests on the other. People are going to the forest to collect wax, honey, wood, etc. and their uncontrolled entry into the forest is taking them to the tiger's habitat which is one of the causes of tiger and human conflict. According to Umashankar Mandal, an activist of Sundarban, people are going into the jungle without following proper training and those who are trained to collect honey are trying to collect fish and crabs. This reckless act is increasing the risk of such people being attacked by tigers. According to him, earlier tigers used to come to the village for food but now the tendency of people to go to the forest is increasing so chances of man and tiger conflict have increased manifold.

From the entire discussion, it may be commented that the incidents of conflicts between tiger and human beings will increase over time, if the present trends in population increase, land use and land cover

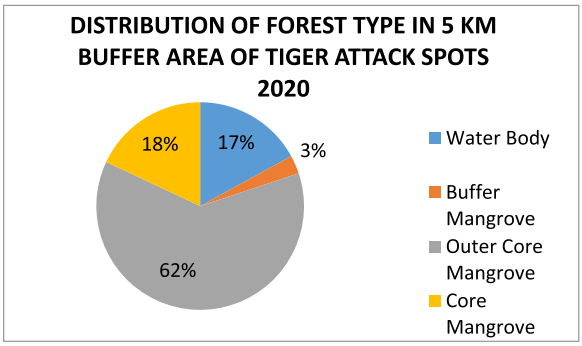

Fig. 12. From the 5 km buffer area analysis of human–tiger attack, it is found that, 'outer core' area is at highest risk for tiger attack followed by the core mangrove and water bodies.

Table 3
Record of human causalities due to tiger attack in the study area.

Sl No.	Forest block	Age	Sex	Occupation	Date	Body found
1	Zilla	50	M	Fisher	22.01.'20	Yes
2	Zilla	52	M	Fisher	16.03.'20	No
3	Zilla	48	M	Fisher	29.03.'20	No
4	Zilla	44	M	Fisher	05.06.'20	No
5	Zilla	58	M	Fisher	28.07.'20	Yes
6	Zilla	52	M	Fisher	02.08.'20	Yes
7	Zilla	30	M	Fisher	03.09.'20	Yes
8	Zilla	45	M	Fisher	04.09.'20	Yes
9	Zilla	62	M	Fisher	06.09.'20	No
10	Zilla	32	M	Fisher	30.09.'20	No
11	Zilla	45	M	Fisher	02.10.'20	No
12	Baghna	60	M	Honey collector	26.04.'20	Yes
13	Chattruri	37	M	Fisher	13.06.'20	Yes
14	Herobhanga	42	M	Fisher	21.06.'20	No
15	Pachamukhi	50	M	Fisher	03.07.'20	Yes
16	Dobanki	64	M	Fisher	18.07.'20	Yes
17	Pirkhali	36	M	Honey collector	20.04.'20	No
18	Pirkhali	65	M	Fisher	20.06.'20	No
19	Pirkhali	40	M	Fisher	01.08.'20	No
20	Pirkhali	60	F	Fisher	01.08.'20	No
21	Pirkhali	40	M	Fisher	12.08.'20	Yes

Source: Field Survey.

change, exploitation of forest resource etc. remains the same. Proper measures should be taken to check that problem. Although it is a conscious step, it can be controlled through proper awareness of the local inhabitants. However, instead of reducing forest-based activities and creating other employment opportunities, steps should be taken to change people's livelihoods (Das, 2018). The suggestive methods that can be taken to reduce the incidents of man and animal conflicts are as follows:

1 In addition to financial support, alternative employment opportunities arrangements can be made to reduce the dependence of the people on the forest-based livelihood.
2 To develop forest and animal-friendly awareness activities in the area under study.
3 In addition, global warming over the past few decades has resulted in rising sea levels. As a result, the coastal areas are gradually inundated under seal level. This is creating a threat to biodiversity and people are being severely affected, losing their land and livelihood. In such a situation, proper relocation planning should be prepared to save them in the long term.
4 Indian Forest Act (1927), Prevention of Cruelty to Animals (1960), Wildlife Protection Act (1972), and Forest Conservation Act (1980) are to be strictly implemented by the State and Central Government.

5. Conclusion

Tiger and human conflict have been a significant problem in the Sundarban region for a long past, but in recent years such incidents are increasing. Recently, the impact of the COVID-19 pandemic has changed the socioeconomic condition of Sundarbans. Incidentally the forest dependent people went to the forest for their profession to collect fish and honey ignoring the risk of tiger attack. Among the various islands of the Sundarbans, tiger attacks are more severe in Jheela CD block. On the other hand various types of natural calamities, usually cyclones, have threatened the existence of the people of Sundarbans. Two recent storms Aila (2009) and Amphan (2020) have threatened the normal life of people in the Sundarbans, with saline water intrusion into the agricultural land, almost destroying the agriculture. It has resulted in increased dependence of the people in the forest and the casualties due to human–tiger conflict (Chatterjee, 2023). It may be strongly argued that tigers in the Sundarban were not usually man-eaters but frequent natural calamities, destruction and degradation of forest cover by human intervention etc. are increasing the possibilities of man-tiger conflict. Hence, tigers repeatedly attack human beings for their survival and protection. Generally, wildlife usually does not attack human beings until a survival crisis arises for them. Increased human intervention into the jungle and the tigers' habitat is pushing people to the brink of tiger attack where many people are losing their lives every year. Such an important ecosphere like the Sundarban is not at all auspicious for the future which has caused concern to various environmentalists. It is undeniable that the unprecedented human population growth in that area is posing a great threat to the Sundarban, especially to its wild lives. This is the correct time to plan and implement some effective measures to protect the habitat of the entire wildlife of Sundarban including the tiger, which could reduce the occurrences of man–tiger conflict.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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